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# COMMUNITY WATER SUPPLY AND SEWAGE DISPOSAL PROGRAMS IN LATIN AMERICA AND CARIBBEAN COUNTRIES

DEPARTMENT OF ENGINEERING AND  
ENVIRONMENTAL SCIENCES  
TECHNICAL SERIES



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**COMMUNITY WATER SUPPLY AND  
SEWAGE DISPOSAL PROGRAMS IN LATIN AMERICA  
AND CARIBBEAN COUNTRIES**

**STATUS AND TRENDS - PROJECTIONS 1968-1971**

THIS DOCUMENT DISCUSSES THE STEPS WHICH LED TO THE  
GOALS ESTABLISHED IN THE CHARTER OF PUNTA DEL ESTE FOR COMMUNITY  
WATER SUPPLY AND SEWERAGE, THE SITUATION IN 1961, PROGRESS MADE  
FROM 1961 THROUGH 1968 AND PROJECTIONS FOR 1971

**TECHNICAL SERIES OF THE DEPARTMENT OF  
ENGINEERING AND ENVIRONMENTAL SCIENCES**

**DOCUMENT NO. ES 5**

**JUNE 1969**

**PAN AMERICAN HEALTH ORGANIZATION**  
Pan American Sanitary Bureau - Regional Office of the  
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I. WATER

## I. WATER

### A. Situation at Start of Decade, 1961

Foreshadowing the emphasis placed in 1961 on adequate water supply and sewage disposal in the Charter of Punta del Este, the Director of the Pan American Health Organization established in 1958 an Advisory Committee on Environmental Sanitation which reached a unanimous conclusion - namely, that the concentration of forces to extend and improve existing water supply systems and to construct new systems to furnish water of good quality and abundant in quantity through house connections is the best method of reducing disease, accelerating the rhythm of economic development, increasing tourism, and serving as an incentive for the construction of new housing. The Committee agreed that water supply should have first priority, with the provision of sewage disposal assigned second priority.

As a direct result of the lively interest which was aroused in the Member Governments by this agreement, originally formulated by the Advisory Committee on Environmental Sanitation, the Governments of Latin America established for themselves in the Charter of Punta del Este goals for water supply and sewage which were specific and ambitious, namely, within the Alliance for Progress Decade from 1961-1971 to provide adequate water supply and sewage disposal to not less than 70 per cent of the urban and 50 per cent of the rural population.

For most of the countries these goals represented a terrific challenge. The size of the task was stressed by PAHO in a report prepared in 1963 for the Task Force at Ministerial Level, pointing out that of the 100 million urban population in 1961, 40 million (40 per cent) were without



water service in their homes. By 1971 another 46 million persons would be added to the urban population and would also need water services. To achieve the goals of the Charter of Punta del Este, it would be necessary to construct each year urban water supplies for nearly 4.5 million persons at an annual cost of \$233 million.

Less was known in 1961 about the water supplies in rural areas, but to provide water, in accordance with the objectives, to half of the 128 million predicted for 1971 in rural areas would have meant supplying 5.8 million a year at an annual cost of at least \$58 million. The total cost for both urban and rural systems would amount to \$291 million per year.

It was estimated that \$100 million would be required each year from international loans to carry on the construction program in urban communities. Assuming that at least half the cost in rural areas, or \$29 million, must come from international loan sources, the total funds needed for sources outside the countries amounted to \$130 million annually, or over a ten-year period \$1.3 billion.

These estimates covered only the cost of providing additional water supply services in urban and rural communities to meet the Charter goals for 1971 but did not provide for improving existing services. Moreover, no attempt was made to quantify the cost of the sewage disposal facilities needed to meet the goals.

(See Table I from Ten-Year Plan for Water Supply in Urban and Rural Areas of Latin America, TFH/2, Add.1, 1 April 1963.)

Many factors contributed to the lack of adequate water supply services in both urban and rural areas. One was the lack of well-organized,

TABLE I

TEN-YEAR PLAN FOR WATER SUPPLY IN URBAN AND  
RURAL AREAS IN LATIN AMERICA, 1961 - 1971

(TFH/2 Add.I-1 April 1963)

Country	Estimated urban population (in thousands)				Average number to be supplied yearly (in thou- sands)	Annual cost of construc- tion at \$50 per capita (in \$1000 US)	Estimated rural population (in thousands)				Average number to be supplied yearly (in thou- sands)	Annual cost of construction (in \$1000 US)	
	Total		Without water				Total		Without water			at \$10 per capita	at \$15 per capita
	1961	1971	1961	1971			1961	1971	1961	1971			
Total	101,661	147,630	41,297	87,266	4441.9	233,248	107,000	128,009	-	-	5825.6	58,256	87,385
Argentina	15,531	18,743	5,385	8,597	297.4	14,870	5,570	6,744	5,495	6,669	329.7	3,297	4,946
Bolivia	1,448	2,120	640	1,312	67.6	3,380	2,367	2,755	-	-	137.8	1,378	2,067
Brazil	32,963	49,807	14,932	31,776	1683.4	84,170	40,125	48,300	-	-	2415.0	24,150	36,225
Chile	4,874	6,830	1,285	3,241	143.8	7,190	2,486	2,610	2,086	2,190	90.5	905	1,358
Colombia	6,289	9,437	1,334	4,482	248.1	12,405	8,663	10,587	5,171	7,095	180.2	1,802	2,703
Costa Rica	421	676	9	264	25.0	1,250	766	969	587	690	20.6	206	309
Cuba	3,855	5,100	1,673	2,918	138.8	<sup>a</sup> 10,410	3,121	3,452	-	-	172.6	1,726	2,589
Dominican Republic	867	1,580	375	1,088	61.4	3,070	2,095	2,556	1,719	2,180	90.2	902	1,353
Ecuador	1,248	2,337	522	1,611	91.0	4,550	3,183	3,533	-	-	177.0	1,770	2,655
El Salvador	799	1,403	332	936	51.5	2,575	1,675	1,854	-	-	92.7	927	1,390
Guatemala	961	1,206	590	835	47.3	2,365	2,900	3,628	875	1,602	80.1	801	1,202
Haiti	402	541	300	439	27.7	1,385	3,700	4,740	3,700	4,740	237.0	2,370	3,555
Honduras	618	879	406	667	40.3	2,015	1,373	1,703	1,270	1,600	75.0	750	1,125
Mexico	18,398	28,152	8,316	18,070	962.4	48,120	17,490	20,359	-	-	1018.0	10,180	15,270
Nicaragua	568	890	353	675	40.8	2,040	950	1,164	947	1,161	57.9	579	868
Panama	514	741	81	308	19.1	955	574	703	-	-	35.2	352	528
Paraguay	624	980	452	808	51.4	2,570	1,146	1,220	1,146	1,220	61.0	610	915
Peru	4,878	7,288	1,517	3,927	174.1	8,705	5,487	7,620	-	-	381.0	3,810	5,715
Uruguay	1,750	1,950	460	660	14.7	735	620	680	605	665	32.5	325	488
Venezuela	4,653	6,970	2,335	4,652	256.1	<sup>a</sup> 20,488	2,709	2,832	-	-	141.6	1,416	2,124

<sup>a</sup>) At \$75 per capita for Cuba and \$80 for Venezuela.

NOTE: Urban refers to cities of 2,000 or more inhabitants, except for Colombia (5,000) and Cuba (1,000).



efficient institutions or agencies responsible for the design, construction and administration of the systems. Multiple central agencies often had the responsibility, resulting in a certain degree of confusion and in strange partitioning of functions among various agencies. Another was the huge amount of capital investment needed to make any appreciable impression on the water supply and sewage disposal needs. The estimate of \$1.3 billion in international loans, during the decade, for water supply alone was so astronomical that it made the program seem impossible. A desire for perfectionism, a philosophy of all-or-nothing, delayed an effective start on facing up to the ever-increasing needs where the population was mounting at the rate of more than 6,000,000 people per year. An equally persistent obstacle to progress was the firm conviction of both the public and of some officials that water should be provided to all people free of charge. The income from most water systems in Latin America hardly ever paid for the interest or amortization of capital invested. In fact, it was rare that such income could support even the annual cost of maintenance and operation. The result was that water supply systems were far from an attractive investment and the practice of providing money for water services via national or central government grants was almost universal.

On the other hand, there were several fortuitous circumstances in 1961 which created a favorable atmosphere for making a start toward solving the problem. There was a cadre of well-trained sanitary engineers in Latin America prepared to give form and direction to the program. Over the previous 18 years, the Pan American Health Organization, the Agency for International Development and other agencies had been helping to train

sanitary engineers through graduate courses and in-service training programs. The men were ready and, in many cases, specific projects were ready.

Before 1961 the predecessor organization of AID and the Export-Import Bank had made some loans for water supply and sewerage systems in Latin America. In February 1961 the Inter-American Development Bank, which was to play a major role in providing loans for such systems, selected for its first loan the water supply and sewerage systems in Arequipa, Peru. This was the forerunner of many similar loans by the Bank from its three funds, supplemented by loans by other agencies as well.

Thus the stage was set. The goals of the Charter provided a much-needed stimulus and visibility for the continent-wide program, launching it on a course which surprised even its strongest supporters.

#### B. Preliminary Steps in Developing the Program

Shortly after the signing of the Charter of Punta del Este, the Pan American Health Organization called together its Advisory Committee on Environmental Sanitation to consider the implications of the Charter with respect to the development of national plans and programs involving environmental sanitation. The report of that Committee "comments on the goals and objectives to be reached on the existing problems and on mechanisms; and concludes that water supply, sewage disposal and housing are the three top priority programs which should be included and emphasized in all national plans." Of these, water supply was considered highest in priority as it is fundamental for nearly all other programs.

The report points out the differences in approach which will normally exist between urban and rural programs, and the fact that water, sewerage and housing are usually activities not alone of Ministries of Health but of Public Works, Water, Housing and other agencies as well. In urban programs the municipalities themselves will have important roles to play. For this reason, the working group placed unusual stress on the need for the Ministries of Health to coordinate all planning in these fields with the appropriate other governmental bodies.

The first two recommendations in the report may be summarized as follows:

1. If a single program is to be selected for maximum public health dividends, the provision of safe and ample water, not only for drinking but for personal cleanliness, should be first in priority.
2. Whenever studies are made and plans are drawn for a water supply, consideration should also be given to sewage and waste water disposal. In most instances, the financing of sewer plans will not be possible at the time of the water supply construction. However, the existence of preliminary sewer plans will permit municipalities to construct portions of the systems as problems develop and financing becomes available. Sewers should be considered as priority two in the environmental sanitation activities.

In setting priorities within the water supply field, it was agreed that urban water supply should have the highest priority. Rural water supply was given a slightly lower priority.

Two major divisions of action which could proceed simultaneously were identified for implementing the water supply program:

1. Organization and Administrative Action

Each country should initiate study of the best type or types of organization for carrying out the national water program.

2. Technical Action

Since it could be expected that changes in organization and administrative structure would require time, it was urged that no country wait for success in those activities before proceeding with the following technical actions. Every country should:

- a. Have a reasonably complete inventory of the water service situation in community aggregates of people throughout the country;
- b. Have a classification of areas unsupplied with water according to sizes of communities;
- c. Make a selection of the areas which are the largest, which have the greatest need, and which will offer the fewest obstacles to immediate success;
- d. Prepare a preliminary design and cost estimate for servicing each of the areas selected. This should include new sources, treatment plants, pumping facilities, etc., if required;
- e. Prepare for each area a rate structure, encompassing property taxes, consumption charges, special assessments, or other sources, sufficient to pay annually charges for interest on and repayment of loans, for maintenance and operation, and for new additions;
- f. Provide for establishment of the managerial instrument to execute, finance and administer the project, whether national or local;

- g. Provide for the creation of the administrative unit to be responsible for total water development and finance in the large capital and other metropolitan areas;
- h. Prepare the legislation required to implement the items delineated above;
- i. Arrange for the continuing collection of pertinent experience of other areas to provide for the education of officials, general public, industrialists, economists and financiers, and water consumers;
- j. Delineate each proposed project in great detail from its engineering elements to the charge for water to each class of consumer in order to sell its value and low cost to the public;
- k. Prepare and distribute authoritative and sound literature spelling out examples of successful water service, self-supported, in other countries.

A start was made early in many countries in setting up enabling legislation assigning specific water supply and sewage disposal responsibilities and in developing the institutions for carrying out those responsibilities. In some countries, an existing agency was strengthened, while in others, autonomous agencies were established. No single type of administrative structure was suggested as best for all countries. The Organization advised on the most appropriate type and assisted in developing the legislation and the organizational structure. This was a new venture for the Organization, as formerly assistance had usually been provided only on the technical aspects of design, construction and operation.



During 1961, legislation was approved creating national or centralized water supply and sewage authorities in Bolivia, Costa Rica, El Salvador, Honduras and Panama (with the initials of ABOS, SNAA, ANDA, SANAA and IDAAN) and strengthening existing agencies.

At the request of the agencies in eight countries, during that first year of the Decade, the Organization provided them assistance in the preparation of feasibility studies and loan requests for the improvement of existing systems or the construction of new ones.

The international lending institutions were ready for these requests, particularly the recently created Inter-American Development Bank which, during 1961, approved or signed twelve loans for a total of \$62.6 million with matching national contributions of \$47.1 million, as indicated in Table II. This compared with loans of about \$40 million made to Colombia, Costa Rica, Ecuador, Mexico, Paraguay and Uruguay by other international credit organizations during the previous four years.

The two most recently created international lending institutions, the Inter-American Development Bank (IDB) and the International Development Association (IDA) of the International Bank for Reconstruction and Development (IBRD), were authorized to make loans under favorable conditions for water supplies.

The Pan American Health Organization, responding to resolutions of its Governing Bodies to assist the Member Governments to meet the goals of the Charter, initiated several steps to expand its community water supply activities. Very material assistance was provided for this expansion by the early contribution of \$216,418 by two Member Governments to a special

TABLE II  
 LOANS APPROVED BY THE INTER-AMERICAN DEVELOPMENT BANK,  
 POPULATION TO BE SERVED AND LOCAL CONTRIBUTIONS  
 FOR WATER SUPPLY AND SEWERAGE SYSTEMS,  
 FEBRUARY-DECEMBER 1961

Country	City	Type of service	Population to be served <sup>(a)</sup>	Loan (US dollars)	Local Contribution (US dollars)
Brazil	Salvador (Bahia)	Water	340,000	4,120,000	2,000,000
Chile	Concepción y Talcahuano	Water	220,000	3,500,000	1,500,000
Colombia	Cali	Water	210,000	2,454,000	1,660,000
	Cartagena	Water and sewerage	130,000	5,969,000	5,000,000
	Cúcuta	Water and sewerage	90,000	5,900,000	1,160,000
El Salvador	Medellín	Water	550,000	6,048,000	4,000,000
	39 cities	Water and sewerage	300,000	4,800,000	2,530,000
Guatemala	Puerto Barrios	Water	40,000	175,000	90,000
Peru	Arequipa	Water and sewerage	240,000 <sup>b</sup>	3,900,000	2,100,000
Uruguay	Montevideo	Water	800,000	5,743,000	7,100,000
Venezuela	57 cities (between 5000 and 10000 pop.)	Water	300,000	10,000,000	10,000,000
	330 cities (less than 5000 pop.)	Water	400,000	10,000,000	10,000,000
<b>TOTAL</b>			<b>3,620,000</b>	<b>62,609,000</b>	<b>47,140,000</b>

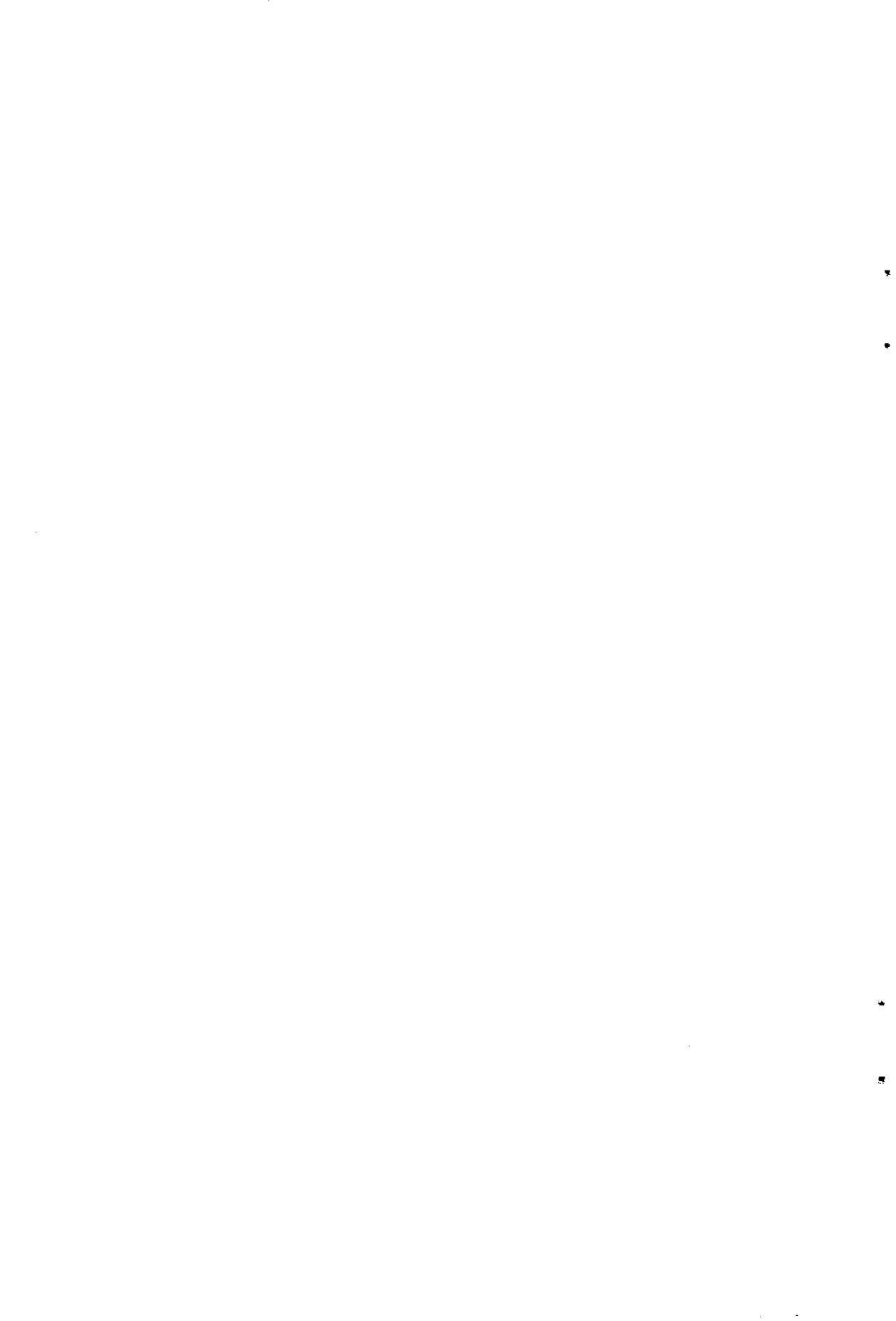
(a) Population estimated to be served either in 1970 or 1980

(b) Population estimated to be served in the year 2000



TABLE III  
CONTRIBUTIONS TO PAHO COMMUNITY WATER SUPPLY FUND  
(U.S. Dollars)

COUNTRY	1960	1961	1962	1963	1964	1965	1966	1967	1968
Brazil									3,000
Colombia				9,111	500				
Ecuador								12,000	
Honduras						10,000			
Jamaica						5,000			21,835
Nicaragua						10,000		1,000	24,000
Peru					8,383	931		20,235	17,460
Trinidad and Tobago					5,000				25,000
U. S. A.	200,000	125,000	300,000	300,000	300,000	300,000	300,000	115,000	1,906
Uruguay									25,000
Venezuela	16,418			15,000	10,028		894		
<b>TOTAL</b>	<b>216,418</b>	<b>125,000</b>	<b>300,000</b>	<b>324,111</b>	<b>323,911</b>	<b>325,931</b>	<b>300,984</b>	<b>148,235</b>	<b>118,201</b>



Community Water Supply Fund. Since that time, these contributions have amounted to over \$2 million, as tabulated below.

Of these special CWS funds, 80 per cent has been used to finance sanitary engineers assigned full-time to the community water supply program throughout the Region and short-term consultants for that program. The remaining 20 per cent has been used to finance training and education and a small amount of supplies and equipment. These funds have made it possible for the Organization to provide to the continent-wide community water supply program, over and above regular staff, an additional 70 man-years of full-time staff and 260 man-months of services of short-term consultants.

Even before the start of the Decade, the Organization was concerned about training the professional personnel required for the water supply program. During 1960 and 1961 it organized three courses on administration and financing of urban water supplies. The first was held in the United States of America and was attended by all PAHO and AID sanitary engineering staff serving in the Latin American countries; the second, at the University of Mexico, was attended by 41 water supply engineers and officials of Mexico and of the Central American and Caribbean countries; and the third was held at the University of São Paulo for 65 engineers and water supply officials of South America.

A seminar was held in Montevideo, Uruguay to study and recommend new approaches to water-rates practices in Latin America. This was attended by 72 water supply engineers from 19 American countries and three territories in the Caribbean. The conclusions of the seminar were published in the Water Rates Manual (Scientific Publication PAHO 54, 1961).

To overcome the lack of experienced design engineers in several of the countries, PAHO organized a three-month course on the design of urban water supplies which was given in Mexico in 1961 and which was attended by 30 design engineers from Mexico, Central America and the Caribbean.

Fellowships were also provided for formal graduate courses in sanitary engineering as well as two short courses on ground-water development.

Thus preliminary preparations were made during the first year of the Alliance for Progress Decade to meet the ambitious goals of the Charter.

#### C. Progress and Results as of 1968

A series of supporting resolutions and recommendations have been issued by various bodies and authorities in Latin America since the signing of the Charter. Two of them are quoted.

##### Recommendations of the Task Force at Ministerial Level, 1963

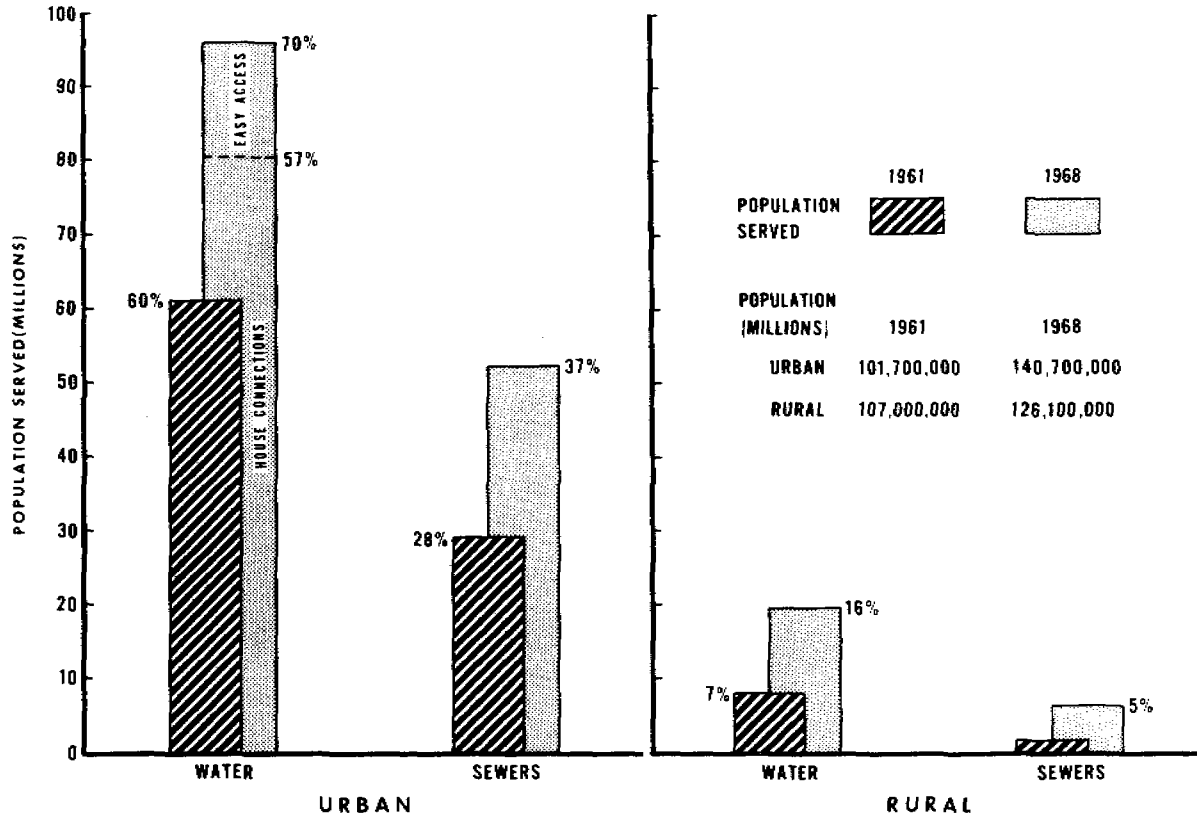
"Among health programs the highest priority should be given to environmental sanitation and, within this field, to water supply and sewage disposal systems in urban and rural areas in Latin America . . . .

"Programs for the construction of water supply and sewage disposal systems should be intensified to the maximum in urban areas; they should be self-financing through the establishment of rational water rates and should be well organized and administered . . . .

"In order to fulfill the objective of the Charter of Punta del Este in rural areas, the Pan American Health Organization should study the possibility of establishing a special fund, which might be called the Special Rural Welfare Fund . . . ."

Figure 1

LATIN AMERICA AND CARIBBEAN COUNTRIES  
 POPULATION SERVED - WATER SUPPLY AND SEWERAGE  
 1961 AND 1968







Declaration of the Presidents of America, April 1967

"Improvement to health conditions is fundamental to the economic and social development in Latin America.

"Available scientific knowledge makes it possible to obtain specific results, which, in accordance with the needs of each country and the provisions of the Charter of Punta del Este, should be utilized to obtain the following objectives:

"a. . . . .

"b. Acceleration of programs for providing drinking water supplies, sewerage and other services essential to environmental sanitation in urban and rural areas, giving preference to the lower-income groups. On the basis of studies carried out and with the cooperation of international financing agencies, national revolving fund systems shall be used to assure the continuity of such programs."

With this type of official national support plus the very material assistance of the international lending institutions, of the national water agencies, and of the Organization, very dramatic progress has been made since 1961.

The results of the program are summarized in the following tabulation of the people served by house connections or through public hydrants in 1968 as compared to the start of the Decade.

TABLE IV  
PEOPLE SERVED BY WATER SUPPLY SYSTEMS, 1961 AND 1968

	Urban		Rural		Total	
	Number	%	Number	%	Number	%
1961	61,100,000	60	8,000,000	7	69,100,000	33
1968	98,399,000	70	20,086,000	16	118,485,000	44
Increase	37,299,000		12,086,000		49,385,000	

This reflects only a portion of the picture as, in addition to the increased number of people being served in 1968, more than 10 million are now receiving better service. (See Figure I)

The status of the program in the various countries of the Region in 1968 is tabulated in Table V, which shows the number served by house connections and those with easy access to public hydrants. (It should be noted that all data in this report, except Table I, are compiled for the 25 countries itemized plus the Eastern Caribbean Islands. Comparative data for 1961 has been estimated for those countries not then Member Governments.)

The Region as a whole was on schedule in 1968 for water supply in the urban areas, with 70 per cent of the population served either through house connections or easy access to public hydrants. Of the 25 countries, 19 had reached or passed the 70 per cent goal. Only half that number were serving 70 per cent or more of the urban population in 1961. The percentage of rural population served has more than doubled to 16 per cent with six countries reaching or passing the 50 per cent goal.

TABLE V

## STATUS OF WATER SUPPLY AND SEWERAGE SYSTEM SERVICES - 1968

(Population in Millions)

COUNTRY	Date of Data	WATER SUPPLY														SEWERAGE DISPOSAL					
		Total						Urban					Rural					Urban	Rural	Total	%
		Population	Population Served			%	Population	Population Served			%	Population	Population Served			%					
			House Conn.	Easy Access	Total			House Conn.	Easy Access	Total			House Conn.	Easy Access	Total						
Argentina	Dec. 68	23.600	11.756	1.100	12.856	54	17.100	11.300	66	0.900	12.200	71	6.500	0.456	0.200	0.656	10	5.750	-	5.750	24
Barbados	June 68	0.251	0.110	0.141	0.251	100	0.115	0.093	81	0.022	0.115	100	0.136	0.017	0.119	0.136	100	-	-	-	-
Bolivia	Oct. 68	4.660	0.305	0.651	0.956	21	1.270	0.302	24	0.629	0.931	73	3.390	0.003	0.022	0.025	1	0.439	0.004	0.443	10
Brazil	Dec. 68	90.830	22.240	4.000	26.240	29	46.780	22.240	48	2.000	24.240	52	44.050	-	2.000	2.000	5	11.240	-	11.240	12
Chile	Dec. 68	10.050	4.020	1.900	5.920	59	6.900	3.900	57	1.780	5.680	82	3.150	0.120	0.120	0.240	8	2.320	0.170	2.490	25
Colombia	Dec. 68	19.886	8.300	4.900	13.200	66	10.722	6.700	63	2.100	8.800	82	9.164	1.600	2.800	4.400	48	6.600	2.200	8.800	44
Costa Rica	Dec. 68	1.636	1.060	0.156	1.216	74	0.552	0.488	88	0.064	0.552	100	1.084	0.572	0.092	0.664	61	0.169	0.002	0.171	10
Cuba	June 66	7.950	5.610	0.650	6.260	79	5.020	3.840	77	0.650	4.490	90	2.930	1.770	-	1.770	60	1.700	-	1.700	21
Dominican Republic	Dec. 68	4.028	0.783	0.374	1.157	29	1.374	0.719	52	0.216	0.935	68	2.654	0.064	0.158	0.222	8	0.155	-	0.155	4
Ecuador	Dec. 68	5.776	1.126	0.703	1.829	32	2.189	1.031	47	0.510	1.541	70	3.587	0.095	0.193	0.288	8	1.105	0.110	1.215	21
El Salvador	Sept. 68	3.286	1.266	0.158	1.424	43	1.105	0.721	65	0.158	0.879	79	2.181	0.545	-	0.545	25	0.685	0.002	0.687	21
Guatemala	Dec. 68	4.876	0.670	1.090	1.760	36	1.670	0.667	40	0.769	1.436	86	3.206	0.003	0.321	0.324	10	0.664	-	0.664	14
Guyana	Dec. 68	0.711	0.363	0.022	0.385	54	0.205	0.198	97	0.007	0.205	100	0.506	0.165	0.015	0.180	36	0.080	-	0.080	11
Haiti	July 68	4.674	0.165	0.130	0.295	6	0.386	0.120	31	0.050	0.170	44	4.288	0.045	0.080	0.125	3	0.075	-	0.075	2
Honduras	Dec. 68	2.413	0.427	0.359	0.786	32	0.633	0.361	57	0.231	0.592	93	1.780	0.066	0.128	0.194	11	0.350	0.001	0.351	15
Jamaica*	Mar. 68	1.893	0.910	0.570	1.480	78	0.525	0.510	97	0.010	0.520	99	1.368	0.400	0.560	0.960	70	0.070	-	0.070	4
Mexico	Dec. 68	47.857	17.910	7.200	25.110	52	26.937	17.300	64	4.000	21.300	79	20.920	0.610	3.200	3.810	18	13.800	0.600	14.400	30
Nicaragua	Dec. 68	1.831	0.350	0.336	0.686	37	0.710	0.317	45	0.303	0.620	87	1.121	0.033	0.033	0.066	6	0.230	-	0.230	13
Panama	July 68**	1.372	0.541	0.169	0.710	52	0.637	0.515	81	0.055	0.570	89	0.735	0.026	0.114	0.140	19	0.381	0.003	0.384	28
Paraguay	Dec. 68	2.231	0.131	0.090	0.221	10	0.814	0.131	16	0.010	0.141	17	1.417	-	0.080	0.080	6	0.112	-	0.112	5
Peru	Sept. 68	12.272	2.540	1.135	3.675	30	5.624	2.500	44	1.090	3.590	64	6.648	0.040	0.045	0.085	1	3.140	-	3.140	26
Surinam	Sept. 67	0.350	0.122	0.015	0.137	40	0.220	0.120	55	0.010	0.130	59	0.130	0.002	0.005	0.007	5	-	-	-	-
Trinidad and Tobago	Dec. 68	1.020	0.522	0.447	0.969	95	0.340	0.277	81	0.063	0.340	100	0.680	0.245	0.384	0.629	92	0.165	-	0.165	16
Uruguay	Dec. 68	3.032	1.844	0.246	2.090	69	2.445	1.826	75	0.205	2.031	83	0.587	0.018	0.041	0.059	10	1.140	-	1.140	38
Venezuela	Dec. 68	9.779	6.116	2.243	8.359	86	6.269	4.326	69	1.943	6.269	100	3.510	1.790	0.300	2.090	60	2.427	0.063	2.490	25
Eastern Caribbean ***	June 68	0.513	0.114	0.399	0.513	100	0.122	0.082	70	0.040	0.122	100	0.391	0.032	0.359	0.391	100	0.032	-	0.032	6
TOTAL		266.777	89.301	29.184	118.485	44	140.664	80.584	57	17.815	98.399	70	126.113	8.717	11.369	20.086	16	52.829	3.155	55.984	21

\* The figures given for rural population served (house connected and easy access) should be qualified in that the figures represent populations for areas with a piped water supply system and do not take into account the reliability of the supply (e.g., many of the supplies are fed from rain-water catchment tanks) and whether the supply is of satisfactory quality and quantity. It is estimated that only 30-40% of the supplies meet minimum requirements for reliability, quality and quantity.

\*\* Funds to September 1968

\*\*\* English-speaking, except Barbados

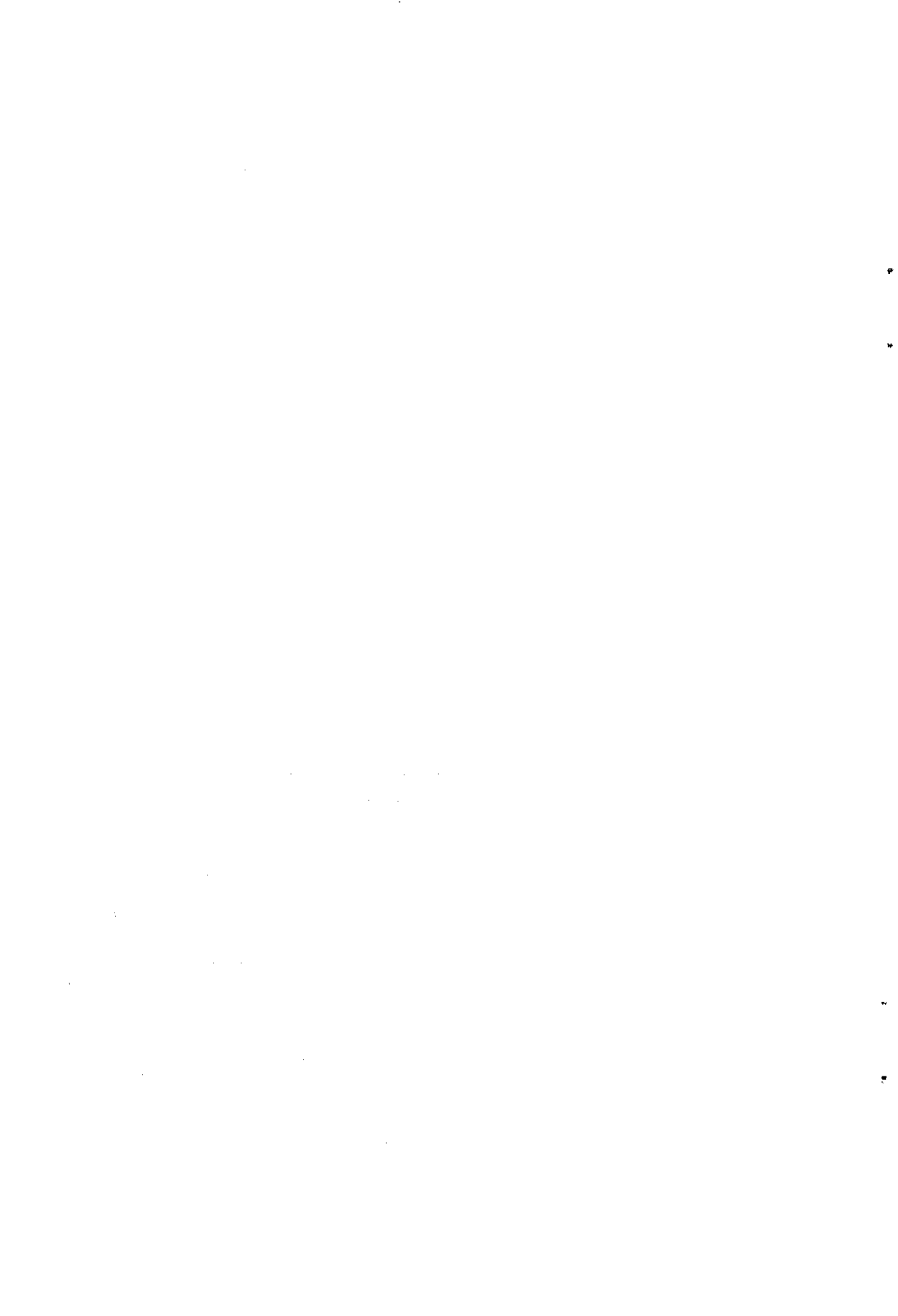


TABLE VI  
 TEAM CONSULTATION ON ADMINISTRATION AND MANAGEMENT  
 OF WATER SUPPLY AND SEWERAGE AGENCIES

DATE	COUNTRY	AGENCY
1965	Honduras	Servicio Autónomo Nacional de Acueductos y Alcantarillados
1965	Nicaragua	Empresa Aguadora de Managua
1966	El Salvador	Administración Nacional de Acueductos y Alcantarillados
1966	Uruguay	Administración de Obras Sanitarias del Estado
1966	Colombia	Instituto Nacional de Fomento Municipal
1966	Peru	Dirección de Obras Sanitarias, Ministerio de Fomento y Obras Públicas
1967	Dominican Rep.	El Instituto Nacional de Agua Potable y Alcantarillado
1967	Ecuador	El Instituto Ecuatoriano de Obras Sanitarias
1968	Guatemala	Servicio Nacional de Salud, Departamento de Ingeniería Sanitaria
1968	Jamaica	Water Commission of Kingston, Jamaica
1968	Trinidad	Water and Sewerage Authority
1968	Nicaragua	Departamento Nacional de Acueductos y Alcantarillados
1968	Uruguay	Administración de Obras Sanitarias del Estado
1968	Colombia	Servicio Nacional de Salud
1968	Mexico	Secretaría de Recursos Hidráulicos

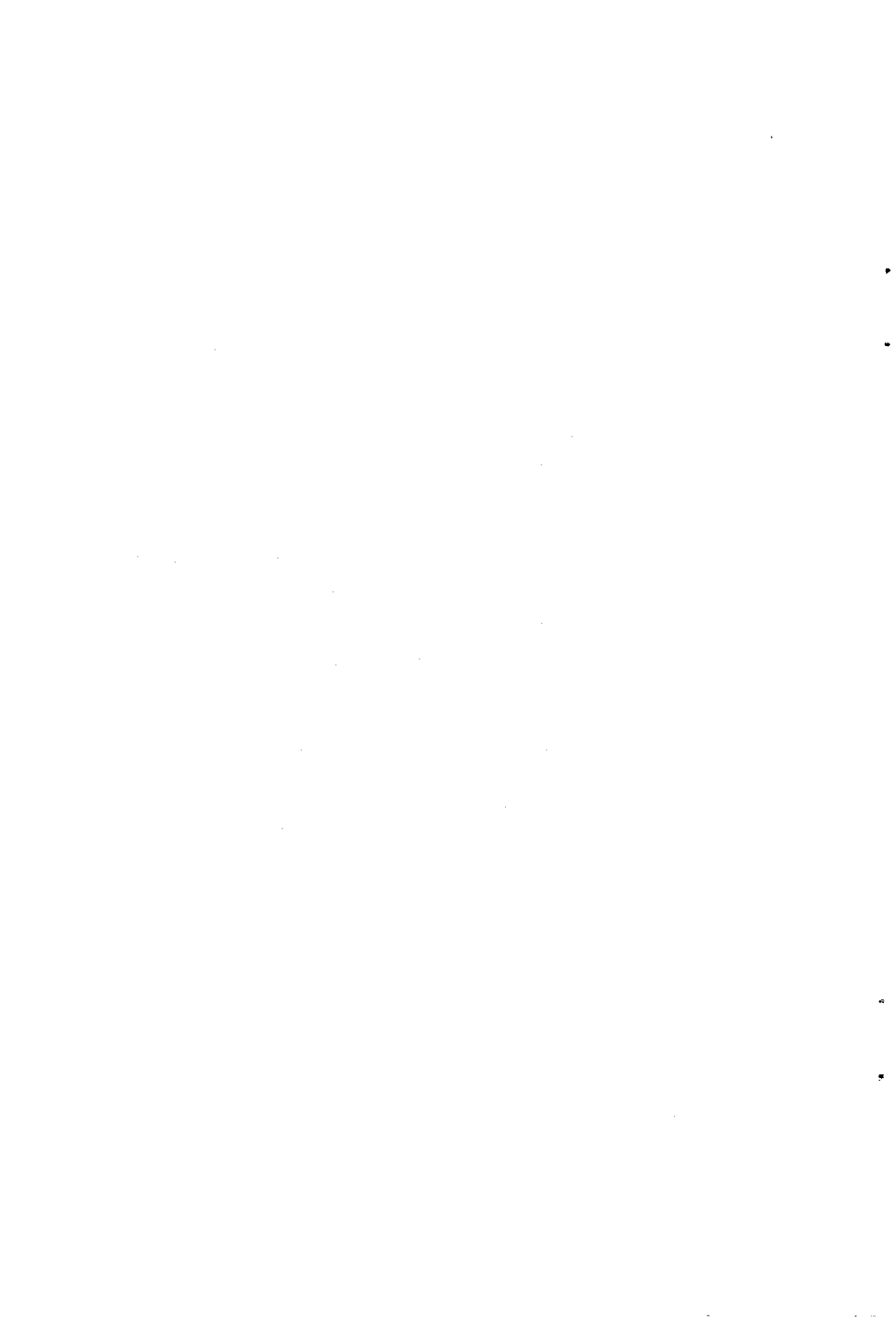


TABLE VII

NATIONAL INSTITUTIONS CONCERNED WITH THE PROVISION OF WATER AND SANITARY SEWERS IN LATIN AMERICA WITH REFERENCES TO NEW IMPORTANT LOCAL INSTITUTIONS AND LAWS OR SPECIAL FUNDS OF NATIONAL SCOPE ESTABLISHED SINCE 1961

COUNTRY	DATE OF ESTABLISHMENT				PROJECTS
	1961	1962	1963	1964	
ARGENTINA	The Basic National Institution: OSN and Provincial Agencies			New Regime for Law 16.660*	
	Urban Sanitation Fund for the Buenos Aires Area (Law 16.437)*			National Service of** Rural Potable Water and Sanitation (SNAP)	
BOLIVIA	Bolivian Administration of Sanitary Works (ABOS) ** General Engineering			Local Service of *** Potable Water and Sewers of Oruro	
	The Municipal Organizations				
BRAZIL	New State and Municipal Agencies were Established				Corporation of Aqueducts and Sewers(CORPAGUAS)
	Department of Sanitary Works (DNOS) National Fund of Sanitary Works*	The Federal Organization (SESP and others), State and municipal			
COLOMBIA	National, Departmental, and Municipal Institutions: INSPOPAL, Departmental Anonymous Societies, Autonomous Municipal Agencies, and the Division of Environmental Health of the Ministry of Public Health				
COSTA RICA	National Service of** The Division of Sanitary Engineering of the Ministry of Health and the municipal systems Aqueducts & Sewers(SNAA) that have not been transferred to SNAA				
CHILE	The basic National Institution: Direction of Sanitary Works, and also the Direction of Planning, Ministry of Public Works. Section of Environmental Hygiene, Ministry of Health and Municipal Services				
ECUADOR	The Department of Sanitary Works of the Ministry of Public Works, Agencies of the Ministry of Health and Municipal Services, Municipal Agencies or Canton Boards. There is not a National Agency.				Ecuadorian Institute of San. Works
EL SALVADOR	National Administration of Aqueducts & Sewers (ANDA)**	The Division of Sanitary Engineering of the Ministry of Health and Municipal Systems not yet transferred to ANDA			
GUATEMALA	The INFOM, the SESP, the National Committee of Potable Water, Department of Aqueducts and Sewers of the Ministry of Public Works, and the municipal systems				
HAITI		Hydraulic Services of Haiti		Autonomous Metropolitan Central of Potable Water (CAMEP)***	
HONDURAS	National Autonomous Service of Aqueducts & Sewers (SANAA)**	The Division of Environmental Sanitation of the Ministry of Health and municipal systems not yet transferred to SANAA			

(continued)



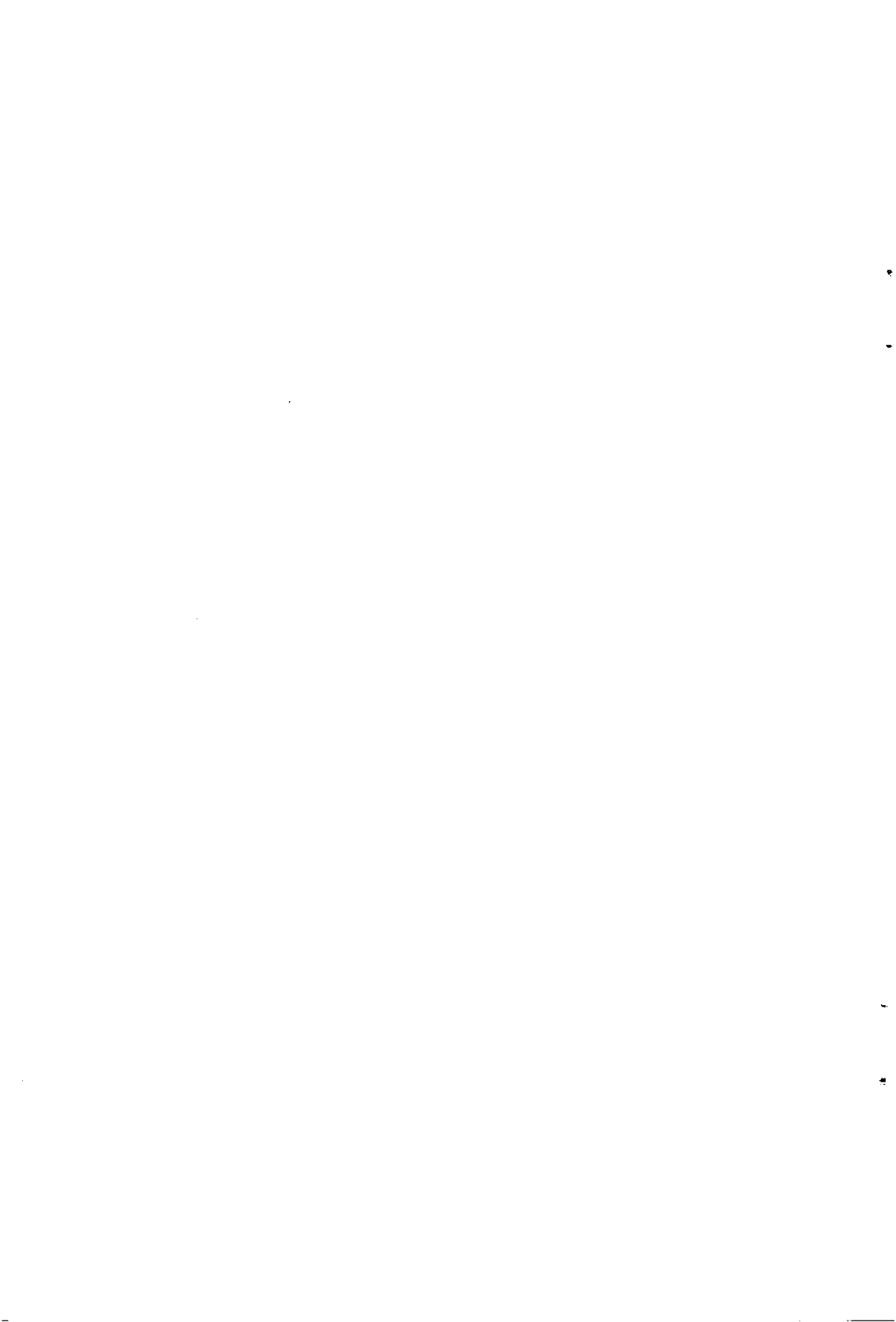


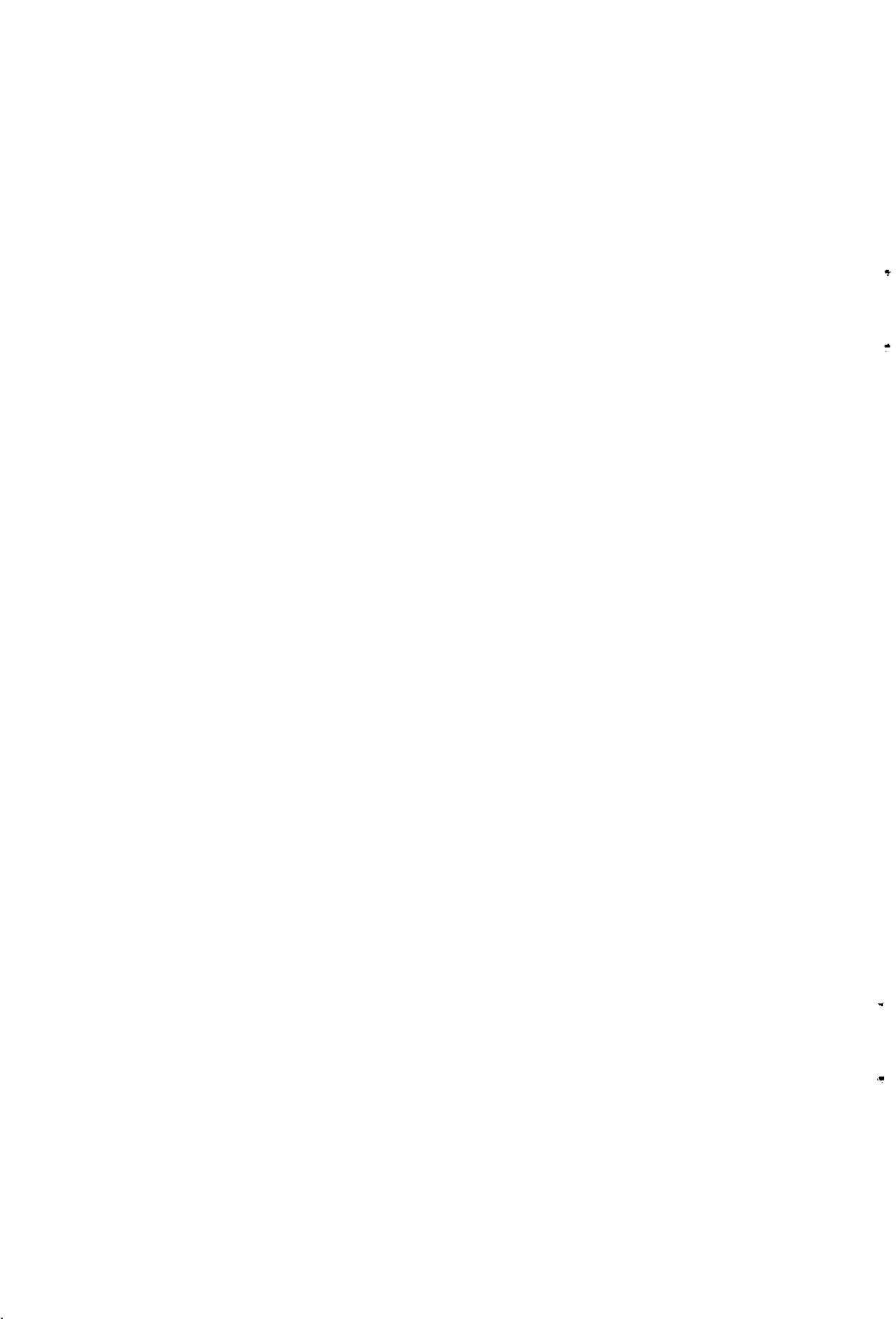
TABLE VII (Continued)

NATIONAL INSTITUTIONS CONCERNED WITH THE PROVISION OF WATER AND SANITARY SEWERS IN LATIN AMERICA WITH REFERENCES TO NEW IMPORTANT LOCAL INSTITUTIONS AND LAWS OR SPECIAL FUNDS OF NATIONAL SCOPE ESTABLISHED SINCE 1961

COUNTRY	DATE OF ESTABLISHMENT					PROJECTS
	1961	1962	1963	1964	1965	
MEXICO	The basic structure: Department of Hydraulic Resources (SRH), National Mortgage and Public Works Bank, the Federal Boards of Potable Water, the Ministry of Health and Assistance, the Federal District Services and Municipal Services					
NICARAGUA	The National Department of Municipal Services, the Ministry of the Interior, the Ministry of Health, the Autonomous Water Supply Agencies, and the Municipal Systems. There is not a National Agency.					
PANAMA	Institute of National Aqueducts & Sewers (IDAAN)**	Department of Public Health of the Ministry of Labor, Welfare and Public Health and the systems not yet transferred to the IDAAN				
PARAGUAY		Autarchic Service of Sanitary Works (SANOS)**	CORPOSANA in Asunción and the Programs of the Ministry of Health in cooperation with internal organizations. There are no other Municipal Systems.			
PERU	Corporation of Sanitation of Arequipa***	Corporation of Sanitation of Lima *** Law of Rural Sanitation (Operation under the SESP)*	The Sub-Director of Sanitary Works of the Ministry of Development and Public Works; the National Fund for Economic Development; the SESP; the National Institute of Housing, the municipal systems, and other departmental agencies			National Institute of Sanitation
DOMINICAN REPUBLIC		National Institute of Potable Water & Sewers (INAPA)**		National Service of Rural Aqueducts (SNAR)**		
URUGUAY	The National Basic Institution: OSE - The Ministry of Health is in charge of the Rural Area with the cooperation of the Geological Institute and OSE. The Montevideo Sewers are under the Department of Engineering and Works of the Montevideo Council.					
VENEZUELA	The Basic Institutional Structures: INOS, the Division of Rural Aqueducts (ACUARUR) of the Ministry of Health and Public Assistance. The coordination is under the Council of Hydraulic Resources.					
PUERTO RICO		The Authority of Aqueducts and Sewers				

REFERENCES: \* Laws or Special Funds of National Scope  
 \*\* New National Institutions  
 \*\*\* Important Local Organizations

SOURCE: Doc. W5/49/3 - Institutional Structure and Administrative Procedures by Eng. Oscar Terrevazzi - presented at Regional Conference on Water Supplies in the Americas, October 1965.



Significant progress has been made since the start of the Decade in other aspects as well. Old phobias are being dispelled. More people in both urban and rural areas are accepting the fact that water must be paid for like electricity and other services. Officials, engineers and economists are realizing that there are ways of obtaining the necessary funds, which they once thought unobtainable, for water supply and sewage disposal.

Legislation has been passed assigning specific responsibilities for water supply and sewage activities; organizational structures have been set up and management has been improved. Table VI (see Page 23), presented in 1965, gives a resumé of the national institutions concerned with water supply and sewerage at that time. Additional changes have been made since then.

As new agencies were established and as the existing organizations began to expand their activities, it became evident that consultation would be required across the board instead of department by department. The Organization responded by developing a team approach with consultation provided by a group of advisors working together but each individually with the national counterpart of his specialty. This has proven so successful that the consultation, already provided in depth to 15 agencies as tabulated in Table VI (see Page 23) has been requested by 26 more. Further proof of the efficacy of this assistance is the willingness of the agencies to finance the cost themselves, either from their own budgets or from a loan for an expansion program. (See Annex C for a more detailed report of the team approach.)

The support of the international lending agencies (\$593.2 million in loans), coupled with the unprecedented amounts of money assigned by the national governments (\$874.8 million), for water supply and sewerage systems has provided the life blood needed for these programs during the period from 1961 through 1968 (see Table VIII).

TABLE VIII

SUMMARY FINANCIAL DATA ON THE COMMUNITY WATER SUPPLY  
PROGRAM IN LATIN AMERICA FOR THE ALLIANCE DECADE  
STARTING 1961

Data as of 31 December 1968

International Loans from:

Inter-American Development Bank	(IDB)	\$ 425,315,100	(a)
Agency for International Development	(AID)	99,112,600	(a)
International Development Association	(IBRD)	38,300,000	
Export-Import Bank	(EXIMBANK)	30,508,355	
		<hr/>	
Total International Loans		\$ 593,236,055	
National Funds - Including Counterpart Funds to support international loans		874,790,000	
		<hr/>	
Total	\$	1,468,026,055	

Number of people benefited

(urban and rural) 65,500,000

(a) Includes loans which have been approved as well as those which have been signed.

Notes: 1) Of total funds (\$1,468,026,055), \$1219.7 million is for urban centers and \$248.3 million is for rural areas.

2) Total figures include small percentage for sewerage works.

TABLE IX

FUNDS ALLOCATED FOR CONSTRUCTION OF WATER SUPPLY AND SEWERAGE SYSTEMS IN LATIN AMERICA  
(January 1961 - December 1968)  
(U.S. Dollars)

Country	International Loans						Estimated national matching funds	
	IDB		IBRD	AID		EXIMBANK		
	Water	Sewerage	Water	Water	Sewerage	Water		Sewerage
Argentina .....	33,730,000	2,270,000	-	1,400,000	-	-	-	43,030,000
Bolivia .....	10,600,000	4,800,000	-	1,145,000	-	-	-	9,397,000
Brazil .....	113,060,000	14,650,000	-	21,695,000	2,500,000	-	-	186,164,000
Chile .....	26,645,000	-	-	2,000,000	840,000	187,850	-	21,104,000
Colombia .....	27,751,397	7,233,000	14,000,000	3,800,000	9,600,000	1,261,000	-	59,598,600
Costa Rica .....	1,400,000	140,000	-	4,900,000	-	4,000,000	-	2,824,000
Dominican Republic .....	4,960,000	1,090,000	-	3,000,000	-	-	-	3,300,000
Ecuador .....	17,200,000	3,568,000	-	-	-	-	-	8,423,000
El Salvador .....	7,680,000	1,520,000	-	75,000	-	-	-	4,540,000
Guatemala .....	6,217,804	2,000,000	-	24,000	-	-	-	4,185,200
Guyana .....	-	-	-	2,650,000	-	-	-	1,200,000
Haiti .....	2,360,000	-	-	-	-	-	-	350,000
Honduras .....	2,550,000	-	-	1,050,000	-	-	-	650,000
Jamaica .....	-	-	-	3,700,000	-	-	-	1,800,000
Mexico .....	13,474,000	550,000	-	-	-	36,000	-	9,296,000
Nicaragua .....	2,000,000	185,000	3,000,000	143,000	-	-	-	4,380,000
Panama .....	5,842,000	370,000	-	21,139,600	10,851,000	-	-	15,007,000
Paraguay .....	3,895,000	4,670,000	-	-	-	-	-	3,550,000
Peru .....	23,424,539	9,736,360	-	5,700,000	2,900,000	5,123,505	1,500,000	41,779,200
Trinidad & Tobago .....	300,000	-	-	-	-	-	9,000,000	9,313,000
Uruguay .....	12,943,000	3,300,000	-	-	-	1,900,000	-	23,768,000
Venezuela .....	46,000,000	7,200,000	21,300,000	-	-	7,500,000	-	121,131,000
TOTAL.....	362,032,740	63,282,360	38,300,000	72,421,600	26,691,000	20,008,355	10,500,000	574,790,000

International Loans .....	\$ 593,236,055
Water.....	\$492,762,695
Sewerage.....	100,473,360
National matching funds.....	574,790,000
Other national funds.....	300,000,000
TOTAL FUNDS.....	\$1,468,026,055

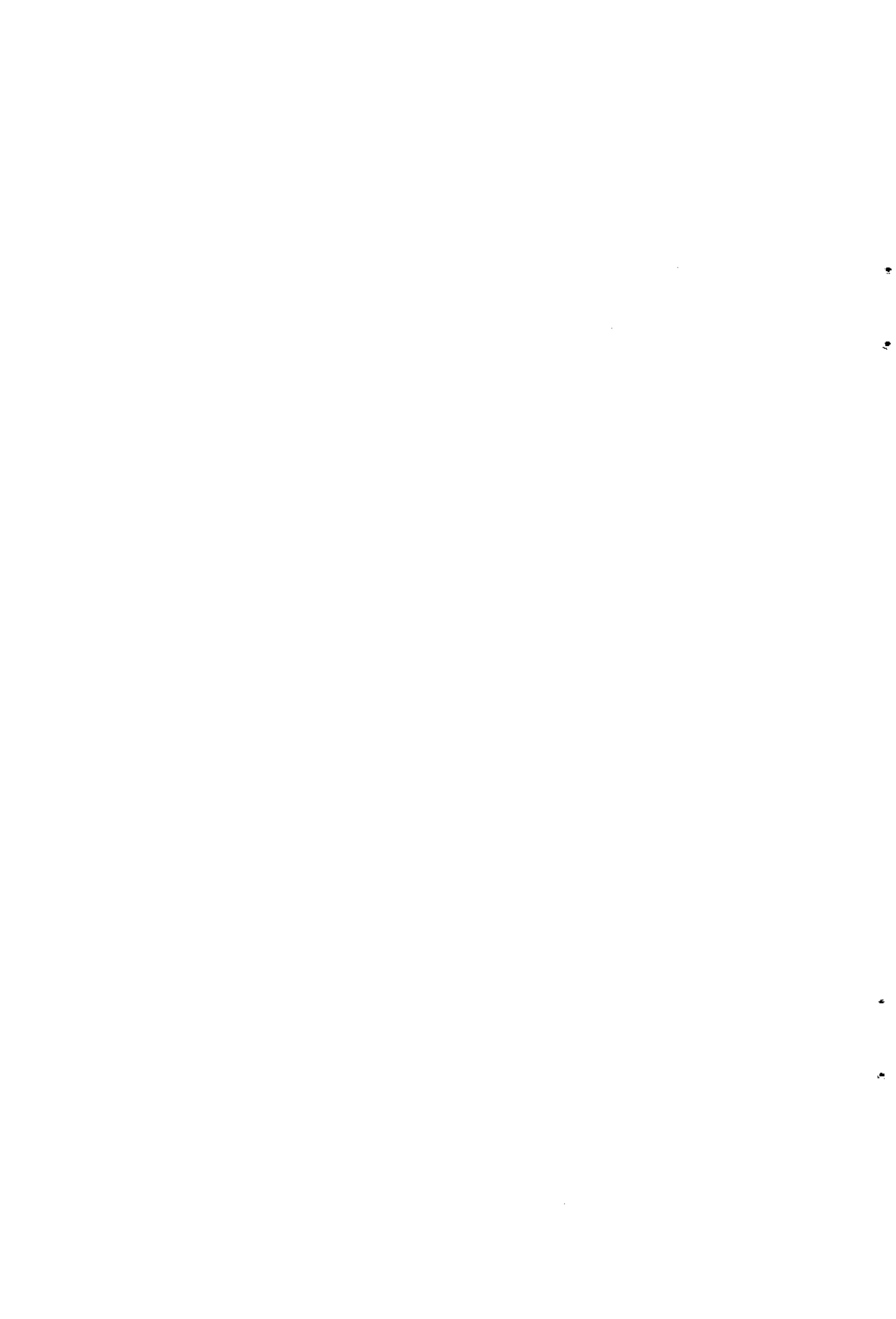


TABLE X  
INTERNATIONAL LOANS AND NATIONAL MATCHING FUNDS FOR RURAL  
COMMUNITY WATER SUPPLY AND SEWERAGE SYSTEMS IN LATIN AMERICA  
(January 1961 - December 1968)  
(U.S. Dollars)

Country	Lending Agency	Year	Loan	National Matching Funds
Argentina	IDB	1965	5,000,000	5,000,000
Bolivia	IDB	1968	1,800,000	1,675,000
Chile	IDB	1964	2,500,000	2,500,000
Costa Rica	IDB	1965	1,300,000	1,000,000
Dominican Republic	IDB	1968	1,950,000	1,050,000
El Salvador	IDB	1961	1,000,000	420,000
		1964	1,060,000	480,000
Guatemala	IDB	1966	1,300,000	800,000
Guyana	IDB	1968	600,000	400,000
Honduras	IDB	1963	1,050,000	-
Nicaragua	IDB	1968	2,000,000	1,330,000
Panama	IDB	1967	1,160,000	607,000
Peru	IDB	1964	1,650,000	1,450,000
		1967	3,135,000	4,044,000
Venezuela	IDB	1962	10,000,000	10,000,000
		1965	<u>10,000,000</u>	<u>10,000,000</u>
TOTAL			45,505,000	40,756,000



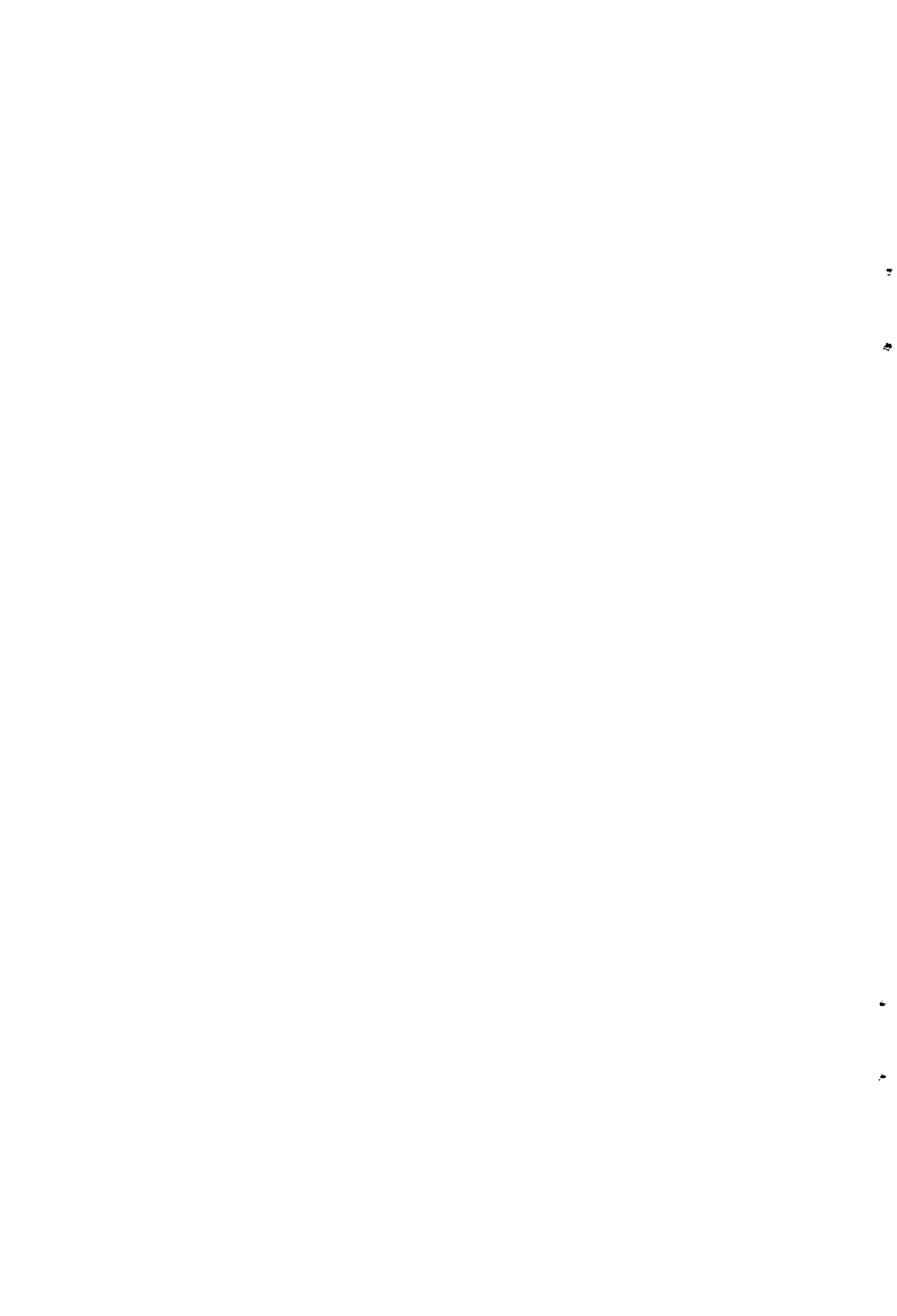
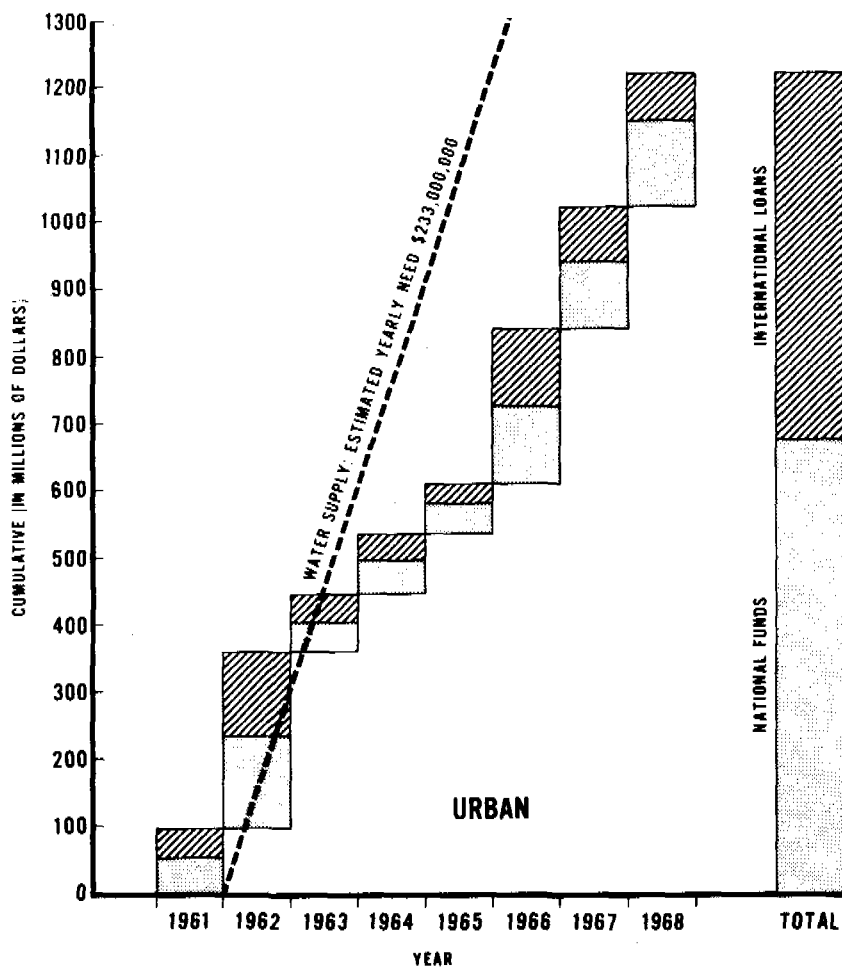


Figure II

NATIONAL FUNDS AND INTERNATIONAL LOANS ALLOCATED FOR CONSTRUCTION OF  
URBAN WATER SUPPLY AND SEWERAGE SYSTEMS IN LATIN AMERICA  
JANUARY 1961 - 31 DECEMBER 1968



SOURCE	1961	1962	1963	1964	1965	1966	1967	1968	TOTAL
INTERNATIONAL LOANS	43.14	127.74	41.82	39.35	27.61	114.36	82.32	71.39	547.73
IDB	24.65	96.30	28.55	31.04	16.04	72.12	72.56	40.20	381.46
AID	3.50	17.44	10.27	8.05	9.30	20.94	10.77	17.19	97.46
IBRD			3.00			21.30		14.00	38.30
EXIMBANK	14.99	14.00		0.26	2.27		-1.01		30.51
NATIONAL FUNDS	51.19	136.56	43.20	52.87	43.30	114.38	101.98	128.50	671.98
TOTAL	94.33	264.30	85.02	92.22	70.91	228.74	184.30	199.89	1,219.71

AMOUNTS IN MILLIONS OF U.S. DOLLARS

NOTE: Loans, until signed, are included in year of approval; thereafter they are listed in year of signature.

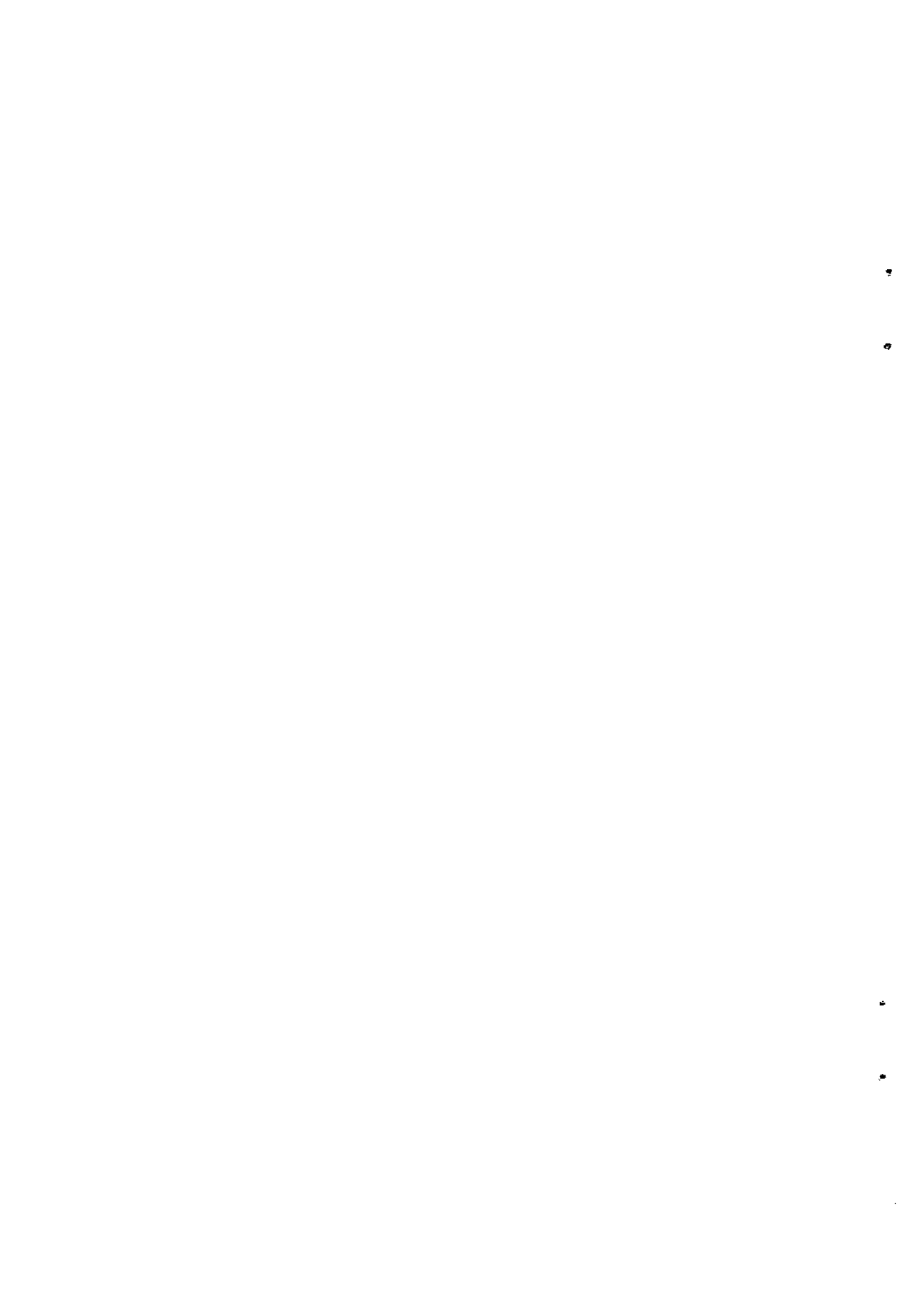
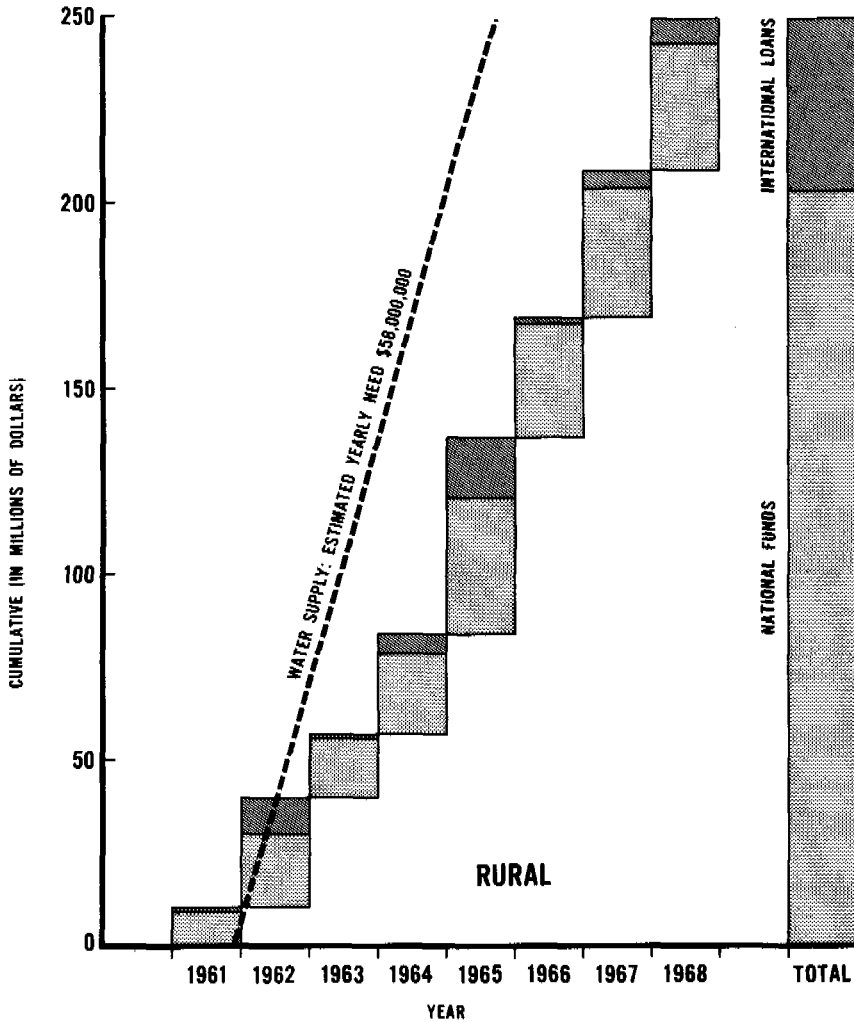


Figure III

**NATIONAL FUNDS AND INTERNATIONAL LOANS ALLOCATED FOR  
CONSTRUCTION OF RURAL WATER SUPPLY AND SEWERAGE SYSTEMS IN  
LATIN AMERICA JANUARY 1961 - 31 DECEMBER 1968**



SOURCE	1961	1962	1963	1964	1965	1966	1967	1968	TOTAL
INTERNATIONAL LOANS	1.00	10.00	1.05	5.21	16.30	1.30	4.30	6.35	45.51
IDB	1.00	10.00		5.21	16.30	1.30	4.30	5.75	43.86
AID			1.05					0.60	1.65
NATIONAL FUNDS	8.50	20.00	17.05	22.00	36.40	30.80	34.65	34.46	202.81
TOTAL	9.50	30.00	16.00	27.21	52.70	32.10	38.95	40.81	248.32

AMOUNTS IN MILLIONS OF U.S. DOLLARS

NOTE: Loans, until signed, are included in year of approval; thereafter they are listed in year of signature.

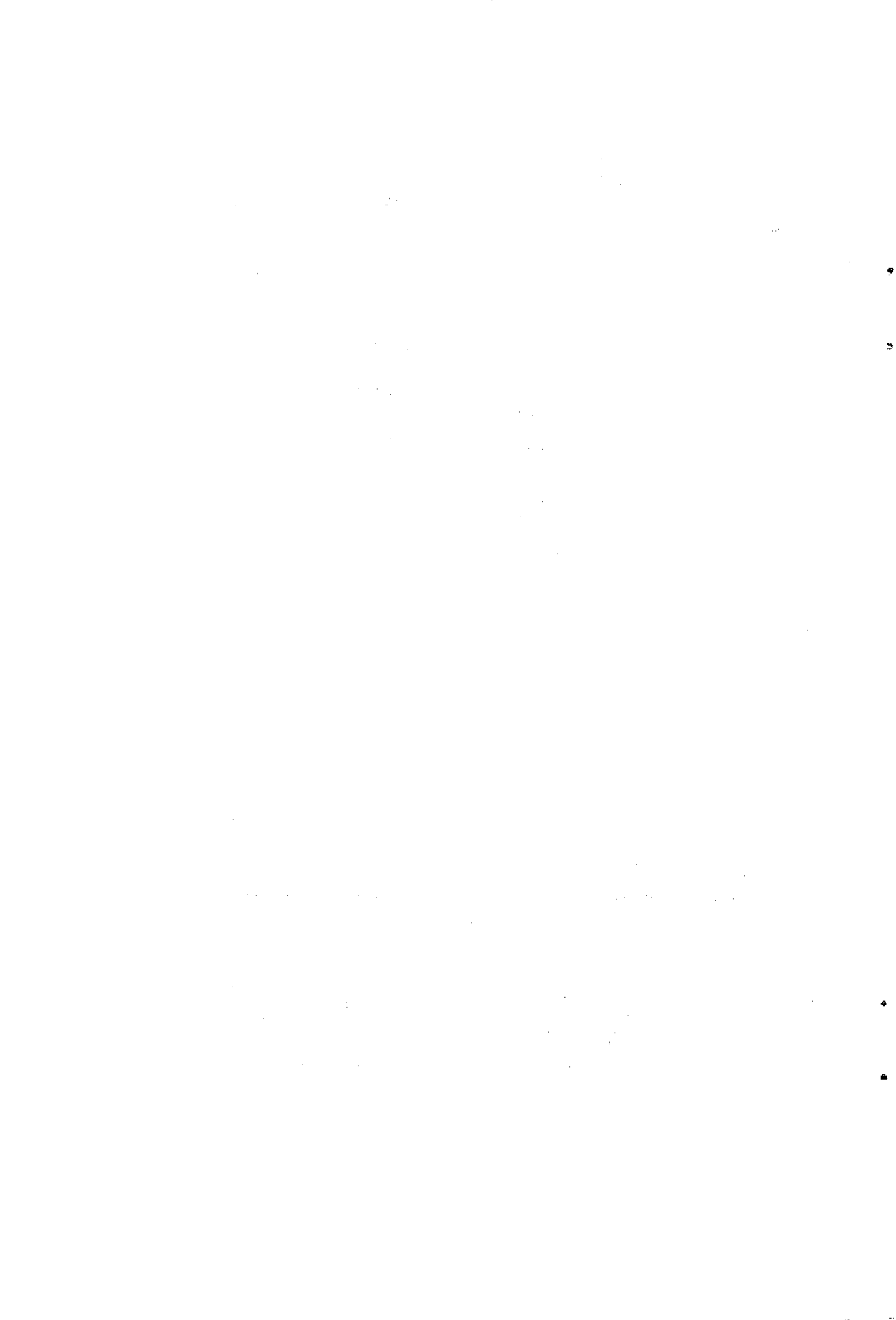
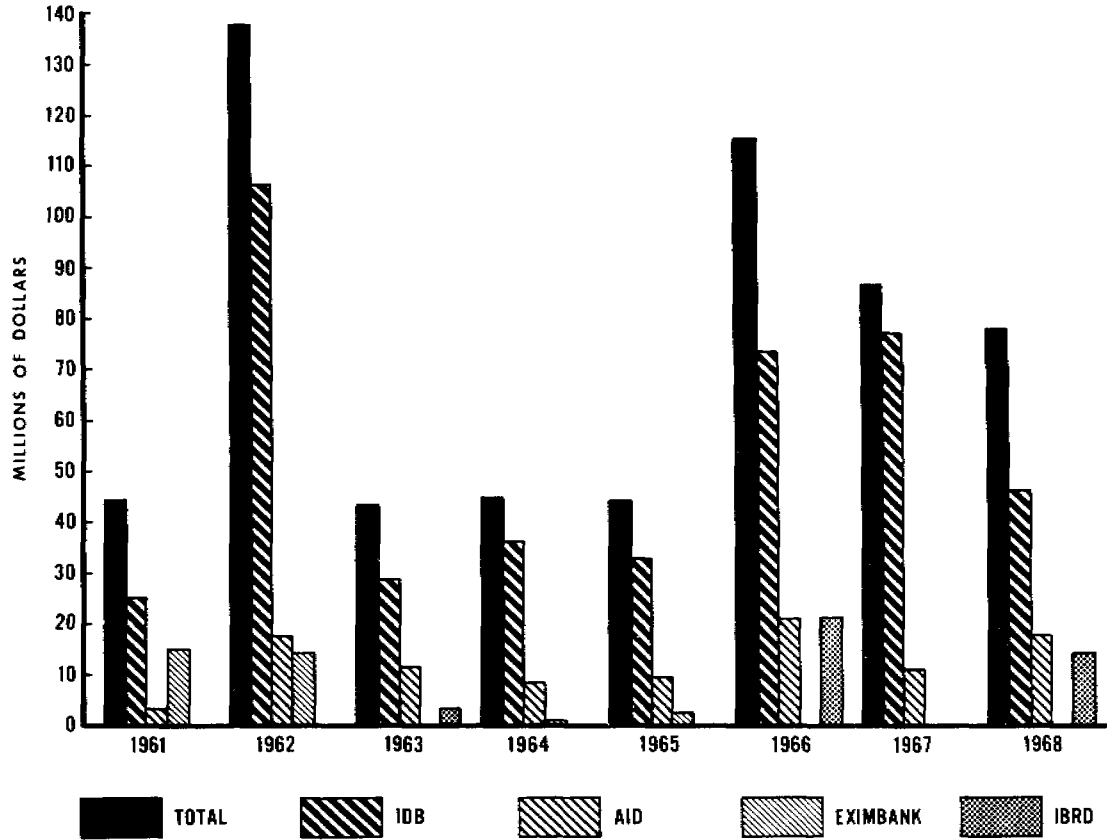


Figure IV

INTERNATIONAL LOANS FOR THE CONSTRUCTION OF URBAN AND RURAL WATER SUPPLY  
AND SEWERAGE SYSTEMS IN LATIN AMERICA, 1961-1968





The breakdown by countries and lending agencies is tabulated in Table IX.

The amounts of money made available annually by the national governments and international lending agencies are shown graphically in Figures II and III for the urban and rural programs. The yearly fluctuations in international loans are presented in Figure IV. Attention is called to the steady decline since the high point in 1966.

Of the total of \$492.8 million provided by international lending agencies for community water supply projects during the period from 1961 through 1968, \$397 million has been for urban systems and \$45 million, less than 10 per cent, has been for rural systems. See the following tabulation for countries which have received loans for rural community water supply programs (includes \$1.0 million for sewerage systems). (See Table X)

A comparison is made in Table XI between the expenditure estimated in 1961 as required to meet the water supply goals of the Charter and the funds actually made available for that purpose during the period 1961-1968.

TABLE XI  
FUNDS FOR WATER SUPPLY CONSTRUCTION, 1961-1968  
(Millions of Dollars)

	URBAN	RURAL	TOTAL
Estimated 1961 for 1961-1968	1,631	406	2,037
Allocated 1961-1968	991	246	1,237



Slightly more than half the amount of money estimated as necessary for both urban and rural programs has been made available.

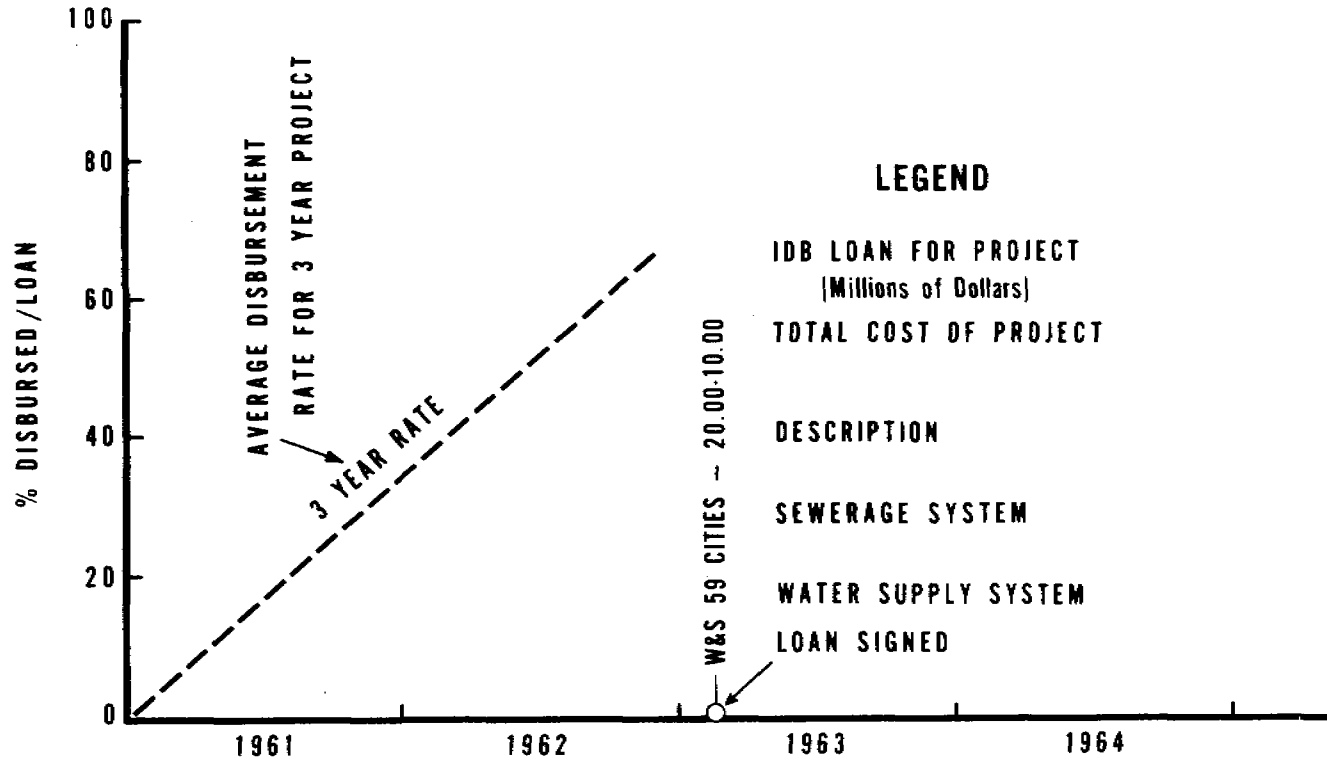
Funding for water supply and sewerage system construction, while a very important aspect of the programs, is overshadowed by the importance of the way the funds are used in carrying out the programs. Some countries have made excellent progress in carrying out their programs once the money is made available. Others have gone through long periods of delay while complying with provisions of the loan contracts or while getting organized to carry out the actual construction. This progress is shown graphically in Figure V for the various loans made by the Inter-American Development Bank. The figures are based on the loan disbursements as a percentage of the amount loaned. While it is true that the loan disbursement is only one element of construction progress, it is an indicator of that progress.

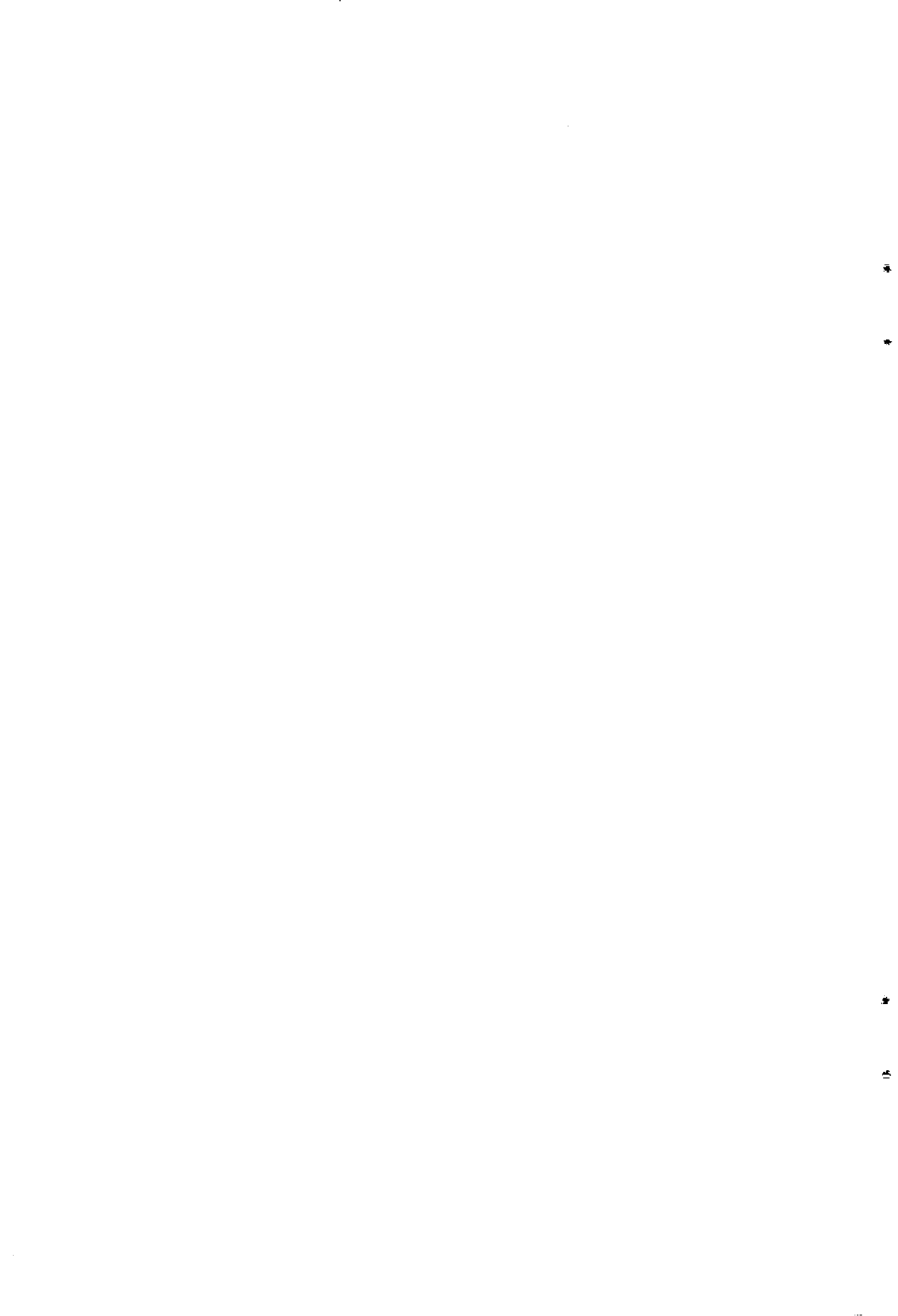
The legend on the first sheet of Figure V explains the meaning of the various elements in each figure. The "3 year rate" line is plotted to give a comparison between actual rate of disbursement and the average rate which would be required to disburse the amount of the loan, assuming that the loan covers a period of three years as do many of the loans.

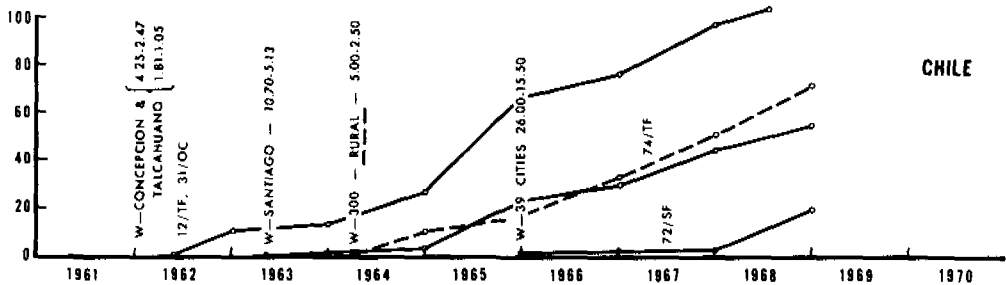
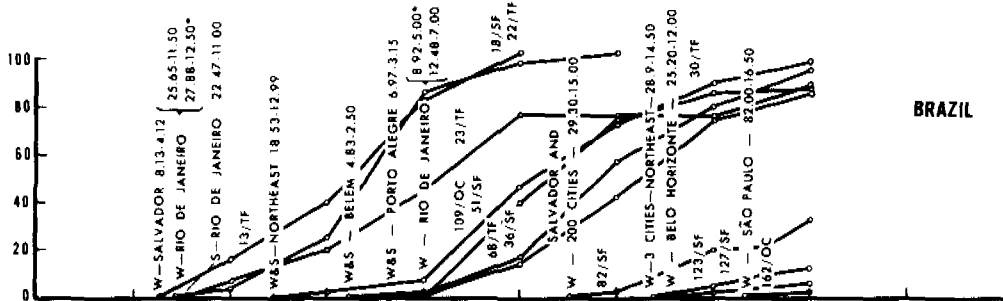
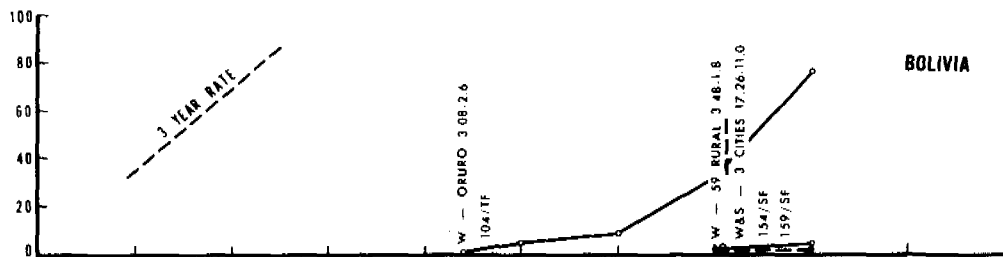
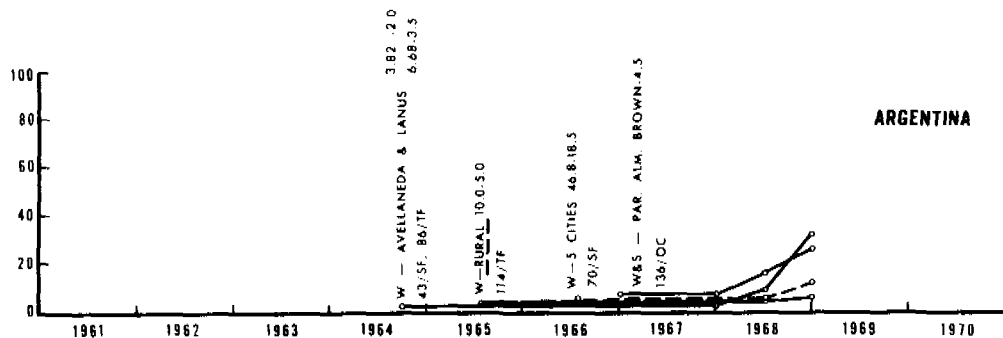
The policies developed by the lending agencies in connection with granting loans for water supply and sewerage systems have had a very effective impact on the organizations requesting those loans. An important consideration is that the administrative, technical and financial capacity must exist so that the project will be carried out properly and the systems will be operated efficiently. In some cases it has been necessary to reorganize the agency responsible for carrying out the project or operating the system.

Figure V

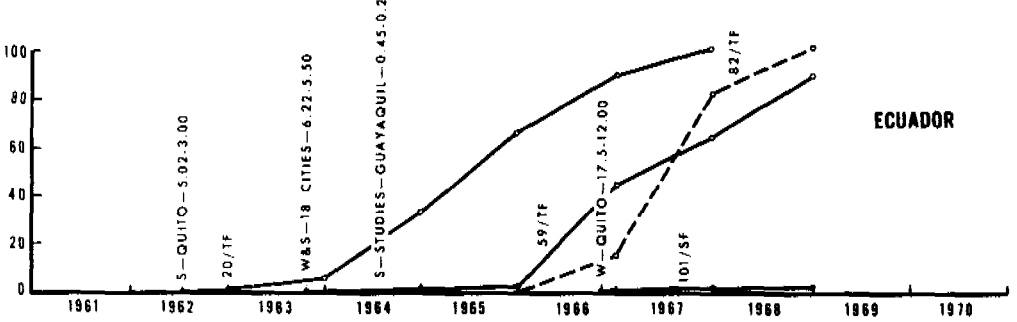
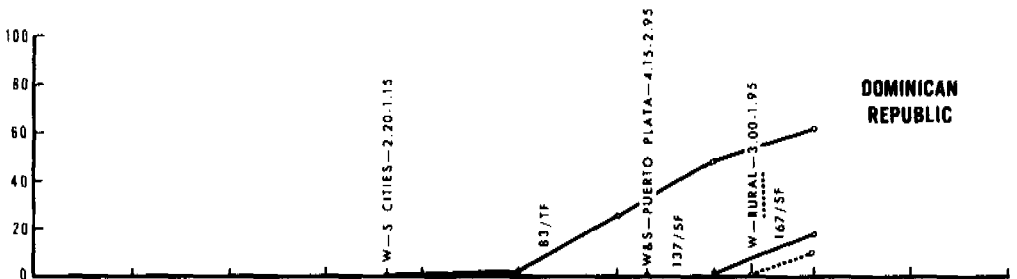
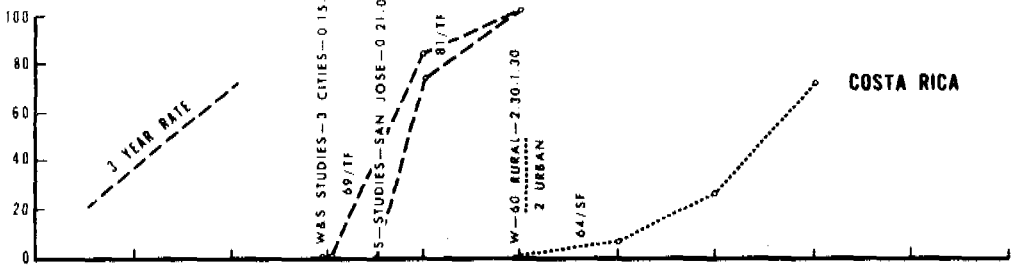
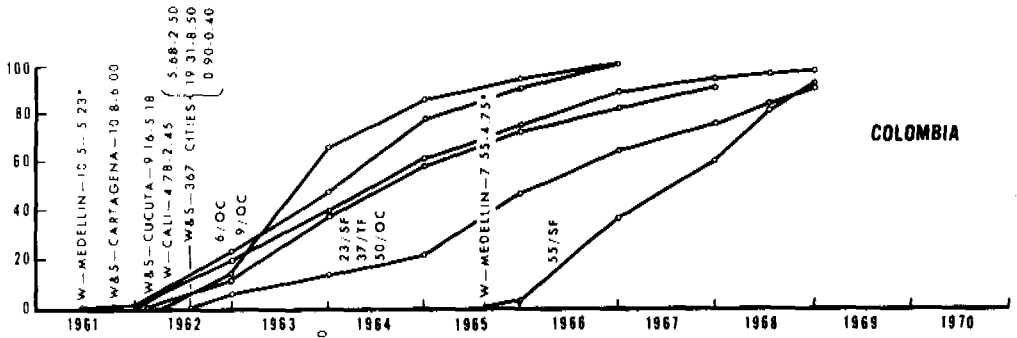
WATER SUPPLY AND SEWERAGE PROJECTS  
INTER-AMERICAN DEVELOPMENT BANK LOANS  
PROGRESS OF LOAN DISBURSEMENTS



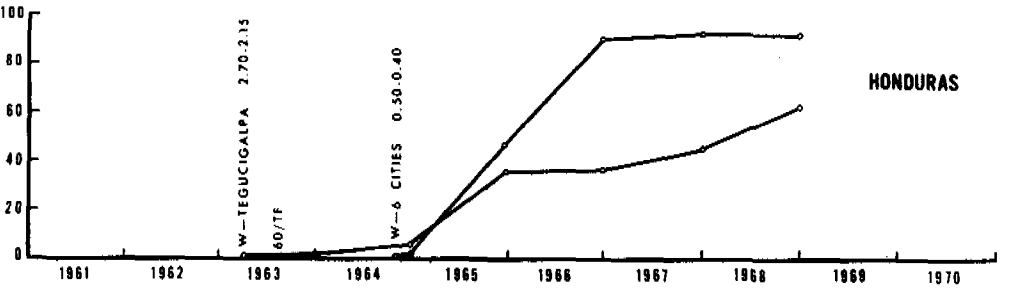
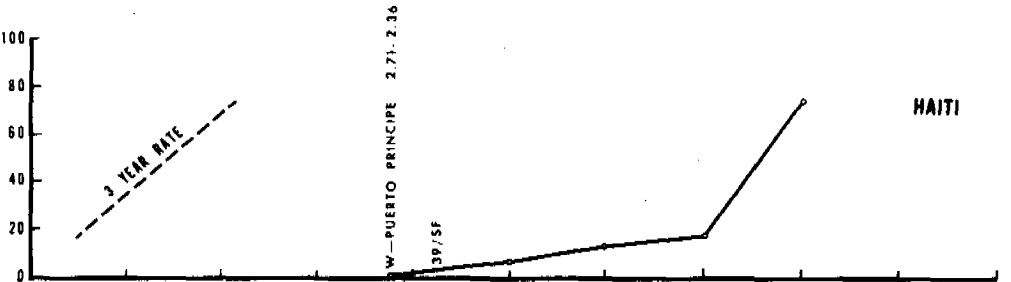
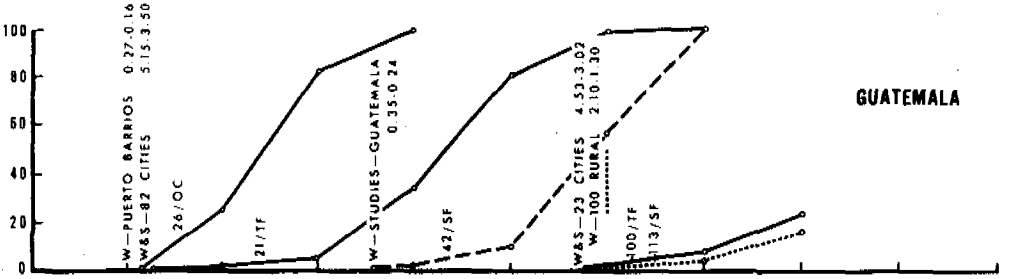
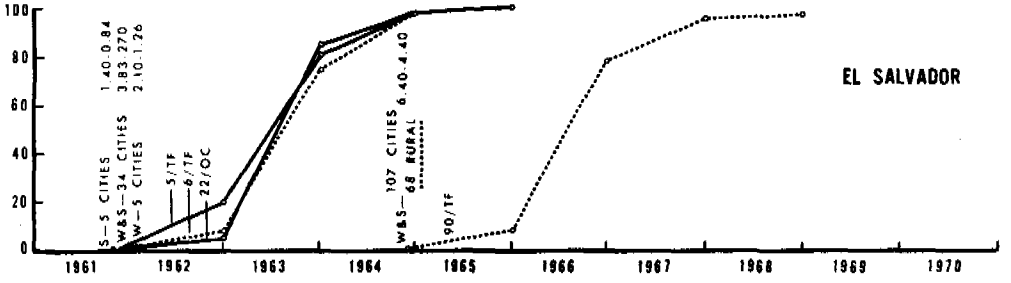






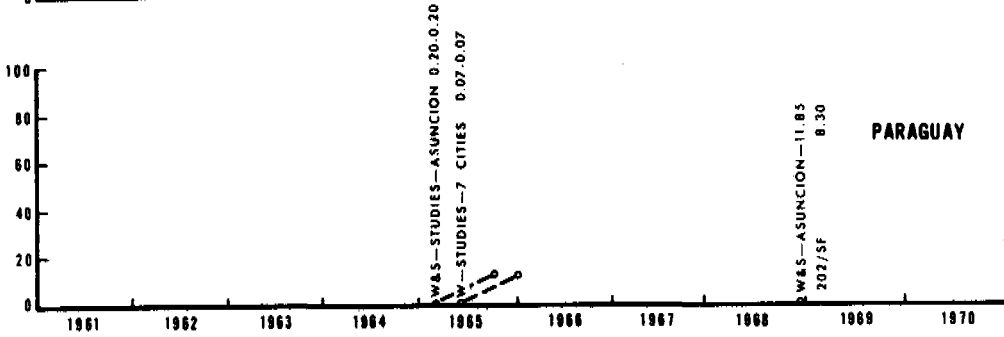
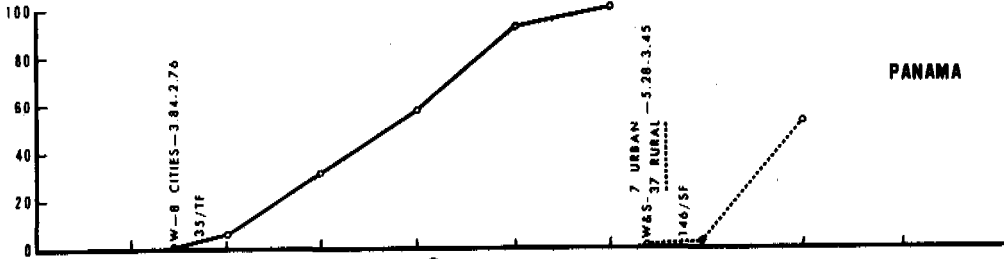
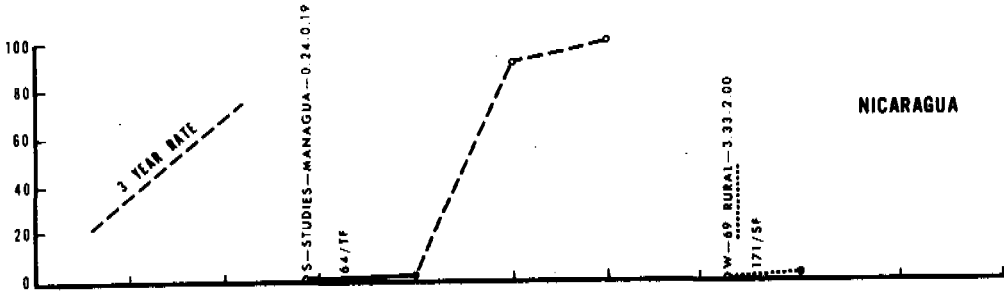
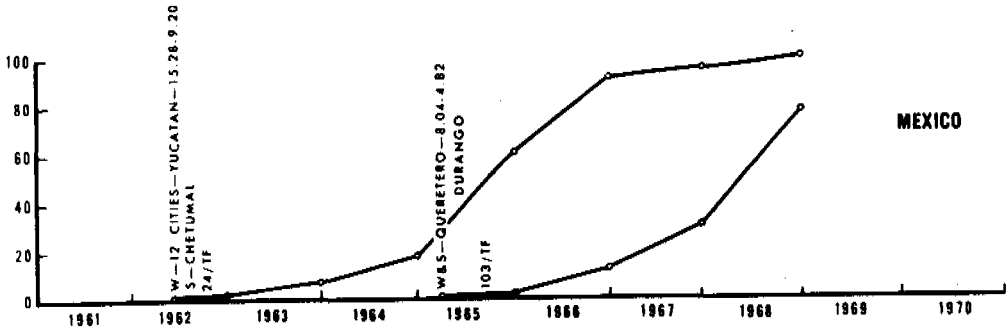




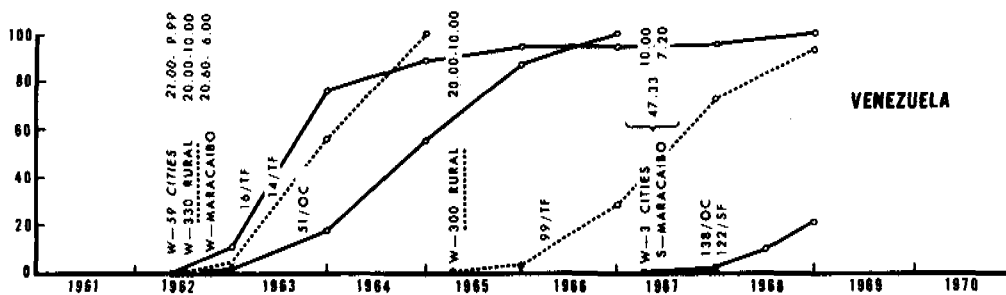
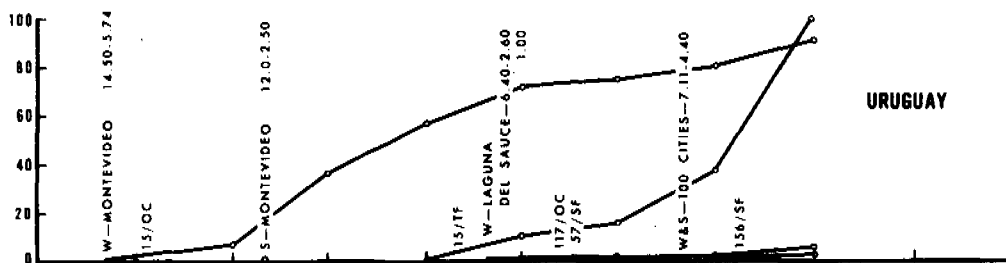
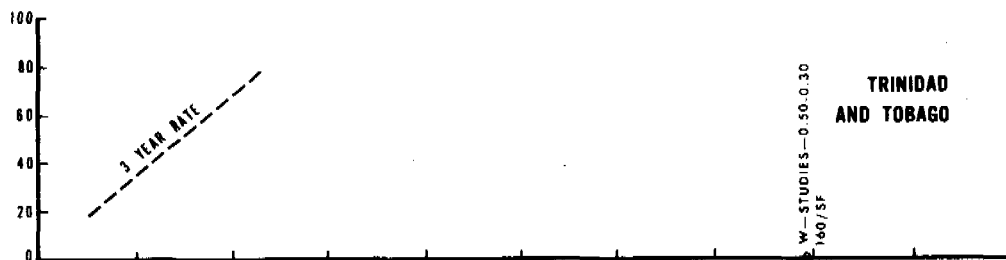
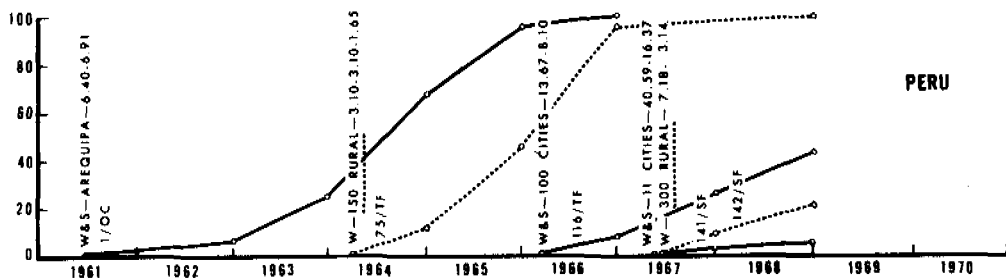


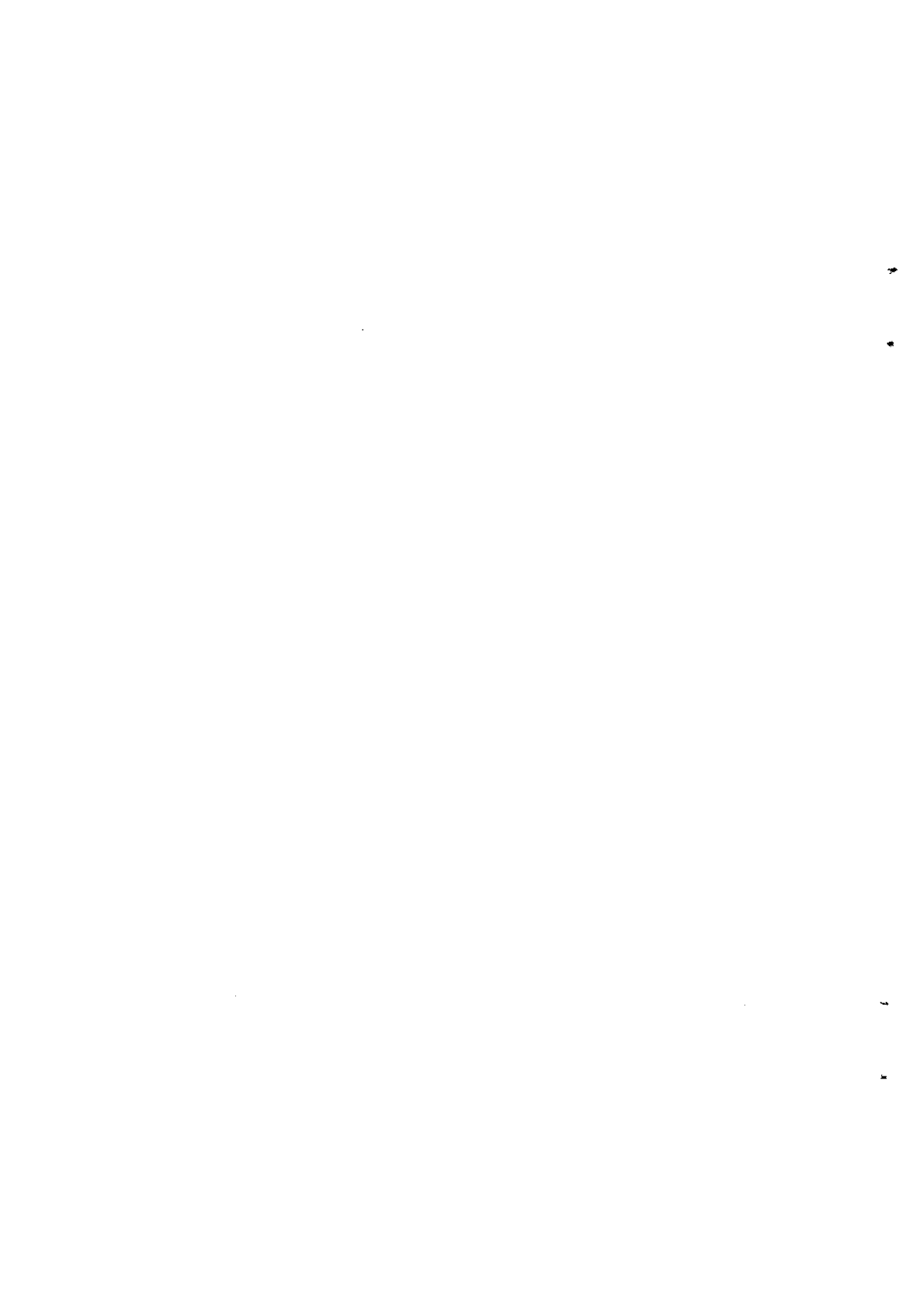












Another consideration is that of water rates. They must suffice to cover at least the regular operating expenses of the system, including those of administration, interest, maintenance, and, as far as possible, depreciation.

All plans must form part of the economic and social development plan of the country, and any request for a loan must have the approval of the national planning agency or the central government. Every individual project must form part of a master plan which takes into account the future growth of the population for a reasonable period of time.

The greatest cause of delay in studying loan requests has been the lack of well-formulated projects and suitable studies. A guide for the submission of loan requests has been prepared by each of the lending institutions. As a result, the presentation of loan requests has greatly improved because the applicants have a better understanding of the institutions' requirements. (See Annex B, Financing Sanitary Engineering Projects, October 1969.)

Progress has been made in establishing the use of the revolving fund as a mechanism for providing loans to rural communities to construct water systems. This financing mechanism has three objectives: (1) to give impetus to the rural water supply programs; (2) to strengthen the organization of the individual community, helping it to take full advantage of its self-help potential; and (3) to establish in each country a self-renewing fund. The use of the revolving fund mechanism has been encouraged by the various governing bodies with the latest Declaration of the Presidents (of 1967) containing the mandatory clause, "National revolving fund systems shall be

used to assure the continuity of such programs" (programs for providing drinking water supplies, sewerage and other services essential to environmental sanitation).

The necessary legislation has been adopted in several countries for revolving funds and they have been established. (See Table XII.) Experience in the use of the funds is being acquired. The Organization has developed methods for setting up the funds and has suggested criteria for their operation in a manual, "El Establecimiento y Operación de Fondos Rotatorios," issued as Document No. ES 1 of a technical series in April 1969. Repayments are being made to the funds which will, in time, reach proportions that will make them another real force in the expanding struggle to help the people provide themselves with the basic necessities of life.

The Pan American Health Organization has continued to give highest priority to the community water supply program through full-time staff assigned specifically to the program, use of short-term consultants individually and in teams, special training programs and seminars, strengthening sanitary engineering education at undergraduate and graduate levels, stimulation of applied research, and other activities.

In 1961 there were three sanitary engineers working fulltime in community water supply programs and eleven attached to other environmental sanitation projects devoting part of their time to the CWS program. The number of sanitary engineers assigned to these programs has varied as tabulated in Table XIII.

TABLE XII  
STATUS OF NATIONAL REVOLVING FUND PROGRAMS

	Legis- lation date	Fund established or being adopted	L o a n   d a t a				Adminis- tering agency
			Date	Loan agency	Millions of US dollars		
					Loan	National	
Argentina	1965	yes	1965	IDB	5.0	5.0	SNAP(a)
Brazil	1965	yes	1965	AID	4.3	2.2	DNOS(b)
Colombia	1965	yes					MPH (c)
Costa Rica	1964	yes	1965	IDB	1.3	1.0	SNAAD(d)
Dominican Republic	1968	yes	1968	IDB	2.0	1.0	INAPA(e)
Peru	In Study	-		-	-	-	SESP(f)

- None
- (a) National Service for Rural Potable Water and Sanitation  
(b) National Department of Sanitary Works  
(c) Ministry of Public Health  
(d) National Water Supply and Sewerage Service  
(e) National Water Supply and Sewerage Institute  
(f) Special Public Health Service



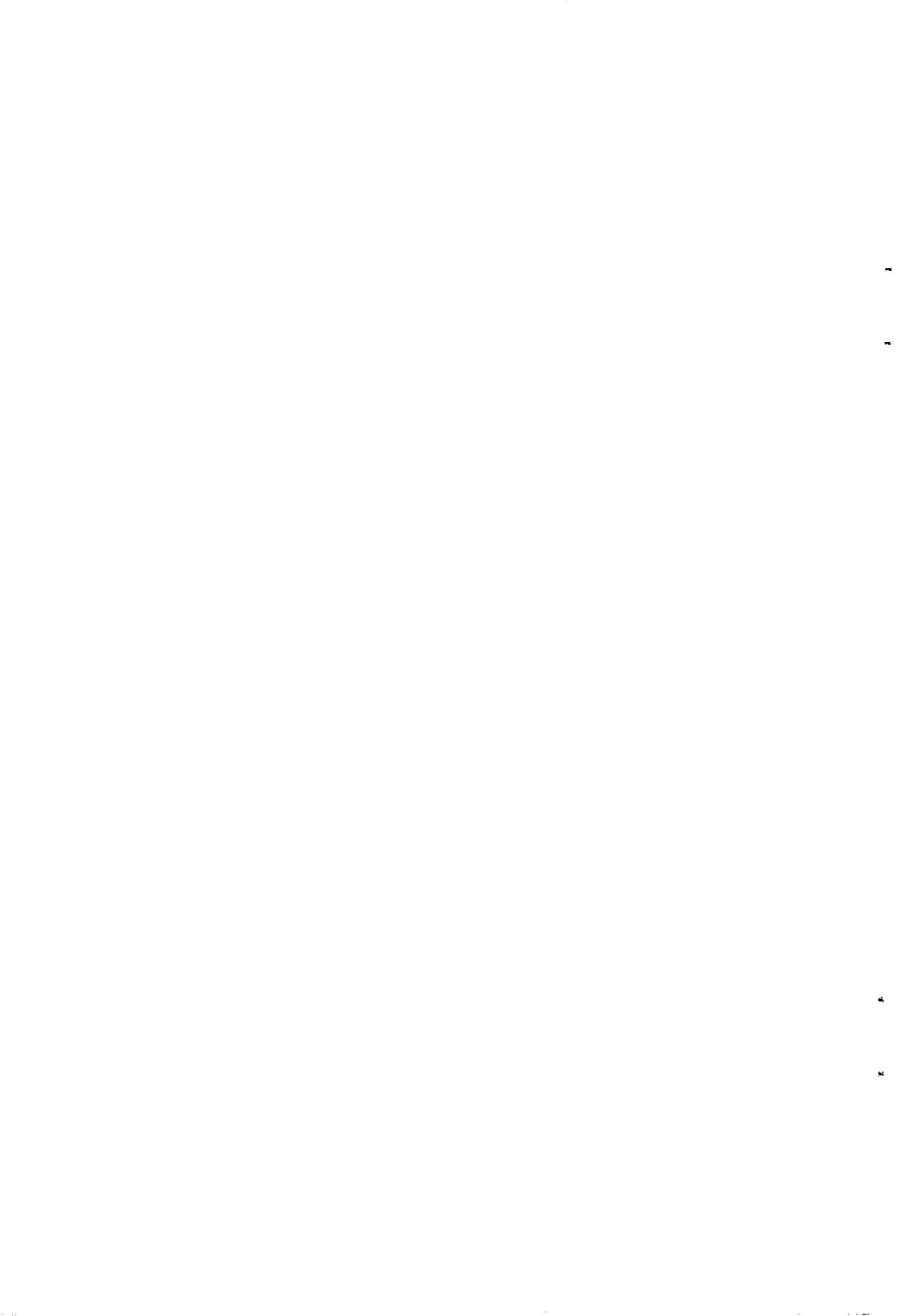


TABLE XIII  
 COMMUNITY WATER SUPPLY AND ENVIRONMENTAL SANITATION PROGRAMS  
 PERMANENT STAFF ENGINEERS AND SHORT-TERM CONSULTANTS

	1961	1962	1963	1964	1965	1966	1967	1968
<u>PAHO Staff Engineers</u>								
Community Water Supply Programs	3	8	14	13	19	19	15	10
Environmental Sanitation Programs	11	14	16	18	22	22	29	32
<u>Short-Term Consultants</u> (Man-months)								
Community Water Supply Programs	9	45	46	42	44	89	77	51

Permanent staff has been supplemented by the use of short-term consultants, particularly on special problems or for short-term requirements. Most of their assignments are for periods of from one to three months. The use of short-term consultants reached a peak of 89 man-months in 1966. It appears as though there may be a leveling off in the use of these consultants at about 60 or 75 man-months per year as fuller use is made of staff personnel on a regional basis so that their special experience and capability may be used more advantageously.

In the field of institution-building, PAHO has been engaged in the following categorical activities:

- 1) Training of engineers and other staff personnel in water and sewerage development and management.
- 2) Study and promotion of new capital development institutions, particularly national revolving funds.
- 3) Support of national sanitary works departments and water and sewerage authorities responsible for planning, design operation

and management. Studies of organization and administration of existing organizations with recommendations for improvement and encouragement of new organizations.

- 4) Preparation of manuals on administration, management and operation for water and sewerage organizations.
- 5) Promotion of countrywide inventory-type data collection, analysis and utilization for water and sewerage systems. (See Annex A, Methodology of Data Collection Programs for Community Water and Sewerage Systems in Latin America.)
- 6) Technical assistance in, and encouragement of, establishment by countries of design standards and adequate, rational water and sewer rate schedules.
- 7) Helping to strengthen the role of health ministries in all environmental health activities including quality control of water supplies and providing special assistance to strengthen the administrative relationships between ministries of health and other ministries sharing water supply and sewerage program responsibilities.
- 8) Continuation and strengthening of liaison relationships between PAHO and international lending agencies for the furtherance of more and sounder water and sewerage loan projects.
- 9) Materials and equipment for water and sewerage systems studies and support for development of: domestic production, more economical and more dependable materials and equipment, testing standards and technical specifications for product quality and uniformity.

TABLE XIV

SEMINARS AND CONFERENCES  
WATER SUPPLY AND SEWERAGE

<u>Date</u>	<u>Location</u>	<u>Title</u>	<u>Sponsor</u>	<u>Attendance</u>
1960	Montevideo, Uruguay	Water Rate Practices in Latin America	PAHO	72
April/61	São Paulo, Brazil	Administration, Management and Financing of Water Supply Systems	PAHO and Univ. of São Paulo	65
June/52	Cincinnati, Ohio	New Developments in Sewage Treatment	PAHO, AID	99
Sept/62	Buenos Aires, Argentina	Water Supply System Design	PAHO	
Feb/63	Medellín, Colombia	Administration of Water Supply and Sewerage Systems	IADB, PAHO	40
1963	Caracas, Venezuela	Use of Plastic Pipe in Water Supply Systems	MSAS, INOS, U.C. of Venezuela, PAHO	50
June/64	Bogotá, Colombia	Water Supply in Rural Areas	PAHO	80
Oct/65	Washington, D.C.	Water Supply in the Americas	PAHO	71
Dec/66	San Salvador, El Salvador	Administration of Water Supply and Sewerage Systems	PAHO	100
May/64	Washington, D.C.	Water for Peace Conference	USA	5000
June/67	São Paulo, Brazil	Symposium on River Basin Development	PAHO	



Although the entire field of institution-building is intangible and hence less apparent to the eye than physical accomplishments such as water and sewerage system construction in terms of money spent and population of new communities served, and institution-building without physical progress would be meaningless, these intangible activities are regarded as being at least as important as the tangible accomplishments from the standpoint of attainment of the long-range objective of perpetually keeping water and sewerage development abreast of population growth.

Important changes have been introduced into the education and training of sanitary engineers, management personnel and related manpower during the Decade. One major difference is that, whereas most of the graduate education was formerly provided outside of Latin America, now a large percentage is being given in institutions in the countries of the area. The trend to graduate-level training in Latin America for sanitary engineers is in full swing. There are now eleven universities offering graduate programs with nearly 200 students enrolled in 1968. Undergraduate programs have been strengthened.

Applied research in sanitary engineering at Latin American universities is increasing. Some 25 teaching institutions are engaged in such research with more than 100 projects underway in 1968, many financed by interested agencies in the countries.

The entirely new concept of short courses has been introduced and now 65 to 70 courses are being given each year by a network of 36 universities in 22 countries. These courses, serving about 1800 participants each year, cover a wide variety of subjects. They include both refresher training

and introduction to new material such as the use of computers for sanitary engineering problems. Advantage is taken of seminars and congresses and section meetings of the Inter-American Association of Sanitary Engineering for the interchange of experiences and information in all aspects of sanitary engineering. (See Table XIV for a list of seminars and conferences.)

D. Needs to Reach Charter Goals

Population growth in Latin America is taking place at an even faster rate than estimated in 1961, with the following results:

TABLE XV  
ESTIMATED POPULATION 1971  
(Millions)

	Urban	Rural	Total
Estimate of 1961	149.04	130.82	279.86
Estimate of 1967	158.31	128.09	286.40

This means that plans made in 1961 for reaching the goals of the Charter have had to be modified as time has passed.

Based on the 1967 estimates, water service must be provided for an additional 34.8 million people in urban areas to meet the goal of adequate water service through house connections. This includes upgrading services now provided by public fountains but does not take into consideration improving present house connection services. For the rural communities services must be provided for an additional 45.6 million people to meet the Charter goal considered as service through house connections or easily accessible public hydrants. The details by countries are tabulated in Table XVI.

TABLE XVI  
WATER SUPPLY  
FOUR-YEAR NEEDS AND PROJECTIONS, 1968-1971  
(Population in Millions)

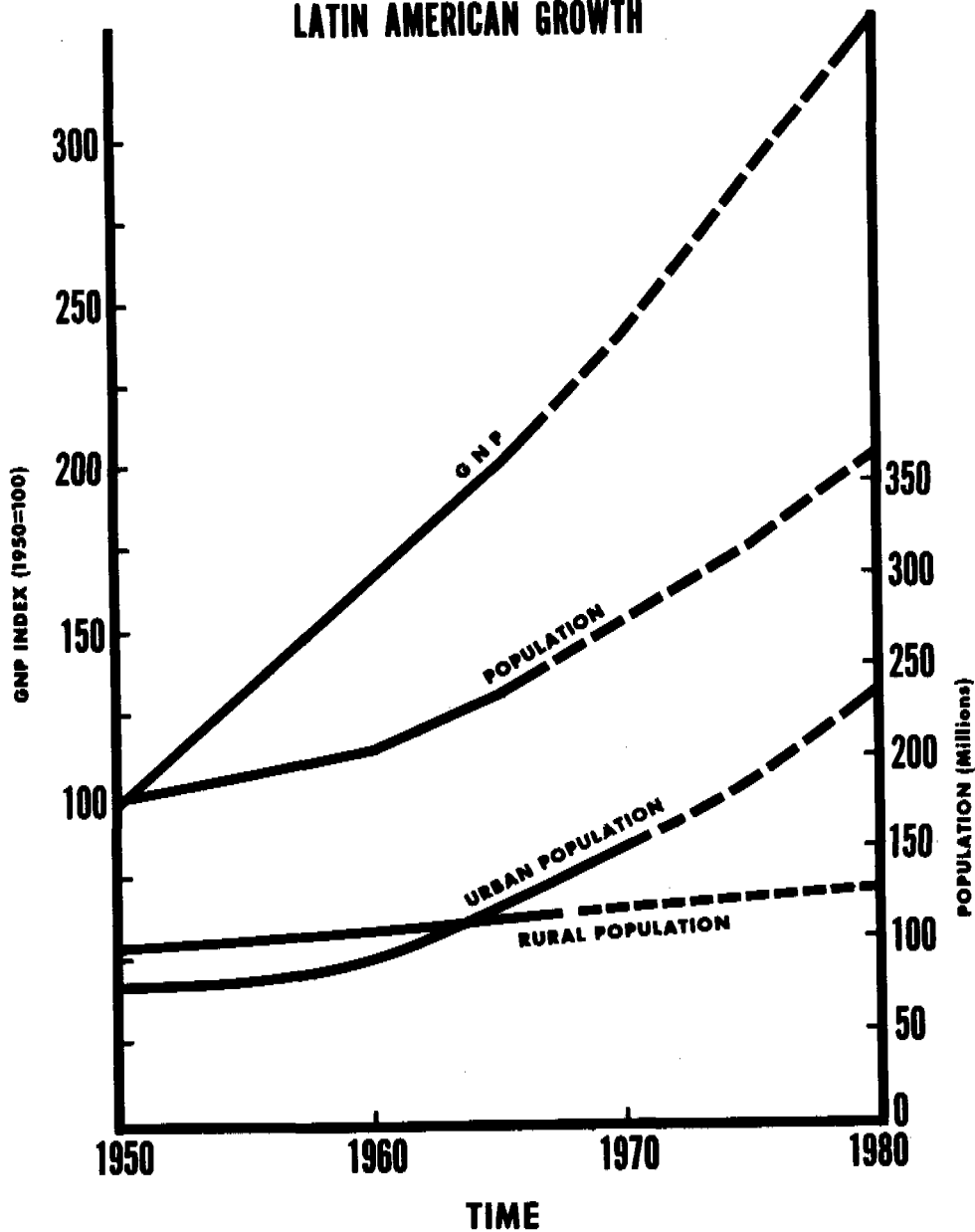
Country	Population 1971			U R B A N										R U R A L								
	Urban	Rural	Total	To Meet Charter Goal			Country Program							To Meet Charter Goal			Country Program					
				Goal 70% 1)	Served 1967 1)	Diff.	Cost/ Cap.	Est. 5)	To be 2)	% 3)	Cost/ Cap.	Est. 5)	Goal 50% 4)	Served 1967 4)	Diff.	Cost/ Cap.	Est. 5)	To be 4)	% 3)	Cost/ Cap.	Est. 5)	
Argentina	18.00	6.60	24.60	12.60	11.80	0.80	51.40	41.10	2.50	79	51.40	128.50	3.30	0.38	2.92	31.00	90.50	0.32	11	31.00	9.92	
Barbados	0.12	0.15	0.27	0.08	0.09	-	-	-	0.02	92	68.00	1.36	0.07	0.13	-	-	-	0.02	100	82.00	1.64	
Bolivia	1.43	3.64	5.07	1.00	0.30	0.70	31.60	22.12	0.63	65	31.60	19.97	1.82	0.01	1.81	6.50	11.90	0.16	5	6.50	1.01	
Brazil	54.20	41.70	95.90	37.90	20.70	17.20	40.50	697.00	11.80	60	35.40	418.00	20.90	2.50	18.40	19.40	357.00	0.20	6	19.40	3.88	
Chile	6.75	3.10	9.85	4.72	3.57	1.15	65.00	74.70	0.91	66	65.00	59.20	1.55	0.22	1.33	51.50	68.50	0.61	27	52.00	31.80	
Colombia	11.23	10.57	21.80	7.86	6.63	1.23	18.50	22.75	1.18	70	18.50	22.00	5.28	4.30	0.98	18.50	18.10	0.75	48	18.50	13.90	
Costa Rica	0.94	0.93	1.87	0.66	0.66	-	-	-	0.22	94	48.50	10.89	0.47	0.38	0.09	37.20	3.24	0.15	57	18.40	2.80	
Cuba	5.45	3.35	8.80	3.82	3.84	-	-	-	1.16	92	80.00	92.80	1.67	1.77	-	-	-	0.73	75	30.00	21.90	
Dominican Rep.	1.75	2.71	4.46	1.22	0.61	0.61	45.00	27.77	0.33	54	45.00	14.90	1.36	0.21	1.15	25.00	28.78	0.58	29	25.00	14.48	
Ecuador	2.48	3.90	6.38	1.74	0.98	0.76	47.80	36.20	0.58	63	54.50	31.84	1.95	0.28	1.67	19.00	31.69	0.06	9	15.00	0.90	
El Salvador	1.20	2.58	3.78	0.84	0.65	0.19	44.00	8.40	0.19	70	44.00	8.40	1.29	0.53	0.76	25.00	19.05	0.05	22	25.00	1.25	
Guatemala	1.76	3.39	5.15	1.23	0.73	0.50	42.30	21.15	0.61	76	42.30	25.80	1.69	0.34	1.35	20.00	27.00	0.10	13	20.00	2.00	
Guyana	0.20	0.54	0.74	0.14	0.17	-	-	-	0.02	95	30.00	0.60	0.27	0.15	0.12	40.00	4.80	0.19	65	40.00	6.28	
Haiti	0.69	4.36	5.05	0.48	0.15	0.33	15.00	5.00	0.33	70	22.40	7.40	2.18	-	2.18	35.00	76.30	-	-	-	-	
Honduras	0.82	1.90	2.72	0.57	0.36	0.21	30.00	6.30	0.22	70	30.00	6.79	0.95	0.16	0.79	25.00	19.75	0.80	51	25.00	2.00	
Jamaica	0.72	1.35	2.07	0.50	0.48	0.02	39.00	1.16	0.24	100	39.00	9.55	0.67	0.86	-	-	-	0.20	79	55.00	11.00	
Mexico	32.00	22.00	54.00	22.40	14.50	7.90	24.00	189.60	7.80	70	30.00	233.00	11.00	3.70	7.30	10.40	76.00	4.08	35	10.40	42.30	
Nicaragua	0.81	1.06	1.87	0.56	0.35	0.21	30.00	6.54	0.21	69	30.00	6.54	0.53	0.04	0.49	15.50	7.60	0.10	13	41.00	4.10	
Panama	0.73	0.78	1.51	0.51	0.51	-	-	-	0.22	100	21.20	4.67	0.39	0.13	0.26	25.00	6.35	0.06	24	22.50	1.24	
Paraguay	0.91	1.55	2.46	0.63	0.11	0.52	40.00	20.80	0.30	45	30.00	9.20	0.77	0.08	0.69	35.00	24.15	0.04	8	35.00	1.40	
Peru	6.10	6.96	13.06	4.27	2.44	1.83	18.90	34.60	1.10	58	26.40	29.00	3.48	0.43	3.05	21.00	64.20	0.50	13	21.00	10.50	
Surinam	0.14	0.27	0.41	0.10	0.12	-	-	-	0.02	97	60.00	0.96	0.13	0.01	0.12	45.00	5.76	0.02	10	45.00	0.90	
Trinidad/Tobago	0.37	0.78	1.15	0.26	0.31	-	-	-	0.04	95	66.67	3.00	0.39	0.62	-	-	-	0.11	93	66.67	7.00	
Uruguay	2.35	0.54	2.89	1.65	1.83	-	-	-	0.21	87	50.00	10.50	0.27	0.06	0.21	20.00	4.24	0.26	59	20.00	5.20	
Venezuela	7.30	3.65	10.95	5.11	4.44	0.67	50.40	33.77	6)	3.77	100	50.40	190.30	1.82	1.72	0.10	70.50	7.05	0.38	58	70.50	26.80
Eastern Carib.	0.16	0.37	0.53	0.12	0.13	-	-	-	0.03	97	106.90	3.10	0.19	0.27	-	-	-	0.03	81	78.55	2.20	
<b>TOTAL</b>	<b>158.61</b>	<b>128.73</b>	<b>287.34</b>	<b>110.97</b>	<b>76.46</b>	<b>34.83</b>	<b>35.70</b>	<b>1248.96</b>	<b>34.64</b>	<b>70</b>	<b>38.80</b>	<b>1348.27</b>	<b>64.39</b>	<b>19.28</b>	<b>45.77</b>	<b>20.80</b>	<b>951.96</b>	<b>10.50</b>	<b>23</b>	<b>21.40</b>	<b>226.40</b>	

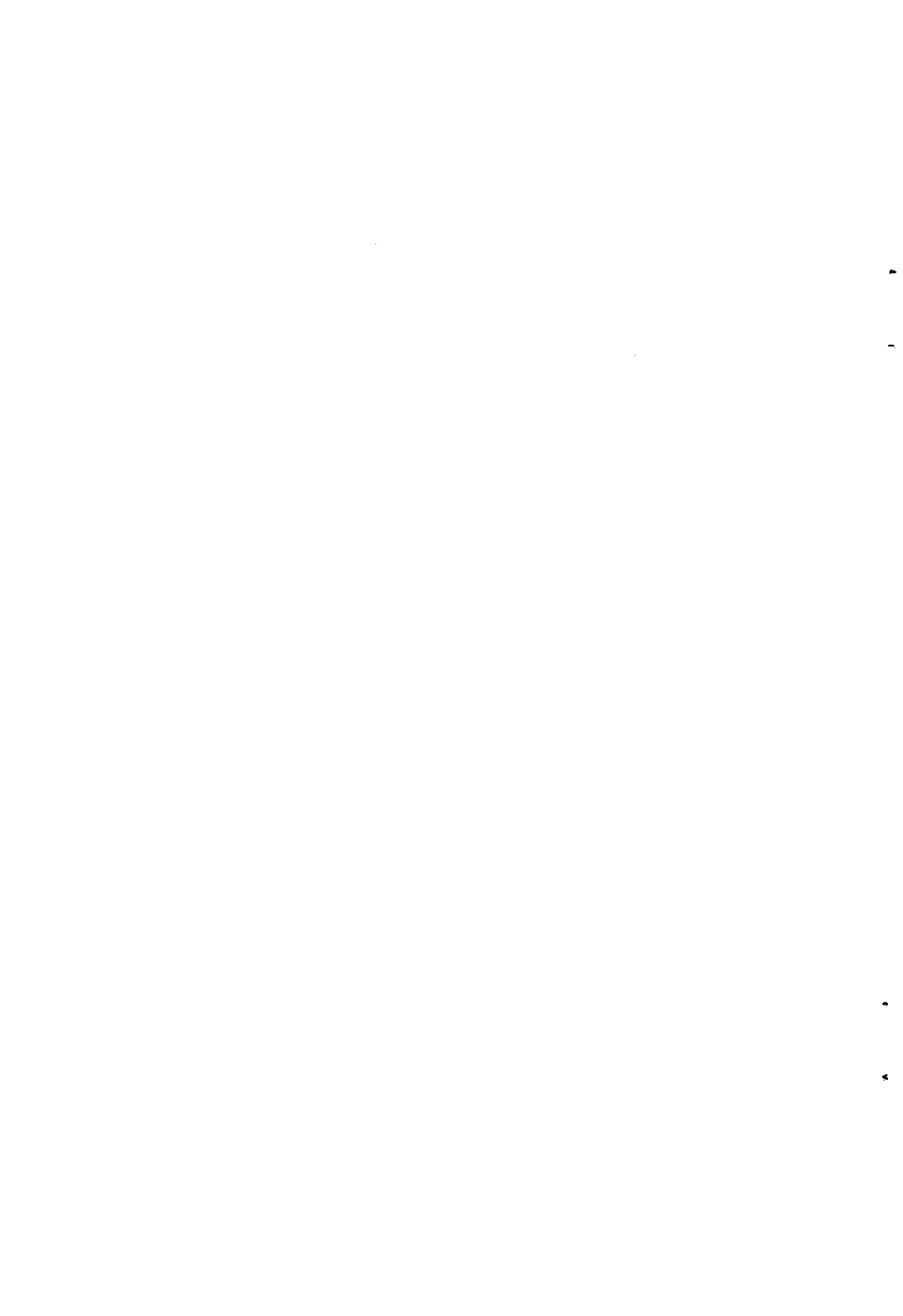
1) Served by House connections. 2) New or improved services. 3) Percentage of population estimated by country to be served by 1971. 4) Served by house connections or public hydrants. 5) Millions of U.S. dollars. 6) Design population. 7) English-speaking - except Barbados.





Figure VI  
**LATIN AMERICAN GROWTH**





The countries calculated in 1967 that it would cost \$1,249 million to reach the urban goal and \$952 million to reach the rural goal, a total of \$2,201 million for the period 1968-1971. The large increase over costs estimated as of 1961 results from a) a more rapid increase in urban population than originally estimated (see Table XV), with a proportionately larger per capita cost, and b) inflationary rise in material and labor costs.

By increasing the pace slightly on urban construction, it will be possible for the region as a whole to reach the goal for urban water supply. It is going to take a tremendous effort - a four-fold increase - to reach the goal for rural community water supply. New approaches must be developed and tried out, facing realistically the problems and possibilities in the rural areas. Full advantage must be taken of community participation, of mass approaches in design, material production, purchasing and stockpiling, construction and even in operation and maintenance. The middle-man-power needed in quantities for a mass approach must be trained and provided with supervision and guidance in carrying out the speeded-up programs which are so urgently needed. It is not merely a question of money but also of organization, manpower and techniques that are economical of time and money. This will require research in all aspects of the program including financing, materials, designs, construction methods, logistics, training, organization, operation and maintenance.

E. National Plans for Remainder of Decade, 1968-1971 incl.

In addition to calculating the number of new services that will have to be provided to reach the Charter goals and the cost, each country has

also estimated what it plans to do during the 1968-1971 period and what it plans to allocate for urban and rural services. These estimates are listed in Table XVI. They are ambitious, involving \$ 1.57 billion for urban and rural water projects. In addition to new systems the plans are to extend and improve existing systems so that by 1971 the goal of adequate service for 70 per cent of the urban population will have been reached and 111,000,000 people will have water service through house connections. Eighteen countries plan to practically reach or exceed the 70 per cent goal by 1971, with ten of them serving more than 90 per cent of their urban population.

The countries plan to step up their rural community water supply programs somewhat so that, by the end of the Decade, 23 per cent of the rural population will have service either by house connections or from public hydrants. Ten countries plan to surpass the 50 per cent goal by 1971.

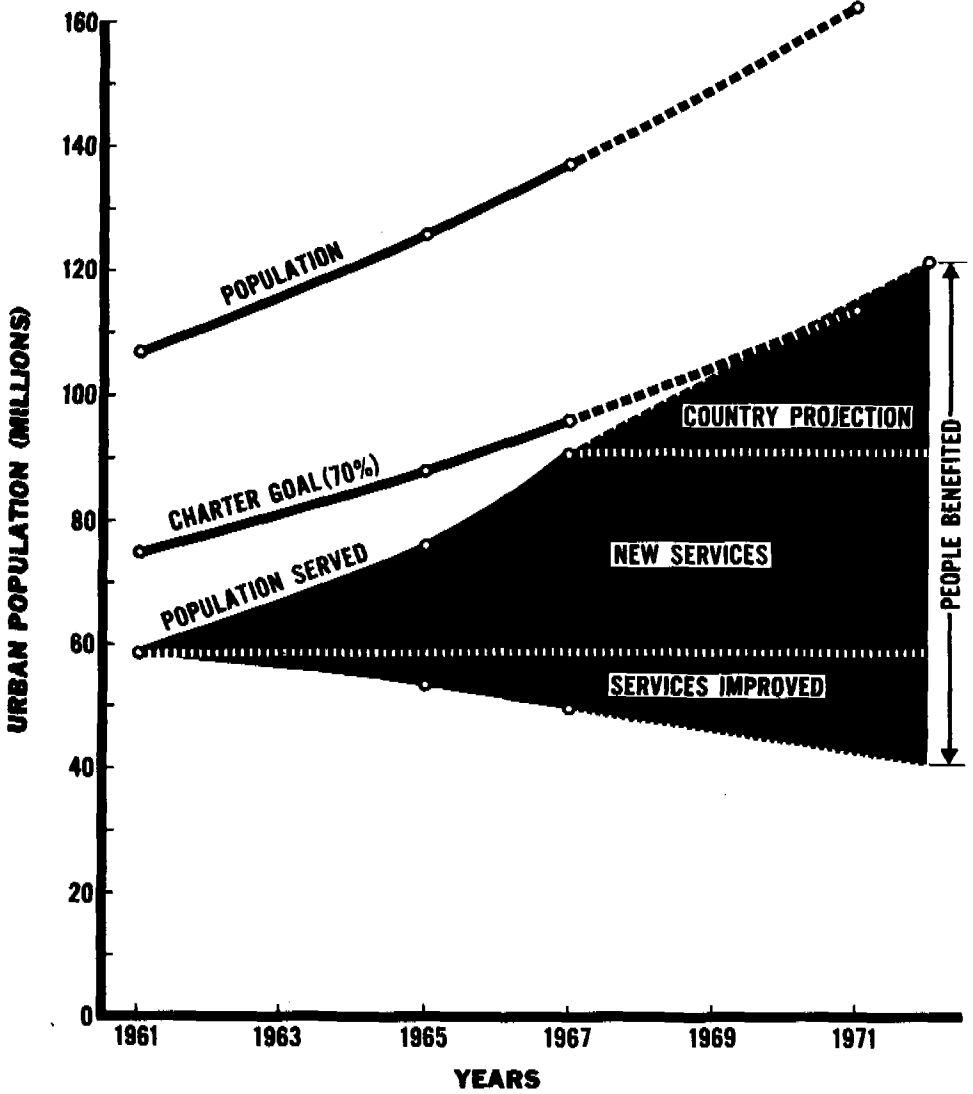
TABLE XVII

ESTIMATES FOR WATER SUPPLY CONSTRUCTION, 1968-1971 INCL.  
(Millions of Dollars)

	Urban	Rural	Total
Required to meet Charter Goals	\$1,249	\$ 952	\$2,201
Country Plans	1,348	226	1,574

Figure VII

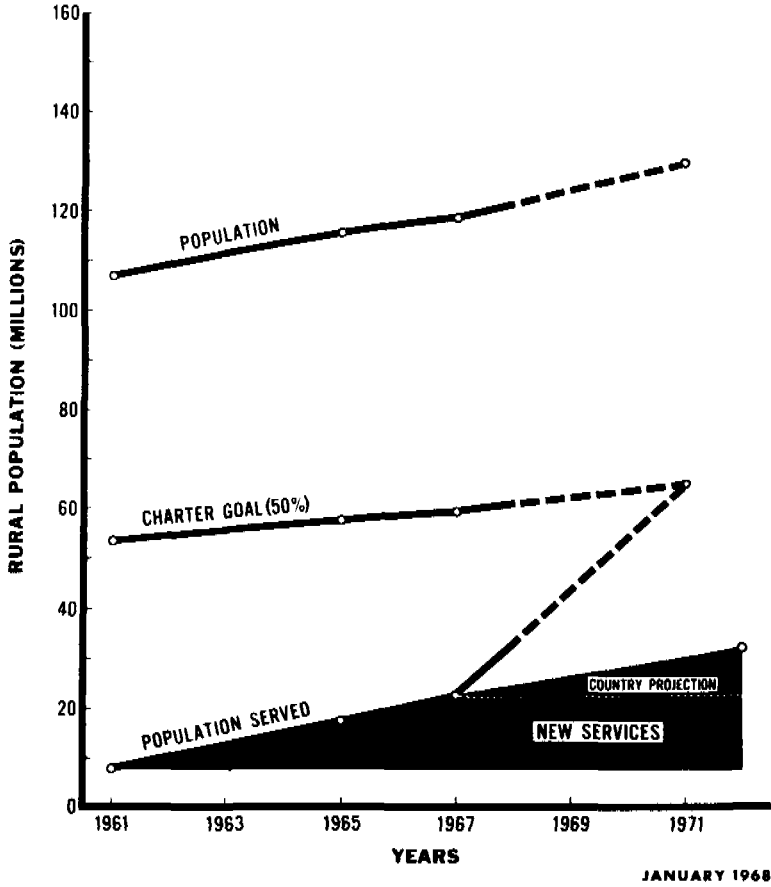
# LATIN AMERICA URBAN COMMUNITY WATER SUPPLY PROGRAM PROJECTIONS



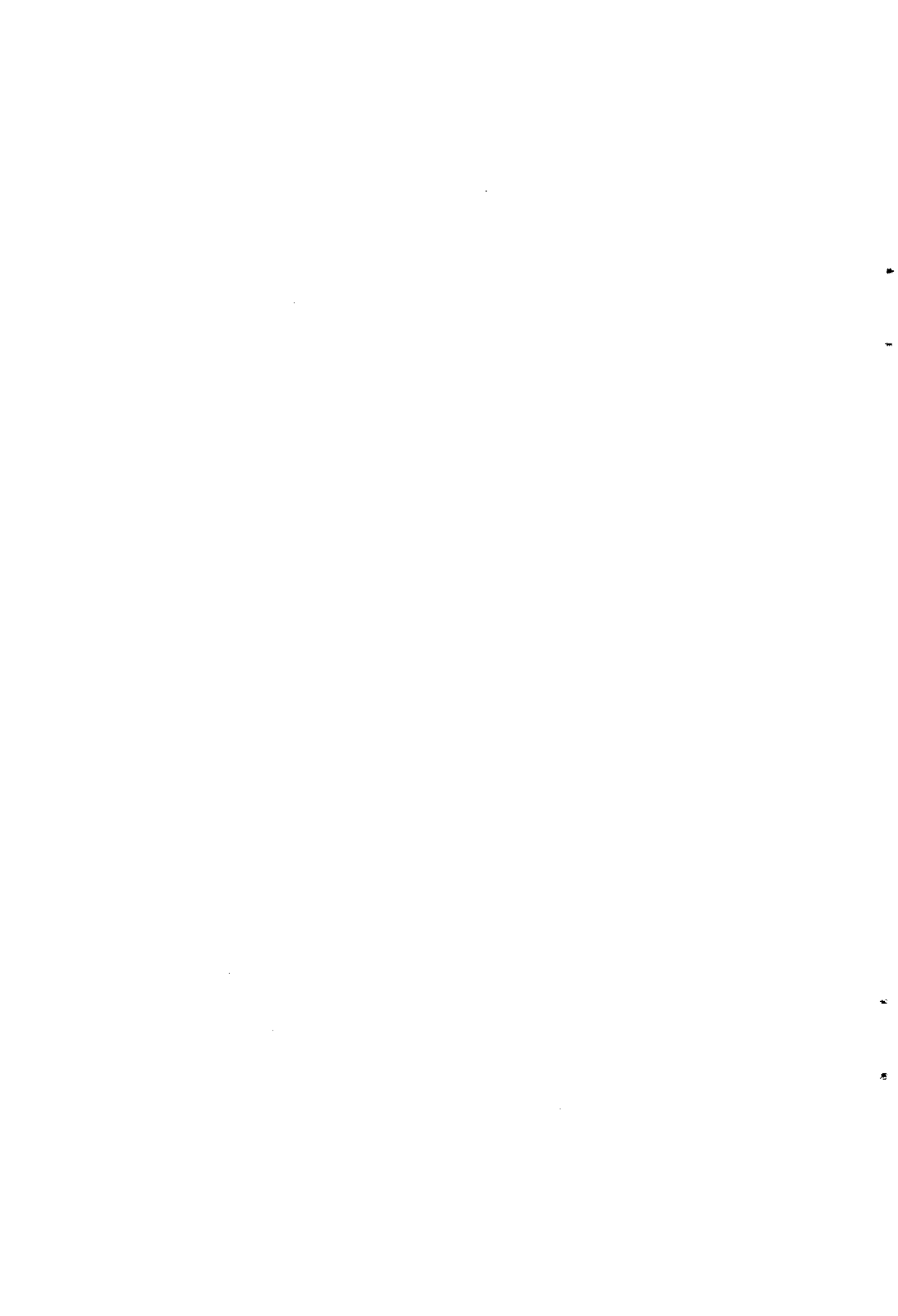
JANUARY 1968



### LATIN AMERICA RURAL COMMUNITY WATER SUPPLY PROGRAM PROJECTIONS







Assuming that about the same relation will continue in the future between international loans and national funds as has prevailed in the past, loans totaling \$674 million and national funds of \$900 million will be required to carry out the country plans.

Figures VII and VIII show progress since 1961 in people served in urban and rural areas as well as the projections proposed through 1971. Data for these figures are tabulated in Tables V and XVI.

F. Projection of Pan American Health Organization  
Participation, 1968-1971 incl.

In the interest of helping the Member Governments obtain more and better water and sewerage service for present and future populations, the Pan American Health Organization's basic objective continues to be focused on helping them to reach the goal of fully viable community water and sewerage systems throughout Latin America. This is the framework on which hangs all of the diverse supportive activities of the Organization in the water and sewerage fields. These activities necessarily follow several paths because attainment of the viability goal has as many facets and ramifications as that of reaching a status of full physical and mental health among all of the peoples of Latin America, even though water supply viability is more readily attainable.

The concept of the "viable" system involves: provision through self-supporting (to the highest feasible degree) systems of an adequate supply of safe piped water by continuous delivery through house connections to 70 per cent of the urban population and through house connections or public hydrants to 50 per cent of the rural population plus the effective safe disposal of their wastes.

Attainment of this primary, comprehensive objective requires many areas of accomplishment which take in a) more new water and sewerage systems; b) major rehabilitation, replacement and augmentation of existing systems; c) improved operation and management of the systems in every aspect of their physical, fiscal and public relations environment; and d) development of a more favorable "climate," local institutions and resources in the areas of trained manpower supply, capital development resources, materials, equipment and organizations.

Because PAHO plays a supportive role to within-country organizations and international development agencies, progress toward the comprehensive objective of each country can be best aided by PAHO through support of institution-building and through the encouragement of intra-institutional liaison and cooperation. It is in these general areas that the Organization has concentrated and proposes to place its main emphasis in the future.

In combination, the specific activities involved help to make up a package of:

1. More capital resources for community water supply and sewerage disposal development.
2. More operating revenues to make possible better operation and more adequate service.
3. Sounder community systems made more eligible for capital development loans through more effective and more adequate operation and fiscal management.
4. Improved service to water and sewer customers and more people served due to improved systems and management.

5. A more adequate, safer supply of water made possible by more fully viable systems.

Included among these specific PAHO activities are plans for the following:

1. Improve basic data collection and utilization systems to enable more economical and efficient planning and design for water and sewerage systems. This calls for a general stocktaking and assessment of present conditions (which is now under way in some countries) a) in terms of existing data collection programs in water and sewerage fields and those in other comparable fields or in other geographic areas and b) also of the environment of statistics-gathering activities within and outside of Latin America. In this way, an objective perspective may be acquired on the procedure of: a) assisting countries in water and sewerage data collection, analysis, and utilization; b) what may be needed; c) what existing information resources might be utilized; and d) what techniques might be considered toward improving existing programs.
2. Assist in the development of national water and sewerage plans and the integration of those plans with the national economic and social development plans.
3. Immediately implement a mass approach proposal for design and construction of rural water supply and sewerage systems with provisions for operation and maintenance after construction. Fullest advantage will be taken of community participation.

The much needed intermediate or middle-level manpower will be prepared to work at the community level as well as at the department and state level. With the techniques and procedures developed and the necessary personnel trained, the methods will be tried out in two pilot projects before going ahead on a large scale on a regional basis. Special financing will be required for this program.

4. Continue to place emphasis on the advantages of the revolving fund techniques, as a means of helping to make the water supply and sewerage programs self-sustaining. Backed by the specific terms of the Declaration of the Presidents made in 1967 and with the assistance of the recently completed manual on the operation of revolving funds, the Organization will assist the countries to adapt this mechanism to their needs.
5. Expand the use of the consultation teams in response to increasing requests for assistance to improve administration, management, and operation of water and sewerage systems. This type of assistance has been provided in one form or another to 15 of the 131 water and sewerage agencies now operating in Latin America. It is estimated that requests now totaling 26 in number will be doubled during the remainder of the Decade. Additional teams must be trained and organized to meet these requests.
6. Develop a closer, more effective liaison with the international lending institutions to assure coordination of objectives and

activities extending from criteria for feasibility studies and designs to methods for establishing water and sewer rates.

7. Strengthen assistance to universities in a) improving sanitary engineering programs at undergraduate and graduate levels; b) expanding curricula to include preparation of sanitary engineers to play their role in river basin and water resources developments; c) extending continuing education programs for water supply and sewerage related personnel; and d) developing applied research programs oriented directly to the needs of the Region for better methods of design, construction, and operation and for improved materials and equipment manufactured in the Region.
8. Bring the Pan American Center for Sanitary Engineering and Environmental Sciences up to full operation to provide in the very near future the special types of assistance for which it is being organized. (See Annex D for the objectives and plans for the Center.)
9. Help individual countries and regions to understand the potential for assistance offered by the United Nations Development Program, assisting in the preparation of project requests. While competition is keen for UNDP assistance and other areas of the developing world are receiving more UNDP funds for water and sewerage projects than Latin America, there are a number of projects which might possibly be considered by UNDP for financing.
10. Encourage the countries to take full advantage of community development methods and the use of co-operatives. Develop special

information programs to secure understanding and support of water and sewerage projects as community responsibilities.

11. Provide refresher training for Organization staff to help them keep up-to-date on advances in their respective fields so that the staff members will be able to provide the more complex types of consultation required as the problems become complicated by expanding technology and urbanization.

For the first time a realistic appraisal has been made of the community water supply situation in Latin America, and an estimate has been prepared of what the countries plan to do during the remainder of the Alliance for Progress Decade toward meeting the goals of the Charter.

For each of the countries of Latin America the percentages of urban, rural, and total population served in 1968 and the percentage the countries estimate which will be served in 1971 are tabulated in Table XVIII and shown graphically in Figure IX. At a glance the relative position of the programs in each of the countries can be seen.

Practically all of the countries plan to improve the percentage of the people served, some by a small amount and others by large amounts.

TABLE XVIII

COMMUNITY WATER SUPPLY  
PERCENTAGE POPULATION SERVED IN 1968 AND PROJECTED FOR 1971

C O U N T R Y	Total		Urban		Rural	
	1968	1971	1968	1971	1968	1971
Argentina.....	51	61	66	79	10	11
Barbados.....	91	96	81	92	100	100
Bolivia.....	7	22	24	65	1	5
Brazil.....	27	37	48	60	5	6
Chile.....	41	54	57	66	8	27
Colombia.....	57	59	63	70	48	48
Costa Rica.....	70	76	88	94	61	57
Cuba.....	71	85	77	92	60	75
Dominican Republic.....	23	39	52	54	8	29
Ecuador.....	23	30	47	63	8	9
El Salvador.....	38	38	65	70	25	22
Guatemala.....	20	47	40	76	10	13
Guyana.....	53	73	97	95	36	65
Haiti.....	5	10	31	70	3	-
Honduras.....	23	32	57	67	11	18
Jamaica.....	78	86	97	100	70	79
Mexico.....	44	56	64	70	18	35
Nicaragua.....	21	37	45	69	6	13
Panama.....	48	62	81	100	19	58
Paraguay.....	9	22	16	45	6	8
Peru.....	21	34	44	58	1	13
Surinam.....	36	40	55	97	5	10
Trinidad and Tobago.....	89	94	81	95	92	93
Uruguay.....	62	82	75	87	10	59
Venezuela.....	66	94	69	100	60	58
Eastern Caribbean.....	92	86	70	97	100	81
T O T A L.....	38	49	57	71	16	23

Urban service through house connections.

Rural service through house connections or easy access to public hydrants.



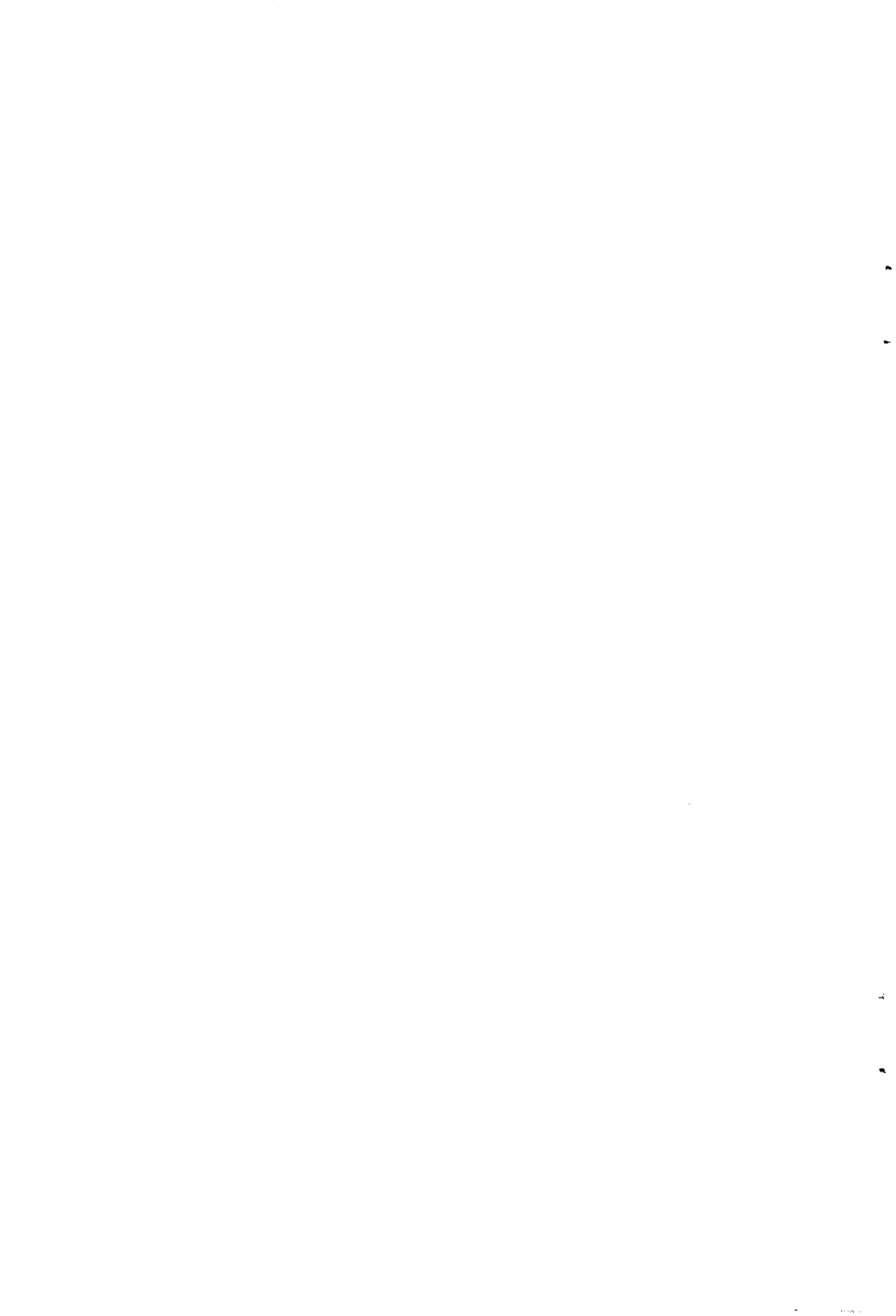
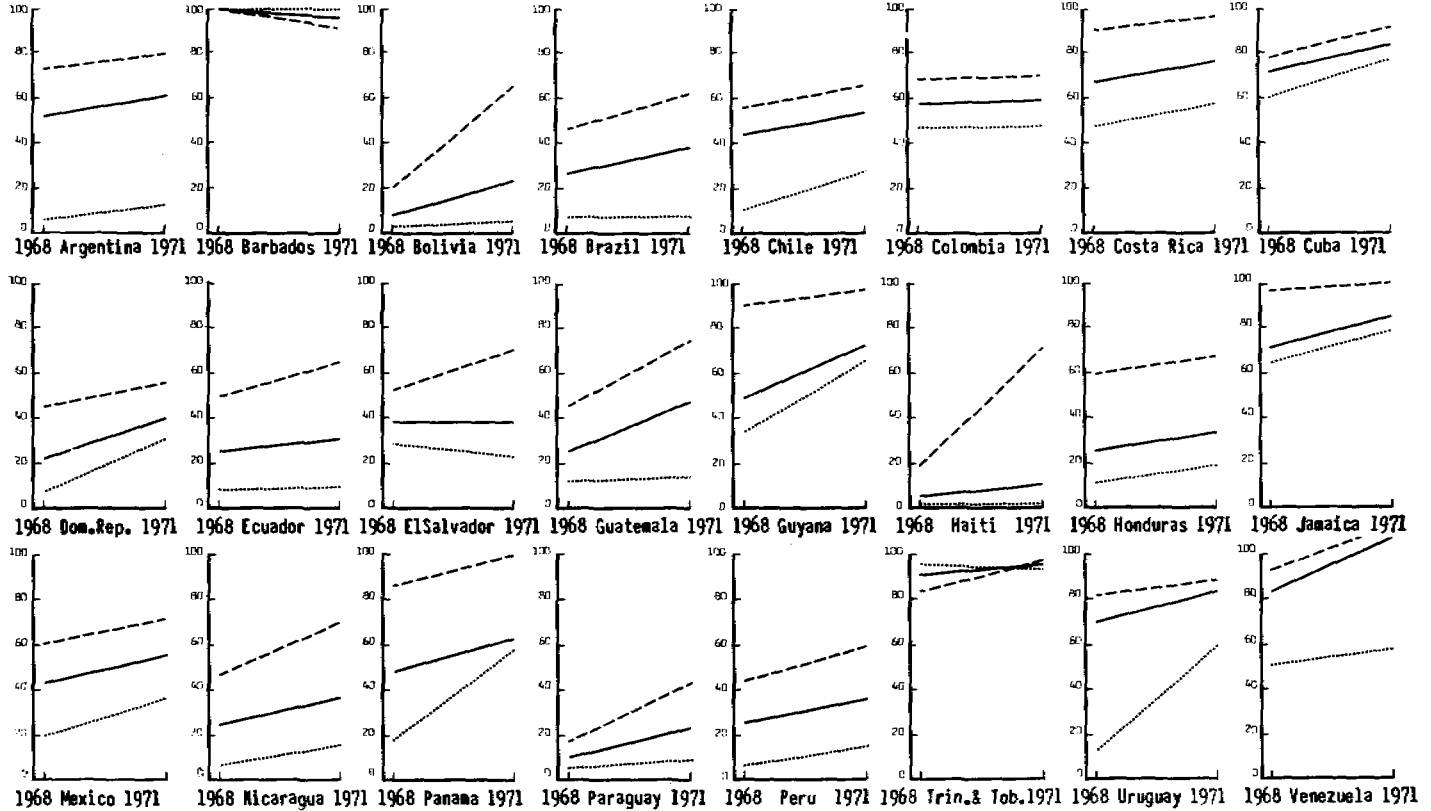
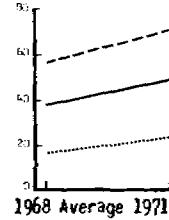


Figure IX

COMMUNITY WATER SUPPLY PROGRAMS PERCENTAGE POPULATION SERVED IN 1968 AND PROJECTED FOR 1971

TOTAL ——— URBAN - - - - RURAL ······



## II. SEWERAGE

## II. SEWERAGE

### A. Situation at Start of Decade, 1961

In the Charter of Punta del Este in 1961, the Member Governments set for themselves the same goals for sewage disposal as for water supply, namely, within the Alliance for Progress Decade from 1961-1971 to provide adequate waste disposal to not less than 70 per cent of the urban and 50 per cent of the rural population. These goals were even more of a challenge than the similar water supply goals because of the much smaller percentage of people with sewerage services in 1961 (13 per cent) than with water supply service (32 per cent) and the greater difficulty of obtaining financing to provide those services.

Statistics on numbers of people with sewerage system service in 1961 are very limited. (See Annex E.) The data available in the reference report indicate the need of supplying about 150 million people with waste disposal services to meet the goals of the Charter by 1971. At a per capita cost of \$30, the overall average estimated from that report, this would require \$450 million dollars a year for sewerage services. This does not include any estimate of the cost of improving the services existing at that time.

### B. Preliminary Steps in Developing the Program

Even as the Charter of Punta del Este was signed, it was realized that the goals for sewage disposal were over-optimistic. The Advisory Committee on Environmental Sanitation, convened a short time after the signing of the Charter, agreed that sewers should be considered as second priority in the environmental sanitation activities in Latin America and

that consideration should be given to sewage and waste water disposal when plans are drawn for water supply projects. The existence of preliminary sewer plans would permit municipalities to build portions of the systems as problems develop and financing could be obtained.

Actually in 1961 loans were made or under consideration for extensions and improvements to sewerage systems in Colombia, El Salvador, Peru and Uruguay.

By the end of 1961 the Organization was preparing with the Robert A. Taft Sanitary Engineering Center for a symposium on New Developments in Sewage Treatment. This was held in June 1962 with the participation of nearly 100 engineers from PAHO, AID, and the countries of Latin America. The symposium included material not only on designs and technical matters but also on cost estimates, financing, and the bases for revenue charges, since, as one participant said, "The resolution of a proper and fair method of financing a sewage project is as difficult and important as the resolution of the technical aspects of the project."

Since that time, other symposia and conferences have touched on various aspects of sewerage system design, financing, and administration in conjunction with the consideration of water supply systems (see Table XIV), but the one at the Taft Center was the only one devoted entirely to the topic of sewerage systems.

#### C. Progress and Results as of 1968

The supporting resolutions and recommendations issued by the various bodies and authorities in Latin America since the signing of the Charter have all made specific reference to sewage disposal systems as well as to

water supply systems. See pages 13 and 14 for quotations from the Recommendations of the Task Force at Ministerial Level, 1963 and from the Declaration of the Presidents of America, April 1967.

With this official support, bolstered by the assistance of the international lending agencies and of the Organization, the countries have made considerable progress so that by 1968, 21 per cent of the population, mostly in urban areas, were connected to sewerage disposal systems.

TABLE XIX  
PEOPLE SERVED BY SEWERAGE SYSTEMS, 1961 AND 1968

	Urban		Rural		Total	
	Number	%	Number	%	Number	%
1961	29,100,000	28	-	0	29,100,000	14
1968	52,829,000	38	3,155,000	2	55,984,000	21
Increase	23,729,000		3,155,000		26,884,000	

In addition to providing new services, many countries have improved the existing services materially in the urban areas.

The status of the program as of 1968 for the various countries of the Region is shown in Table V. By 1968 the Region as a whole had passed the half-way point of the Charter goal for urban population with sewerage services - 38 per cent served. Only 2 per cent of the rural population had this service.

In most countries the same agency or authority is responsible for the sewerage systems as for the water supply systems. See Table VI for a

resumé of these institutions. Concern for and improvement in the administration and management of these institutions have been equally beneficial for the two services.

The amount of money made available by the international lending agencies for sewerage systems during the period 1961-1968 (\$100 million) is comparatively small compared with the amount loaned for water supply systems (\$493 million). However, this amount added to the estimated \$134 million allocated by the national governments makes a total much larger than was foreseen by anyone in 1961. The breakdown by countries and lending agencies is tabulated in Table IX.

A comparison is made in the table below between the expenditures estimated as of 1961 as being required to meet the sewage disposal goals of the Charter and the funds actually made available for that purpose during the period 1961-1968.

TABLE XX  
FUNDS FOR SEWERAGE SYSTEMS CONSTRUCTION  
1961-1968 INCL.

(Millions of dollars)

	Urban	Rural	Total
Estimated 1961	\$1,500	\$1,200	\$2,700
Allocated 1961-1968	\$ 232	\$ 2	\$ 234

Whereas about one-half of the amount of money estimated in 1961 as being necessary for the water supply program was actually made available

for that program, only about one-twelfth the amount estimated for the sewage disposal program has been allocated for that purpose.

While the Pan American Health Organization has given highest priority to the community water supply program, it has assisted with the sewerage system program as well. The staff mentioned as working on water supply activities has also devoted a portion of its time to the sewage disposal programs as requests for assistance have been received from the Governments.

#### D. Needs to Reach the Charter Goals

Based on 1967 estimates, sewerage system services must be provided for an additional 62.4 million people in urban areas to meet the goal of the Charter. This does not include any consideration of the number of services which must be improved to make them adequate from the point of view of service or water quality control. For the rural areas, services must be provided for an additional 61.9 million people to meet the Charter goal by 1971. The details by countries are tabulated in Table XXI.

The countries calculated in 1967 that it would cost \$3,035 million to reach the urban goal and \$1,656 million to reach the rural goal, a total of \$4,691 million. This compares with \$2,200 million to reach the water supply goals.

A number of factors have contributed to the slower performance in the sewage disposal programs including: a) the second order of priority assigned to the program in spite of the fact that the Charter set equal goals for water and sewerage, even though the latter program started from a much lower base line of services available in 1961; b) international loans



are more difficult to obtain for sewerage system construction as the loans are usually made to cover more extensively the foreign currency costs of a project and a larger percentage of the materials for a sewer project can be produced within the country; c) there is more of a felt need by the public for a water supply project, so there is a natural reluctance to move ahead with the sewerage system project until the water system is adequate.

There are some favorable factors as well which are becoming stronger as the water supply programs near their goals, namely: a) as a community receives adequate water supply service, it becomes more imperative that the sewage disposal service also be adequate; b) as water supply problems are reduced, attention may be focused on the need to improve the sewerage systems; c) the efficient organization developed for the water supply phases will be able to move ahead more rapidly to meet the waste disposal needs. The results of these favorable factors are beginning to be apparent. One of these is found in the plans the countries are making to expand their sewerage programs during the next four years.

E. National Plans for Remainder of Decade, 1968-1971 incl.

Tabulated in Table XXI are the estimates of what each country in Latin America plans to do during the remainder of the Decade in providing new sewerage services for their people and what they propose to spend in providing those services. The Region as a whole plans a much greater proportionate increase in spending for these services in comparison to the allocation for water services. The countries plan to spend \$706 million for urban sewerage systems, 3.2 times as much as during the first part of

TABLE XXI

SEWERAGE  
FOUR-YEAR NEEDS AND PROJECTIONS 1968-1971  
(Population in Millions)

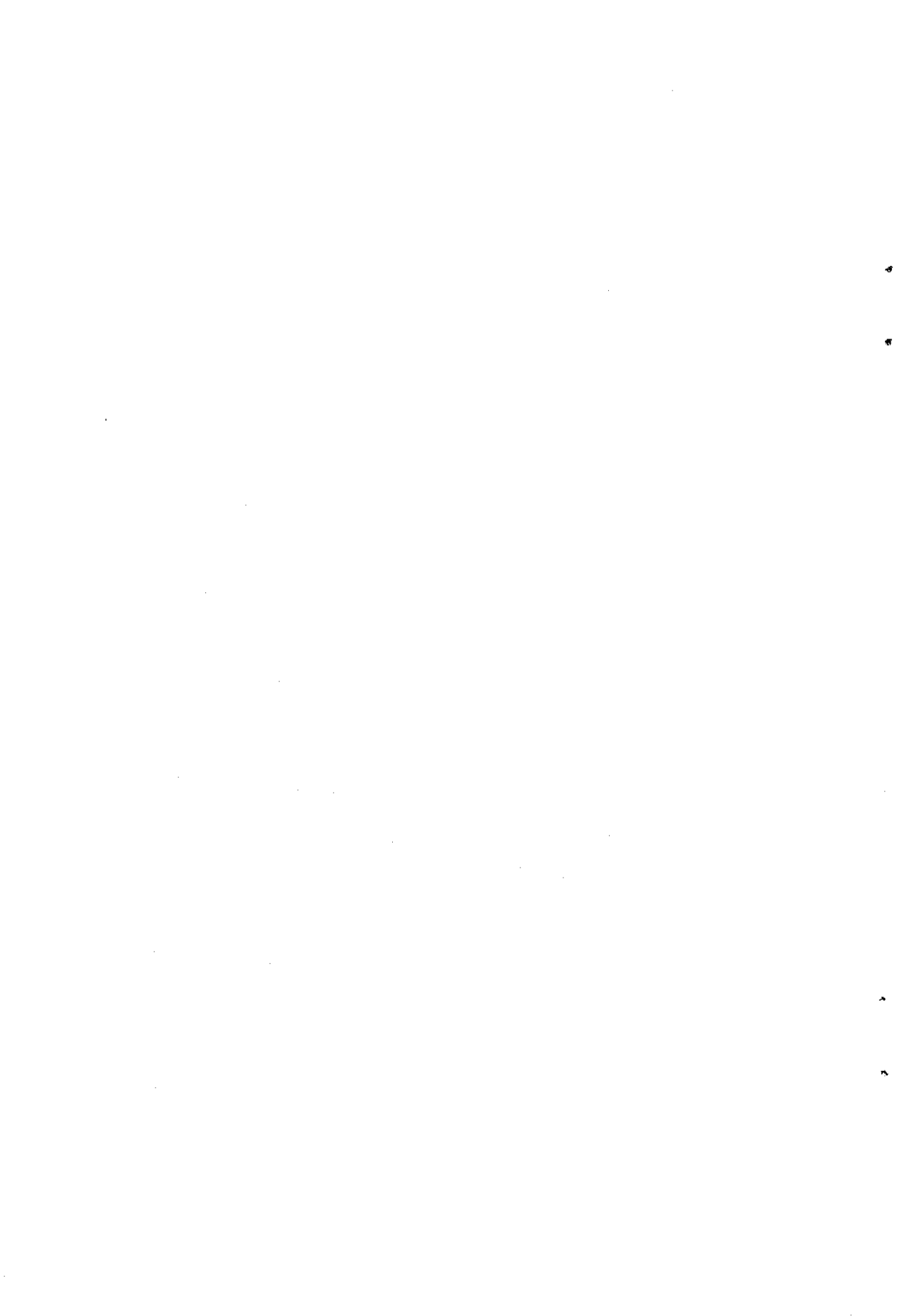
Country	Population 1971			U R B A N										R U R A L							
	Urban	Rural	Total	To Meet Charter Goal			Country Program				To Meet Charter Goal			Country Program							
				Goal 70% 1)	Served 1967 1)	Diff.	Cost/ Cap	Est. 4)	To be Served	% 3)	Cost/ Cap	Est. 4)	Goal 50% 1)	Served 1967 1)	Diff.	Cost/ Cap	Est. 4)	To be Served	% 3)	Cost/ Cap	Est. 4)
Argentina	18.00	6.60	24.60	12.60	5.60	7.00	51.40	359.80	1.00	37	51.40	51.40	3.40	-	3.30	80.00	264.00	-	-	-	-
Barbados	0.12	0.15	0.27	0.08	-	0.08	60.00	4.80	-	-	-	-	0.07	-	0.07	60.00	4.20	-	-	-	-
Bolivia	1.43	3.64	5.07	1.00	0.24	0.76	76.00	57.76	0.10	24	76.00	7.60	1.82	-	1.82	2.00	3.64	0.03	1	2.00	0.06
Brazil	54.20	41.70	95.90	37.90	9.30	28.60	60.80	1738.00	3.90	24	42.00	163.50	20.90	0.700	20.20	19.40	391.00	0.10	2	19.40	1.94
Chile	6.75	3.10	9.85	4.72	2.18	2.54	50.70	128.80	0.55	40	50.70	27.90	1.55	0.170	1.38	15.00	20.70	0.60	25	15.00	9.00
Colombia	11.23	10.57	21.80	7.86	6.67	1.19	12.30	14.62	0.93	68	12.30	11.33	5.28	0.660	4.62	12.30	56.80	0.37	10	10.00	3.70
Costa Rica	0.94	0.93	1.87	0.66	0.17	0.49	17.00	8.25	0.17	36	28.30	4.70	0.47	-	0.47	17.00	7.91	-	-	-	-
Cuba	5.45	3.35	8.80	3.82	1.70	2.12	60.00	127.20	1.20	53	60.00	72.00	1.67	-	1.67	60.00	100.20	-	-	-	-
Dominican Republic	1.75	2.71	4.46	1.22	0.12	1.10	30.00	33.09	0.15	15	30.00	4.59	1.36	-	1.36	20.00	27.12	-	-	-	-
Ecuador	2.48	3.90	6.38	1.74	1.07	0.67	23.50	15.78	0.20	51	23.50	4.63	1.95	0.110	1.84	23.50	43.24	-	3	-	-
El Salvador	1.20	2.58	3.78	0.84	0.51	0.33	6.00	1.98	-	43	-	-	1.29	0.004	1.28	12.00	15.41	-	1	-	-
Guatemala	1.76	3.39	5.15	1.23	0.66	0.57	15.00	8.55	0.21	46	15.00	3.17	1.69	0.020	1.67	15.00	25.05	-	1	-	-
Guyana	0.20	0.54	0.74	0.14	0.07	0.07	60.00	4.20	-	35	-	-	0.27	-	0.27	60.00	16.20	-	-	-	-
Haiti	0.69	4.36	5.05	0.48	-	0.48	30.00	14.40	-	-	-	-	2.18	-	2.18	30.00	65.40	-	-	-	-
Honduras	0.82	1.90	2.72	0.57	0.32	0.25	17.50	4.40	0.06	46	17.50	1.11	0.95	0.001	0.95	15.00	14.25	-	-	-	-
Jamaica	0.72	1.35	2.07	0.50	0.06	0.44	105.00	46.50	0.03	13	105.00	3.36	0.67	0.001	0.67	47.00	31.60	-	1	-	-
Mexico	32.00	22.00	54.00	22.40	12.80	9.60	28.00	268.80	4.23	53	27.60	118.50	11.00	0.600	10.40	28.00	291.50	-	3	-	-
Nicaragua	0.81	1.06	1.87	0.56	0.18	0.38	14.30	5.48	0.10	35	14.30	1.16	0.53	-	0.53	14.30	7.58	-	-	-	-
Panama	0.73	0.78	1.51	0.51	0.34	0.17	16.00	2.80	0.29	81	33.50	9.74	0.39	0.002	0.39	16.00	6.16	-	1	-	-
Paraguay	0.91	1.55	2.46	0.63	0.10	0.53	25.00	13.22	0.07	19	43.00	3.00	0.77	0.150	0.62	2.88	1.80	0.12	17	6.00	0.72
Peru	6.10	6.96	13.06	4.27	2.24	2.03	16.20	32.90	1.24	57	21.40	26.50	3.48	-	3.48	21.40	74.50	-	-	-	-
Surinam	0.14	0.27	0.41	0.10	-	0.10	60.00	6.00	-	-	-	-	0.13	-	0.13	50.00	6.50	-	-	-	-
Trinidad & Tobago	0.37	0.78	1.15	0.26	0.15	0.11	64.40	6.72	0.05	54	149.33	6.72	0.39	-	0.39	125.00	48.44	-	-	-	-
Uruguay	2.35	0.54	2.89	1.65	1.05	0.60	60.00	35.76	0.60	70	60.00	35.76	0.27	-	0.27	35.00	9.46	0.03	6	35.00	1.05
Venezuela	7.30	3.65	10.95	5.11	3.02	2.09	43.30	90.50	3.44	88	43.30	149.00	1.82	0.050	1.77	64.20	113.65	0.09	4	64.20	5.65
Eastern Caribbean	0.16	0.37	0.53	0.12	0.02	0.10	50.00	5.00	-	-	-	-	0.19	-	0.19	50.00	9.50	-	-	-	-
<b>TOTAL</b>	<b>158.61</b>	<b>128.73</b>	<b>287.34</b>	<b>110.97</b>	<b>48.57</b>	<b>62.40</b>	<b>48.70</b>	<b>3035.31</b>	<b>18.52</b>	<b>42</b>	<b>38.60</b>	<b>705.67</b>	<b>64.39</b>	<b>2.470</b>	<b>61.92</b>	<b>26.80</b>	<b>1655.81</b>	<b>1.34</b>	<b>3</b>	<b>16.50</b>	<b>22.12</b>

1) Connected to sewerage system or with easy access.

2) New or improved services.

3) Percentage of population estimated by country to be served by 1971.

4) Millions of U.S. dollars.



the Decade and nearly as much as was spent for urban water systems during that period (\$991 million). They also plan to spend 11 times as much for rural sewerage systems (\$22 million) as they did from 1961-1967.

Assuming that about the same proportion between international loans and national funds will continue in the future as in the past, loans totaling \$310 million and national funds of \$418 million will be required to carry out the country plans.

With these expenditures it is estimated that, by 1971, 42 per cent of the urban population (67 million people) and 3 per cent of the rural population (3.8 million people) will have adequate sewerage services. While this is far below the goal set by the Charter and none of the countries plan to meet the rural goal, four countries plan to approach or pass the goal for urban areas. The encouraging fact is the upswing in plans for construction of sewerage systems during the remainder of the Decade.

#### F. Projection of Pan American Health Organization

##### Participation, 1968-1971 incl.

The Pan American Health Organization's participation in the sewerage system aspects of the programs for the remainder of the Decade have been covered, together with the projections for assisting the community water supply activities. In addition to the various efforts already mentioned, the Organization plans to develop with the lending agencies and the Governments of the countries some practical approaches to ways of charging for sewerage system services. This will require considerable investigation and research which must be undertaken in the near future.

Research will also be stimulated on the development of new materials for sewerage services, hopefully on materials which can be produced in the countries. Additional research must be carried out on the simple treatment methods, including the use of oxidation ponds, to take full advantage of their characteristics in the favorable climates in most of Latin America.

This report on the sewerage services situation in Latin America parallels the report on the community water supply situation in being a realistic appraisal of the status in 1968, as well as an estimate of what the countries plan to do during the remainder of the Decade toward meeting the goals of the Charter.

The percentage of urban and rural people with sewerage services in each country is tabulated in Table XXII and shown graphically in Figure X for 1967 and projected for 1971. The majority of the countries plan to increase the number of people served in the urban areas and several plan increases in the rural areas.

TABLE XXII  
SEWERAGE SYSTEMS  
PERCENTAGE POPULATION SERVED IN 1968 AND PROJECTED FOR 1971

Country	Total		Urban		Rural	
	1968	1971	1968	1971	1968	1971
Argentina	24	27	34	37	-	-
Barbados	-	-	-	-	-	-
Bolivia	10	7	35	24	1	1
Brazil	12	15	24	24	-	2
Chile	25	36	34	40	5	25
Colombia	44	40	62	68	25	10
Costa Rica	10	18	31	36	1	-
Cuba	21	33	34	53	-	-
Dominican Republic	4	6	11	15	-	-
Ecuador	21	22	50	51	3	3
El Salvador	21	14	62	43	1	-
Guatemala	14	17	40	46	-	1
Guyana	11	10	39	35	-	-
Haiti	2	-	19	-	-	-
Honduras	15	17	55	55	1	1
Jamaica	4	4	13	13	-	1
Mexico	30	33	51	53	3	3
Nicaragua	13	15	32	35	-	-
Panama	28	42	60	81	4	1
Paraguay	5	18	14	19	-	17
Peru	26	27	56	57	-	-
Surinam	-	-	-	-	-	-
Trinidad and Tobago	16	17	49	54	-	-
Uruguay	38	58	47	70	-	6
Venezuela	25	60	39	88	2	4
Eastern Caribbean	6	4	26	14	-	-
TOTAL	22	25	38	42	2	3

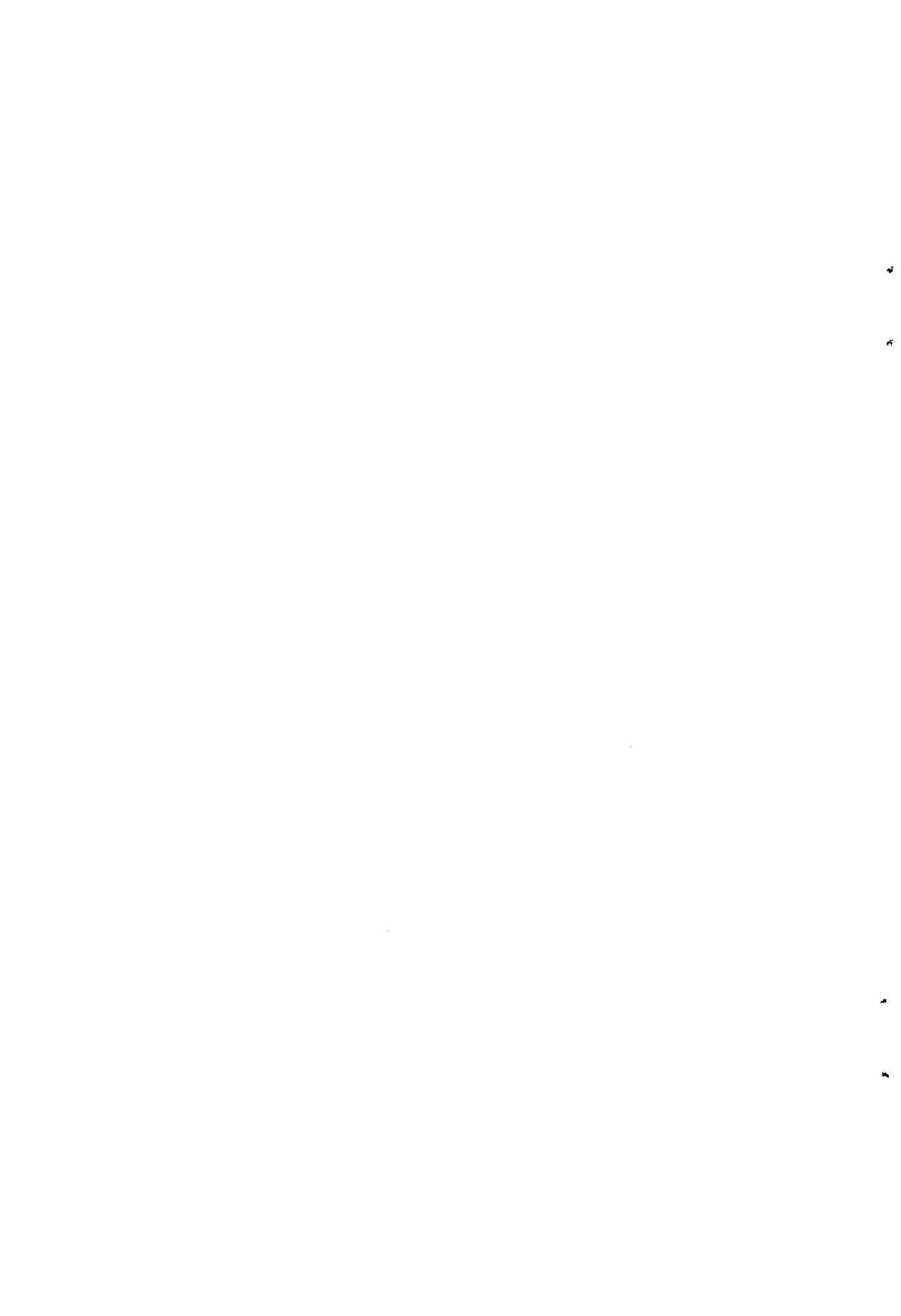
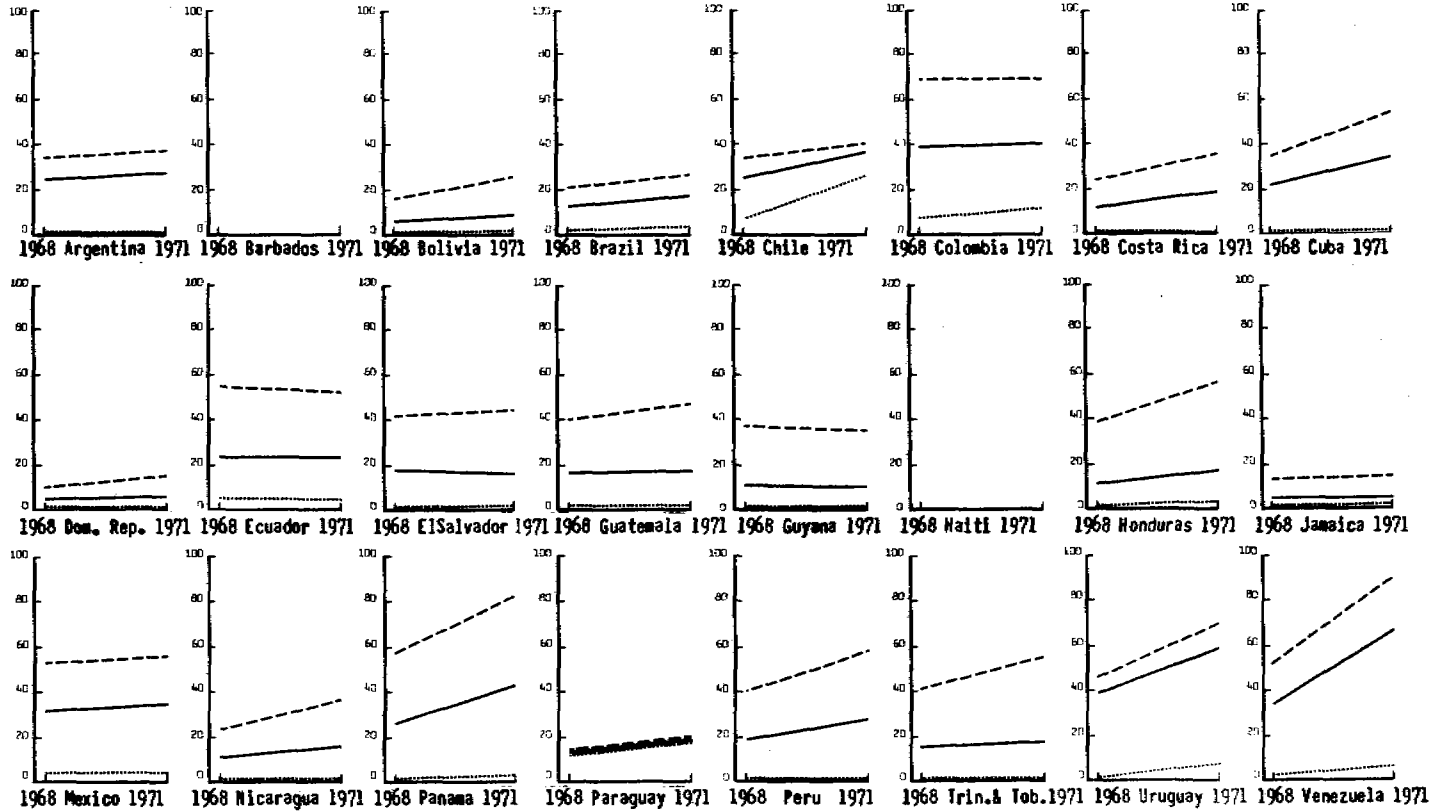
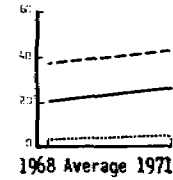


Figure X  
SEWERAGE SYSTEM PROGRAMS PERCENTAGE POPULATION  
SERVED IN 1968 AND PROJECTED FOR 1971

TOTAL ——— URBAN - - - - RURAL ·····





ANNEX A

METHODOLOGY OF DATA COLLECTION PROGRAMS  
FOR  
COMMUNITY WATER AND SEWERAGE SYSTEMS  
IN LATIN AMERICA

A PRELIMINARY APPROACH AND BACKGROUND DOCUMENT

Prepared for the Pan American Health Organization

by

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October 1967

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METHODOLOGY OF DATA COLLECTION PROGRAMS FOR COMMUNITY WATER AND  
SEWERAGE SYSTEMS IN LATIN AMERICA

CHAPTER ONE

PREFACE

- 1.1 This Report on the methodology of collecting, compiling and reporting data on community water supply and waste disposal systems in Latin American countries has been prepared for the Environmental Sanitation Branch of the Pan American Health Organization (PAHO), Washington, D.C., under the provisions of Contract No. PH-86-67-203, with the U.S. Public Health Service, dated June 1, 1967. Work on this study contract was initiated in Rio de Janeiro on 17 June 1967.
- 1.2 The overall contract study scope is concerned with "assisting countries of Latin America to develop or improve methods of collecting reporting and correlating data required for planning and evaluating the progress of their community water supply and waste disposal programs." Work to be performed by the Contractor entails submission of six reports over a two-year period ending June 30, 1969, with the Methodology Report due essentially at the Contract onset and with the remaining five reports dealing with progress in the development and application of data systems and data collected within the respective countries due through the period of the contract.
- 1.3 Because the timetable for this Methodology Report, practically speaking, is "before the fact" rather than following the acquisition of operating experience on the data collection programs involved, this report can only be viewed as preliminary in character, with additional information to be supplied in the succeeding five reports. Of special concern in the present report are general and practical considerations pertinent to the appraisal and evaluation of the water and sewerage data collection programs which are underway in each Latin American country and to their improvement where indicated. Since adequate information is not available at this stage of the study on these existing programs, other data collection programs in Latin America and the United States and water supply inventory programs in the United States are described and analyzed.
- 1.4 The overall program, of which this contract study constitutes a small part, is a collaborative one which relies primarily on within-country resources for data collection and utilization and on the six Regional Offices of PAHO which are participating actively through direct communication with the member countries on program assistance and as communication channels with PAHO/Washington and the Contractor.

1.5 A basic reason why this Methodology Report was scheduled at the very beginning of the contract study period is the need to provide guidance and indoctrination at an early date to a group of short-term consultants on data collection methods. These consultants are scheduled to supplement the Contractor's work and will visit various PAHO zone areas to work in collaboration with the Zone Offices and with organizations in the selected countries.

1.6 Ultimate objectives of the overall program are stated as:

- 1) Data collecting and processing.
- 2) Preparation of a five-year water and sewerage development plan.
- 3) Obtaining acceptance of the five-year plan within a comprehensive national socioeconomic development plan.

1.7 Without losing sight of the latter two objectives, it is the inherent purpose of this Methodology Report to follow an oral procedure and to concentrate on Objective No. 1, which is first in time, reserving specific consideration of the remaining objectives to some or all of the succeeding reports.

John M. Henderson, P.E., Contractor.

## CHAPTER TWO

## INTRODUCTION

- 2.1 Exploration into the subject of Data Collection Programs on *community water and sewerage systems in Latin America* calls first for a general stocktaking and assessment of present conditions - in terms of existing data collection programs in the water and sewerage fields, those in other comparable fields or in other geographic areas and also of the environment or "climate" of statistics-gathering within and outside of Latin America. In this way, an objective perspective can be acquired on: 1) the procedure of assisting countries in water and sewerage data collection, analysis and utilization; 2) what may be needed; 3) what existing information resources might be utilized; and 4) what techniques might be considered toward improving existing programs.
- 2.2 Because this report (one of a series) has been prepared at the onset of the data assistance contract study, detailed information is presently lacking on most characteristics of water and sewerage data collection activities on a country-by-country basis, but enough is known of a general nature to develop some criteria and baselines. The foregoing approach in Item 2.1 is not confined to this introductory chapter, but carries through the corpus of the report and appendices.
- 2.3 Types of Data Needed
- 2.3.1 The types of data needed depend greatly on who is going to use it and the purpose of application. This point needs clarification at the onset because of the distinction between what is ordinarily thought of as "statistics-gathering" or "inventory-taking" and what is sometimes termed "basic data."
- 2.3.2 If the primary purpose of a data program is to provide information to expedite and simplify the development of sound engineering design for the construction of water and sewerage systems (along with other civil construction), the most valuable information that can be supplied for planning and design is that which is otherwise obtainable at the project site only after much time delay and expense. Such information largely falls into the category of basic data and includes:
1. Long-term stream flow records - especially minimum drought flows, which are especially important in many Latin American countries due to the high proportion of surface streams utilized in urban water and sewerage development.
  2. Groundwater hydrologic data where groundwater sources are actually or potentially involved.

3. Geologic maps and reports, especially for dam and aqueduct construction.

4. Adequate and accurate planimetric and topographic maps of the local and surrounding terrain, primarily for determination of feasibility and for selection between alternate water supply sources.

5. Maps or other reliable records of the sizes, location and condition of underground pipelines, especially principal water lines. Under present conditions, this information is generally incomplete because of systems growth over a long period of years, intermittent record-keeping and lost records.

6. To this primary list might be added a lengthy list of secondary basic data items which are generally more readily procurable through inquiry, by reconnaissance or sample analysis, and also demographic data (generally available through past population censuses capable of being updated by applying other current local growth data).

2.3.3 It is apparent that most of the foregoing basic data items are of limited interest to those concerned with the collection and utilization of data of the systems-inventory type. However, the extent to which they are available has great bearing on the rate of progress and soundness of urban water and sewerage systems development.

2.3.4 For purposes of definition of scope, the rest of this report deals only with systems-inventory and cost data. The term "inventory" implies a complete stocktaking of water and sewerage systems. In this report, however, "inventory-taking" is used in a broader sense to include partial samples as well as complete (100 per cent) samples.

#### 2.4 Existing Data Collection Programs in Latin America - Water and Sewerage Systems

2.4.1 Inventory-type data collection in these fields has been carried on at least to some extent in every Latin American country, in some cases for many years. As might be expected in a hemispheric area containing so many countries varying greatly in population, geographic area, transportation facilities, economic and cultural characteristics and organizational development, these data collection and derivative activities vary greatly in adequacy (completeness), in accuracy and in the effectiveness with which they are applied toward program development. Rated on a scale of 0 to 100, the extreme range of these programs may be in the order of 20 to 90, although no precise evaluation has ever been made along these lines or is probably practical to perform.

2.4.2 Thus, any present collaborative efforts to assist data collection-compilation-analysis-application programs should be concerned not with the introduction of completely new concepts and programs but rather

with the possible modification of existing programs along organizational, procedural or technical lines. In view of the diverse environmental-organizational climate existing among the Latin American countries, it is equally apparent that: 1) modification of existing programs, where proposed, should be individually designed for the individual country or in one case perhaps, region, and not cut from a common pattern; 2) data collection systems should be kept as simple as possible in content and procedure; and 3) standardization between countries of technical content and terminology of data collection items should be avoided, except for a minimum number of the most basic items.

CHAPTER THREE  
STATISTICS IN TODAY'S SOCIETY

- 3.1 In this report, the term "data" and "statistics" are often employed interchangeably even though there are slight differences between them. "Statistics" means systematically collected and classified numerical facts (data). Statistics, accordingly, are actually the end-product of the overall data collecting-compiling-analyzing-dissemination process. Thus, "statistics" symbolizes the data collecting-analysis process as an entity in that it represents the end product. Also, by definition, non-systematically collected data are not "statistics."
- 3.2 Data-collection is as old as human society. It may have had its origin in tribal population censuses and animal herd counts. In recent years, however, there has been a worldwide upsurge in statistics production for public information and misinformation and much so-called "statistical" information released is of questionable validity. From a global standpoint, a large part of the expanded output of statistics at the national level has been due to national socioeconomic planning, such as the development of Five-Year Plans, and also to increasing socialization in many countries, whereby each individual person becomes a cog (number) in a nationwide machine. Public officials increasingly rely on the use of statistics to buttress their case, and industry in some countries has become "computerized" in order to cope with the ever-mounting volume of statistics as well as to operate industrial processes and machines.
- 3.3 This trend in statistics output has resulted in the collection and dissemination of many types of data and statistics - meaningful and meaningless, accurate and inaccurate, leading and misleading.
- 3.4 It is said by the nationals of at least one large Latin American country that statistics are available on almost every imaginable subject but that few of them can be trusted. The people of that country(ies) can take heart in knowing that the United States is also afflicted with the same problem, as summarized in the statement that: "In a numerically conscious society, progress is measured by numbers, not quality."
- 3.5 Because of its pertinency to an understanding of the present climate of data collection and statistics dissemination, two recent editorials on the subject in United States periodicals are given in Appendices 3-1 and 3-2.
- 3.6 The inaccuracy of many economic statistics also has not gone unnoticed in the daily press in the United States, as evidenced by the following headline in a recent issue of the Wall Street Journal

(Sept. 12, 1967): "FOGGY FORECASTS. TAX RISE DEBATE PUTS SPOTLIGHT ON INACCURACY OF ECONOMIC STATISTICS. \$33 BILLION GETS OVERLOOKED."

3.7 In summary, any approach to the development of data collection and dissemination in the community water and sewerage field should take into consideration the following two factors:

- 1) Awareness that such collection and dissemination is essential to keep pace with other programs involved in national socioeconomic planning and in the fiscal and other controls which stem from multi-year plans.
- 2) The importance of evaluating the degree of adequacy and accuracy of the statistics which might be practically obtained or are being obtained and, where needed, the development of a practical mechanism to attain those targets, together with the selection of those data categories which are compatible with the objectives of reasonable adequacy, accuracy and program promotion.



## CHAPTER FOUR

### ANALOGOUS DATA-COLLECTING-STATISTICAL PROGRAMS

- 4.1 In this chapter, consideration is given to three data-collecting statistical programs. Two of them have no direct relation in content to the community water and sewerage field; the other is only partially related. All three, however, have certain features in common with a collaborative, multi-national water and sewerage inventory program. Because of these common features, they may serve as guidelines or as reference frames to the water and sewerage program.
- 4.2 The programs reviewed are those for: 1) Vital Statistics Registration in the United States, 2) the Program for the 1960 Census of America under the auspices of the Pan American Union, and 3) Study of Health Manpower and Medical Education in Colombia - I. Methodology. These three collaborative programs provide a source of information on such factors as: 1) completeness of coverage and accuracy of results; 2) eligibility standards and timetable for an evolving collaborative program; 3) flexibility in scope and terminology for a coordinated multinational program employing common, basic criteria; and 4) some program limitations.
- 4.3 The Census of America includes the collection and dissemination of comprehensive economic statistics for each country, which are not reviewed in this report, as well as population and housing censuses, which are. The Housing Census phase of the program has particular applicability to any collaborative water and sewerage inventory-taking in the same geographic areas. For this reason, some summarized results of recent housing censuses in six Latin American countries are given in Appendices 4-1 through 4-6. In the summary for Brazil, a table is also attached which gives countrywide water and sewerage system inventory data for 1965, as published by the National Census Bureau and collected by the Ministry of Health.
- 4.4 Vital Statistics Registration in the United States
- 4.4.1 A description of this data-collecting-compiling-analyzing program is given because it provides an example of a continuing, collaborative program by Federal, State and local governments in which reporting adequacy is employed as a basis for data acceptance and because it uses sampling procedures.
- 4.4.2 This program was initiated by what is now the National Office of Vital Statistics (NOVS) of the Federal Public Health Services, on an annual basis in 1900. Because it was considered that grossly incomplete data on this particular program were worse than no data at all and also to provide an incentive for more complete reporting, a standard was

established by the Federal agency that no State would be admitted to the Registration Area without a demonstrated registration completeness of at least 90 per cent, based on field checks.

- 4.4.3 As a result of this requirement, the initial Registration Area was limited to 10 States of the then 45 States when the program was initiated in 1900 and was limited to mortality statistics because the States could not meet the standard as to birth statistics.
- 4.4.4 With passage of time, additional States gradually were admitted to the Mortality Registration Area, and in 1915 the Birth Registration Area was initiated in the original 10 Death Registration Area States. Finally, in 1933, all of the then 48 States met the requirements for both Birth and Death Registration and the program since then has included all States.
- 4.4.5 U.S. practice is to require that birth and death certificates be filed in a central State Vital Statistics office by local offices. Currently, death statistics compiled at the Federal level are based on a 10 per cent sample of death certificate data in the State offices and on a 50 per cent sample of birth certificate data.
- 4.4.6 Field checks made in 1940 and again in 1950 on reporting adequacy showed that, with 7 to 35 years of program development behind them, birth reporting was 92.5 per cent complete in the first check-year and 97.5 per cent in the second. Because registration of births tends to be lower than that of deaths, mortality registration completeness approached 100 per cent.
- 4.4.7 Vital statistics data programs also offer a prime example of the distinction between "completeness" or "adequacy" of reporting and the accuracy of reporting data elements. On Vital Statistics Programs, if all births or deaths are reported, "completeness" is 100 per cent. These programs, however, are concerned with many other details contained in birth and death certificates, among them being "cause of death." These details introduce the factor of "accuracy." Accuracy in reporting cause of death is known to be of a very much lower order than "completeness," based on differences between cause of death by autopsy and the original diagnosis. Consequently, until all human cadavers are autopsied, the accuracy of cause of death can never equal the "completeness" of reporting deaths per se.
- 4.4.8 In water supply and sewerage data programs, this situation is analogous to data which may be virtually complete with respect to number of "systems" but inaccurate in details pertaining to the individual systems, such as "population served."
- 4.4.9 Among other things, the U.S. Vital Statistics Registration Program illustrates the following points:

- 1) Importance of a continuing program.
  - 2) The long span of time needed to achieve an optimum level of completeness (97.5 per cent for birth registration) - from 1900 to 1950.
  - 3) Use of a sampling procedure.
  - 4) Recognized inaccuracy of some detailed data (cause of death) in spite of a high order of completeness for total births and deaths.
- 4.4.10 The matter of completeness versus accuracy of certain data items is also illustrated by results of the 1960 U.S. Population Census. This Census was carefully and systematically carried out and has a long program history. While it is recognized as having a high order of completeness in terms of total population count, recent analyses indicate that the negro population was about 10 per cent under-reported and the male negro population was about 16 per cent under-reported (Moynihan).

#### 4.5 Program for the 1960 Census of America of the Pan American Union

- 4.5.1 The principal coordinated census-inventory-taking operation involving all of Latin America is that of the Pan American Union (PAU), through the Inter-American Institute of Statistics (IAIS), with offices in Washington, D.C. The present phase of IAIS activities is termed "Program for the 1960 Census of America" and applies to the 1960-1969 decade. It is a continuing program with planning underway for the 1970-decade censuses. The Program embraces a wide range of socio-economic inventory-taking and data collecting, not only in the demographic-social sector, but also economic-financial reports and indexes, the latter involving different procedures and reporting frequencies than the strictly census activities.
- 4.5.2 IAIS activities in the social sector are of pertinent interest in this Methodology Report not only because of the obvious importance of population censuses in water and sewerage inventories, but also because:
- 1) The IAIS Program provides an example and a developed experience in coordinated inventory-census-taking operations blanketing the Americas, which provide, on the one hand, establishment of common criteria toward consistency in reported results among the member countries, and on the other hand, flexibility in the scope of and terminology used in the censuses to meet within-country conditions.
  - 2) The Housing Census, in combination with the Population Census provides data on the average number of occupants/dwelling unit,

thus supplying a partial basis for converting numbers of water and sewer service connections into population-served values. Because this particular Housing Census item is often directly linked into the Population Census, occupants/dwelling unit are often reported by minor civil subdivisions, extending down through individual municipalities and at times listed for local neighborhoods (bairros or barrios). This is in contrast to other reporting items in the Housing Censuses.

- 3) The Census of Housing Conditions provides direct numerical data on water, sewerage and excreta disposal facilities by dwelling units and by number of occupants. Because these data are obtained through house-to-house visits, these data may be more complete and more accurate than information obtained from many municipal water departments, particularly those with incomplete records or which maintain records on a service-connection basis. Housing Census results, being confidential with respect to individual respondents, may also reflect a portion of the clandestine connections which rarely show up in local water department records. (In at least one known situation involving a city of several hundred thousand population, clandestine connections amounted to one-third of the total connections.)

#### 4.5.3 Program Flexibility

Flexibility in the collaborative IAIS Housing Census Program is provided for in the following manner:

- 1) Number and Type of Census Questions

The more basic questions are contained in a "Minimum Program" to which all member countries are expected to conform. Optional supplemental questions are listed in the "Expanded Program." Individual countries may also add their own questions and may rephrase questions to conform to local terminology and types of materials and facilities.

- 2) Report Format

As a minimum, housing census data are reported for the nation and by major civil subdivisions (States, Provinces or Departments). Succeeding, expanding steps are to: a) classify data into Urban and Rural, b) report results for principal cities, and c) report results by minor civil subdivisions.

- 4.5.4 Under the 1960 Census of America Program, Population and Housing censuses were concurrently carried on in all but one of the mainland Latin American countries between June 1960 and April 1964 (exception - Bolivia), and in all but two cases (Brazil and Guatemala) all questions

in the "Minimum Standards" list for water and sewerage facilities were asked on a "full count" basis. Census-taking of these items in Brazil and Guatemala was by "sample." Some countries also added supplemental questions, either within or without the IAIS Expanded Program List.

- 4.5.5 Because of the significance of these Housing Census results in this Methodology Report, further details on questions and results in the Water and Sewerage area are given in Appendices 4-1 to 4-6, which contain summarized percentage results for Brazil, Costa Rica, Guatemala, Honduras, Mexico and Panama.
- 4.5.6 Although water and sewerage data in these Housing Censuses in their present form are a distinct asset to persons in water and sewerage inventory-taking activities, they also have important shortcomings which limit their utilization.
- 4.5.7 The first weakness is inherent in the entire IAIS Census Program for Population and Housing - namely, that the reporting interval is once every ten years.
- 4.5.8 A second weakness applicable to data for water and sewerage pertains to insufficient detail in the reports of some countries, such as failure to classify between Urban and Rural categories. Also in those countries which report Urban and Rural results but only by major civil subdivision, although the percent served in Urban and Rural areas for the nation can be determined, it is not possible to determine these values by "Size of City" grouping or for individual cities. However, in some countries, Census Bureaus possess much compiled, unpublished data, and agencies with special interests in a particular topic may, at times, be able to obtain these unpublished statistics.
- 4.5.9 A further weakness lies in the sewage-excreta disposal area. The Housing Census is more interested in the method of defecation in terms of type of facility than in ultimate disposal. The number of flush toilets may, for example, be reported but not whether the waste is disposed of on-premises or by public drain or sewer. This limitation partly reflects the capability of some respondents to give knowledgeable answers.
- 4.5.10 In a few countries, there was evidence of possible intercession with census authorities by those interested in public water and sewerage development, in that one or more optional questions were added for sewerage to provide additional detail (such as in Brazil).
- 4.5.11 The IAIS has many mimeographed publications of a planning-progress report type for the Housing Census of the 1960's and on the planned census for the 1970's, which are of potential interest to those concerned with water and sewerage inventories. This material includes a list of categories used by each country in the 1960 censuses in

schedules for water, toilet systems and bath facilities (Table 2 of 5116a-1/13/66-50).

#### 4.6 Study on Health Manpower and Medical Education in Colombia

- 4.6.1 This study was initiated in 1964 by the Ministry of Public Health and the Colombian Association of Medical Schools with the assistance of 21 outside consultants, with financial support by the Milbank Memorial Fund and with PAHO as a co-sponsor. Following its performance, a two-volume report was published in 1967 by PAHO, one volume dealing with Methodology and the other with Preliminary Findings. The total cost of the study was US\$382,000.
- 4.6.2 The project was divided into nine study areas: 1) Demography, 2) Mortality, 3) National Health Survey, 4) Nursing Resources, 5) Health Institutions, 6) Socioeconomic Studies, 7) Medical Resources, 8) Medical Education, and 9) Nursing Education, of which the first six were the responsibility of the Health Ministry and the last three, of the Medical Schools Association. The National Health Survey (Area 3) dealt primarily with morbidity, but also covered some items on housing conditions, including water supply and sewage disposal.
- 4.6.3 Of principal interest from the standpoint of this Methodology Report on water and sewerage systems is the fact that the Colombian study was concerned with making countrywide inventories and with checking the completeness of available inventory-census data, such as the number of reported deaths.
- 4.6.4 Because of the magnitude of the task making a complete inventory in Area N<sup>o</sup> 3 among the 18 million people of Colombia by means of household visits to every dwelling unit, a sampling procedure was adopted for the National Health Survey. The sampling methodology, developed for both the Household Visits element and for a clinical examination sub-sample, illustrates the possibility of employing a very small sample to measure conditions in a large mass, provided the sampling procedure is carefully designed in accordance with statistical procedures and also provided a considerable probability error can be tolerated.
- 4.6.5 The universe of the Household Sampling Survey comprised 18 Departments containing 98.7 per cent of the total national population but only 52.7 per cent of the geographic area, thus greatly reducing transportation problems without appreciably reducing the population sampled. (This factor is pertinent to many other Latin American countries having primitive transportation facilities in sparsely settled areas and opens to question any decision to carry out a 100 per cent inventory of urban and rural water and sewerage systems under such conditions.) The size of the Household Survey sample was 8,920 households with 52,964 persons, of which 8,669 households with 51,473 persons were actually interviewed. The survey was performed in 1965, when the total

population of Colombia was 18.04 million and the sample size was 0.3% of the total population. The clinical examination subsample was 10 per cent of the household sample, or 0.03% of the total population. Based on an assumed value of 10 per cent for any item in the Household Sample survey, the true percentage would be in the range of 8.2 to 11.8 per cent at a 95 per cent confidence level.

4.6.6 Results of the water and sewerage element of the household survey were:

Per Cent Available - Colombia - 1965

	<u>Total</u>	<u>Urban</u>	<u>Rural</u>
<u>Water Supply</u>			
Inside house	44.3	69.0	16.3
Outside house	24.5	20.2	29.5
No service	30.6	10.2	53.6
No information	0.6	0.6	0.6
<u>Sewage Disposal Facilities</u>			
Toilet (Inodoro)	41.5	71.7	7.4
Latrine	14.8	14.0	15.6
No service	43.0	13.6	76.3
No information	0.7	0.7	0.7

4.6.7 These survey results show that more people had toilets than had water supply inside the house, which invites speculation. The report contained no definitions of the water supply and sewerage questions nor instructions to the census takers on these items. In common with the housing censuses of the Census of America, the questions were concentrated on household facilities rather than types of water supply and sewage disposal.

4.6.8 Condensed data on the Household Interview survey were also supplied in the report for the five principal geographic regions of Colombia by total populations. Compared with a national average of 44 per cent with water service inside the house, the range by regions was from 21 per cent to 73 per cent. Compared with a national average of 42 per cent having toilets, the range by regions was from 18 per cent to 91 per cent. In the "high" region, 18 per cent of the total population had toilets but not water service inside the house.

## CHAPTER FIVE

### EXAMPLES OF EXISTING WATER AND SEWERAGE DATA PROGRAMS

5.1 Two distinctly different types of community water and sewerage data programs of an inventory type are described and discussed in this chapter, with limited mention of some other types of data facilities. Both of the two described programs are collaborative in character, one national and the other international. The international program was selected because of the minimum detail contained in the reporting form used in the current phase of the program and in related instructions, and it is that of the Pan American Health Organization (PAHO). The other was selected because the reporting forms and accompanying instructions contain maximum detail (U.S. Public Health Service Inventory of United States Community Water Facilities).

#### 5.2 PAHO Water and Sewerage Latin America Inventory

5.2.1 The current PAHO inventory report form is of an interim type, designed to obtain limited information in the shortest possible time on the total urban and rural populations supplied with piped water and served by or accessible to sewers in each Latin American country in 1967. The reporting form consists of a single page for each country with three line items and four columns to be filled in. This form and accompanying instructions are shown in Appendix 5-3. The content and scope of this reporting form are not intended by either PAHO or by this Contractor to represent all of the data which it would be desirable to obtain; rather, it shows the ultimate in simplicity.

5.2.2 The PAHO form uses the term "Basic Data" in a different sense than that used in this Methodology Report (see Chapter Two). This point is mentioned only as a reminder that the scope of the data needed for urban water and sewerage system development is much more comprehensive than that visualized from a purely inventory-taking standpoint.

5

#### 5.3 U.S. Public Health Service Water Systems Inventory Program

5.3.1 The U.S. Public Health Service Community Water Systems Inventory is described in detail in Appendix 5-1. There is also a comparable inventory program for community sewerage systems which is not described in this Report because of its general similarity to the water inventory program. (Responsibility for future water and sewerage inventories of this type has been recently transferred from the Public Health Service to the U.S. Interior Department.)

5.3.2 This former Public Health Service Water Inventory Program is characterized by:



- 1) Great Volume of Detail - Line item listing of each local system (19,236 systems in latest report), with 18 data column headings for every system and 33 column headings for larger systems. In addition, up to 73 different data categories can be entered under a single column heading by use of coded letters and symbols.
- 2) Infrequent Censuses - Five-year interval for systems serving under 25,000 population.
- 3) Long Time Period for Development of Program to Current Status - Initiated 1939 with 1st Stage of Development completed in 1958 (19 years).
- 4) Long Time Lag in Publishing Results - Up to seven years, of which five years represents census interval.
- 5) Incomplete Reporting of Some Data Items - Due to detailed nature of report form. On the other hand omission of some data helps to strengthen validity of data reported.

#### 5.4 U.S. Data Resources on Water

- 5.4.1 It would be misleading if the former U.S. Public Health Service Water Inventory Program is thought of as comprising all data collecting-reporting operations in the water and sewerage field in the United States. As an index of the magnitude and comprehensiveness of data resources and dissemination, a 1966 Directory of Information Resources on Water in the United States (published by the National Referral Center for Sciences and Technology) lists some 750 to 800 non-profit organizations alone in this field. A bulletin on Federal Programs for Collection of Data on Water Use, published in 1959, has 43 pages of listings (Notes on Hydrologic Activities, Bulletin No. 10, U.S. Public Health Service).
- 5.4.2 From the standpoint of water system development in the United States, a major omission in the Water System Inventories Program formerly carried on by the Public Health Service is lack of data on unit and total costs of needed improvements to meet current and future needs and on water and sewerage rates, revenues and expenses. This void in construction costs is partly filled by surveys and publications of the Business and Defense Services Administration of the U.S. Commerce Department and by information in periodicals such as the Journal of the American Water Works Association and Engineering News Record. Also, water and sewer service rate schedules are published in part by the AWWA Journal as above and by State Associations of Municipal Governments.

#### 5.5 Original Data Sources for Water and Sewerage Inventories

- 5.5.1 State agencies in the United States, which are the main collectors, compilers and transmitters of water and sewerage inventory data

on local-state-federal collaborative programs, rely almost exclusively on two sources for the original data from which their reports are compiled: 1) local water systems management and 2) engineers who design new water and sewerage systems or improvements to existing systems. Even when personal visits and inspections are made by outside personnel for data collection, the great bulk of the data is obtained from local personnel and local records. These same two sources are believed to be of similar importance in Latin America, except that in some countries having state or national water authorities or other agencies engaged in water and sewerage system management and/or construction, the data sources tend to be partly or wholly intra-organizational.

5.5.2 Procedure followed by State agencies in the United States in obtaining data from designing engineers is to require prior approval of engineering plans for local water and sewerage construction before the work is commenced and, where applicable, before any subsidy is granted. One element of the approval procedure is submission of a data sheet on which is listed all pertinent information. Appendix 5-2 shows a Basic Design Data Sheet for a sewage treatment plant. Design Data Sheets for water system improvements and for sewer lines are comparable in character. Copies are transmitted by State agencies to Federal agencies where applicable.

5.5.3 The foregoing procedure is designed for improvements to locally managed systems, but the completion and central filing of such design data sheets is equally applicable where design is performed by national or state water authorities or by ministries of public health and public works.

## CHAPTER SIX

### PLANNING AND DESIGNING DATA PROGRAMS FOR WATER AND SEWERAGE SYSTEMS

#### 6.1 Foreword

This chapter contains a discussion of some key points involved in planning and designing data programs as defined in the chapter heading and which are of the inventory type, either whole samples or partial samples. A list of precepts and principles follows to conclude the chapter.

#### 6.2 The Completeness Factor

6.2.1 The term "completeness" is used in this discussion primarily to denote whether the name and location of every community water system is listed in inventory records because this is the basic step toward obtaining additional data on the systems. It applies in a secondary sense to all other data items.

6.2.2 Full completeness of the basic step is relatively feasible to attain, even in large Latin American countries, provided the data program is confined to urban communities with a baseline population of, say, 5,000 or 10,000. It becomes increasingly difficult when the program takes in smaller urban communities and/or total rural populations unless a single organization has been responsible for building all small systems and has kept a continuous set of records. As an index of the task of ferreting out all small community water systems, including rural systems, under less favorable circumstances, Brazil in 1960 had 3957 municipalities, all potential candidates for investigation, with a goodly number inaccessible to passenger cars, or in some cases, any land transportation. Mexico in 1960 reported 88,151 rural populated "centers" in addition to 1,461 "urban" communities. Reliance on National Housing Census data generally permits use of only national and state summaries and not individual system records. Selection of a suitable population baseline affects such factors as time interval between updating periodic reports and the time lag in releasing them after the closing date of the updating period. In countries where it is difficult to obtain even basic-step information for all rural and urban systems, one alternative is to collect and publish two reports, one for urban systems above a certain population baseline, complete as to Basic-Step listing, the other a partially complete "as-is" report issued less frequently for "all other systems." A second alternative is to follow the reporting practice of many national housing censuses and lump "all other systems," to the the extent they are known, into State and National summaries.

6.2.3 The degree of completeness with which data items other than name and location are obtainable depends on many variables including the accuracy factor, complexity of reporting form and manpower resources

available for data collecting. However, the primary variable in at least some countries is the competency and adequacy of local water system management, and this variable is not necessarily related to size of system.

### 6.3 The Accuracy Factor

6.3.1 Under this heading, attention is first centered on the data item "Population Served" because it probably is included in every water and sewerage system inventory program and is more difficult to accurately determine in many Latin American countries than any other item except the extent, size and condition of buried pipelines in old systems. Partly for this reason, estimates of population served may vary as much as 50 per cent when furnished by different individuals in the same local water department.

6.3.2 In the United States, "population served" in community water system inventories can be readily obtained because it is generally 100 per cent in urban and suburban communities. Where it is lower, the number and per cent unserved tends to be small and can be obtained by subtracting the population of a small unserved fringe area from the total population of the city. In most Latin American countries with extensive water system deficiencies, a reverse procedure is indicated - one of directly determining "served" rather than "unserved" populations. This is a more difficult procedure for reasons given in the rest of this section.

6.3.3 The term "population served" is inherently vague, with different definitions employed by statistics-gathering programs, including: 1) those with piped water within the dwelling unit; 2) piped water within the building; 3) outside piped water on the premises; 4) within a block; 5) within 1/4 mile; and so on. Values for some of these different definitions appear in Appendix 4.

6.3.4 All of the foregoing definitions in turn can be modified by the "continuity of service" factor. In terms of "population served," this is seldom if ever done on a numerical basis, although it can be important from both a social standpoint and in terms of improvements needed and, hence, capital cost. Currently, in one very large Latin American city, following 5 1/2 years of massive water system improvements (still under way), only about 50 per cent of the connected population receives regular delivery of water. In one section of the city with 90,000 population, water is furnished to the overall area seven days/week, but through rotational delivery is supplied to individual neighborhoods only one day/week, with intermittent delivery to some customers on that day. This poses a question: When is a connected customer "served" (effectively served) and when is he "unserved" (ineffectively served)?

6.3.5 In some cities, clandestine connections result in underestimating the connected population by a substantial margin. In one large city,

clandestine connections are reported to amount to 33 per cent of the total connections. Such connections are made by tapping into nearby service connection lines as well as into street mains which may be exposed or in shallow cover.

- 6.3.6 For further discussion of the per capita served or connected aspects, see Chapter Eight.
- 6.3.7 A basic reason in many Latin American water and sewerage systems of all sizes for lack of firm data on population served is the inadequacy and/or lack of competency of municipal governments, including water and sewer departments; these conditions partly stem from inadequate rates and revenues, for which inflation in turn can be a significant factor. The status of general municipal government as well as the water department is involved because water and sewer billing records and revenue collections may lie outside of water department jurisdiction, and it is this activity which is most directly concerned with statistics on connections, customers, etc. Also, many local systems impose no charge for sewer service, which eliminates commercial division motivation for sewer customer records.
- 6.3.8 Another major reason for inadequate data on population served is billing rate schedules based on the service connection rather than the customer (i.e., dwelling unit), especially where hydrometers are installed. This condition exists partly because in cities having multi-family structures, enumeration of the number of customers requires inspection of each multi-family building or building plans, including separation of space used for offices, stores and tiny industries from space used for residential purposes. In one large city with service connection records, the number of residential customers is determined by crude estimates ranging from 1.5 to 2 residential customers for each service connection (all types) on a city-wide basis.
- 6.3.9 In order to determine population served, it is also necessary to convert residential customers into "people." To be reasonably accurate, this should be done on a neighborhood (barrio, bairro or census tract) basis for water and sewer systems having spotty distribution system coverage, because the average number of occupants/dwelling unit can vary by 50 per cent in different neighborhoods of a city. Unfortunately, population and housing censuses only occasionally report the number of occupants/dwelling unit by neighborhoods in Latin American countries.
- 6.3.10 In summary, this discussion of "population served" indicates that, while use of this data item is accepted as essential for some purposes, it is also highly fallible and subject to major inaccuracies. This situation emphasizes the need for exploration on the present PAHO data assistance program into ways of: 1) minimizing these inaccuracy potentials by such data collection procedures as selective sampling

and 2) turning to possible other indices for use in such items as estimation of capital development requirements and adequacy of existing systems.

- 6.3.11 The foregoing situation also raises the question as to how accurate "population served" and other items in any Latin American data collection program should be, not in an absolute sense, but in context with other data and cost estimates involved in such statistical programs as national five-year plans.
- 6.3.12 By way of approach, it might be pointed out that one element of economic statistics is the development and use of indices to show the amount of change and rate of change with time, as well as for other comparative purposes. Since indices are concerned with arbitrary, comparative values rather than absolute values, statistical errors in them have little significance provided they are "built-in" and have a constant impact on all elements of the index table, and again provided the error is relatively modest in magnitude.
- 6.3.13 For example, if the error is a constant (k), an initial error of plus or minus 10 points in an index having an arbitrary baseline value of 100 gives an adjusted baseline of 90 to 110. When the index reaches a value of 200, the adjusted value becomes 190 to 210 and the comparative values of the arbitrary and adjusted indices are very little different. On the other hand, major built-in errors, such as 50 points in the arbitrary baseline value, can have a major impact on comparative index values, irrespective of whether the error is a constant (k) or a percentage.
- 6.3.14 With regard to the accuracy of "population served" data relative to the accuracy of other socioeconomic data, little is known by this contractor of the actual degree of error in them for different Latin American countries. It is obvious, however, that all or most of these other socioeconomic data are approximations and this statement applies as well to most socioeconomic data for the United States.
- 6.3.15 The data item "population served" is only one example of many potential items in a data-collection program which might be discussed in terms of the Accuracy Factor. However, the foregoing discussion adequately describes the complexity of the Accuracy Factor in water and sewerage data-collecting programs in Latin America.
- 6.3.16 Some engineers and data-hounds with a passion for absolute accuracy and a blind acceptance of the accuracy of published data may look askance at any degree of inaccuracy in water and sewerage inventory data. However, engineering practices in some other fields are not always as accurate as they appear to be. One example is cited in a recent article in Civil Engineering, as excerpted below (D.E. Jones, "Urban Hydrology - A Redirection " Aug. 1967). "The last major development in urban hydrology (storm sewer design) was the 'Rational Method'

of Emil Juichling in 1889. The Rational Method has gained wide acceptance, despite the fact that flow quantities deduced from its use may be subject to as much as a 50% or even greater error . . . ."

#### 6.4 Data Collecting by Sampling

- 6.4.1 As is well known, sampling techniques are widely employed in statistical programs, especially in the United States. In the United States, the sample proportion may be as high as 50 per cent of the statistical universe with the previously cited National Birth statistics by the National Office of Vital Statistics, or 10 per cent as with death statistics, or only a tiny fraction of 1 per cent as with some public opinion polls, TV-rating programs and the cited Colombia Health Manpower Study. Accuracy of the statistical results derived from sampling depends primarily on whether the sample is representative, rather than on the sample proportion; some situations may require a high proportion, others low, with carefulness in program design an important factor in determining what is acceptable.
- 6.4.2 In those large Latin American countries having many community water and sewer systems and with a wide range in adequacy and competency of local water system management and in adequacy and continuity of records, the quality (adequacy and accuracy) of data collected might be substantially improved by selective sampling in preference to making inventories of all systems. The inventory technique might still be carried out with respect to collecting minimum data, such as the name, location and size of communities having systems, with the sampling technique used for other data items. The size of a sample in a country such as Brazil might be as low as 10 per cent of the total number of systems (1778 listed municipal water systems and 1245 sewer systems in 1965).
- 6.4.3 Important ancillary advantages of sampling would be the substantial manpower savings which could variously: 1) make the data collecting program feasible; 2) free personnel for directly productive activities in water and sewerage system development; and 3) make more assistance in data collection available for the sampled systems. The logistical advantages of sampling would increase with time and growth in number of systems - for example, in 1965 only 32 per cent of Brazilian municipalities had listed sewer systems and only 45 per cent had listed water systems.
- 6.4.4 One apparent difficulty in initiating an accurate sampling program is that of establishing statistical criteria of a "representative sample" as a basis for selecting systems to be included in the sampling operation. This problem, however, is solvable as demonstrated by other effective sampling programs.
- 6.4.5 Water and sewerage system sampling operations have already been carried out in Brazil, although neither operation fully meets the objectives outlined in this Methodology Report.

Sampling Procedure "A" is one of data reporting rather than collecting and is similar in principle to some population and housing census reports in Latin America. As shown in Appendix 4-1, data for individual water and sewer systems are reported only for State Capitals and Brasilia; data for all other systems as well as for the individually reported ones are summarized by States. In this reporting system, no listing is made of "population served" because of obvious technical difficulties.

Sampling Procedure "B" is both selective and random in character. It is carried on by the National Department of Public Works (INOS) in collaboration with the Water Supply Division of USAID/Brazil. The overall program of water and sewerage development also includes in its training program element the Brazilian Institute of Municipal Administration and the Foundation for Special Health Services (FSESP). INOS is an element of the Ministry of Public Works in the area of water resources facilities construction, including community water and sewerage systems. Unlike the Statistical Service of the Health Ministry, the DNOS-USAID partnership has only limited interest in water and sewerage systems inventories per se. In conjunction with its recently established National Revolving Loan Fund, it considers that fostering the development of sound, feasible community water and sewerage system projects to make them eligible for international, national, state and local loans has top priority and, furthermore, that good local administration is a basic prerequisite to sound projects and good existing systems and also to obtaining meaningful inventory data. Objectives and loan eligibility requirements are spelled out as:

- a) Feasible local projects;
- b) Good local administration;
- c) Adequate water and sewer rates; and,
- d) Maintenance of value of the loan.

Such statistics as it utilizes on water and sewerage systems are obtained primarily from the following sources and mainly represent a random sampling procedure:

- a) Results of an intensive study of 60 widely distributed water and sewerage systems made in 1966 in conjunction with local public administration surveys as an element of the local administration training program. The 1960 population range of these cities was from 25,000 to 780,000, more or less equivalent to 35,000 to 1 million in 1966.
- b) A large file of preliminary engineering and feasibility reports submitted by loan applicants or in connection with DNOS construction financed by direct appropriations.
- c) INOS files of construction cost data.



As a result of the 60-city sampling survey, the DNOS group found the rounded values of urban population connected to water and sewers to be 50 per cent and 30 per cent respectively. They also estimate that for the 38 per cent of the total urban population of Brazil living in cities under 25,000 population in 1960, about 25 per cent were connected to water and 15 per cent to sewers at best under 1966 conditions.

The DNOS group appears to be disinterested in any major inventory program because:

- a) Its major interest is analyzing needs and assisting individual cities along feasible project lines.
- b) The magnitude of water and sewerage development needs is so great that no significant importance is attached to whether the actual present water-connected population in the larger city group is, say, 45 per cent, 50 per cent or 55 per cent. Thus, any further refinement of present data would have no practical significance and would be an unprofitable drain on manpower resources needed on more productive activities.

#### 6.5 The Appropriate Organization to Carry on Water and Sewerage Data Programs and Administrative Aspects

- 6.5.1 In countries having national water and sewerage authorities with full jurisdiction over all community water and sewerage systems, or at least all urban systems, there is a clear case for these authorities to carry on the data program for all systems under their jurisdiction. The data program becomes an internal operation and it would seem inappropriate for any other organization to intervene. For all other Latin American countries, the matter of organizational jurisdiction over data programs should be analyzed separately for each country. This procedure is needed because of the variety of geopolitical conditions in the different countries. In most countries, however, the present basic choice for the urban phase of the data program lies between the ministry of public works or interior and of public health, although one or more of these countries may also have early-stage national water and sewer authorities with current partial jurisdiction over the nation-wide water and sewer systems network. In the latter case, a choice would need to be made between three organizations, or only two where the new authority has taken over all former responsibilities of the public works ministry in the water and sewerage field.

General guidelines which might be followed in all such "Two-agency" or "Three-agency" countries are:

- 1) No agency which is indifferent or resistant to the data program should be given responsibility for it.
- 2) No agency which is unable or unwilling to assign to the data program the minimum necessary manpower should be given responsibility for it.

- 3) In any country having an established, effective data program, responsibility should be retained by the existing agency unless special new circumstances, such as the establishment of a national water authority, should clearly indicate the desirability of transfer.
- 4) In countries with water and sewerage systems under municipal management, the data requested from this source should not be beyond the informational resources and other capabilities of a majority of the managements. The data-collecting system and reporting forms should be designed with this principle in mind.
- 5) In any collaborative data collecting program, each group of participating parties should be consulted with respect to the type of data to be collected and the degree of detail before the program is placed into operation, or revised substantially, in the case of existing programs.
- 6) Employment of one or more persons with a passion for statistics in any data program should be encouraged, but final decision on reporting forms and procedures should be made only by persons with overall responsibility for water and sewerage system development in order that the data program will be designed and operated in balance with other program activities and with manpower resources and capabilities.
- 7) Preferably, the agency responsible for the data program at the national level should have a comprehensive interest in water and sewerage development, at least in the urban sector. "Interest" may or may not include "responsibility." In the absence of a comprehensive interest, the scope of the data program tends to be restricted to some particular aspect, such as water quality.

## 6.7 General Precepts and Principles

- 6.7.1 The quality of data collected can never exceed that of the source data resources, including local sources of information where involved. Where source data are to be obtained from municipal governments and water and sewerage departments, the type of data to be requested at any time should be geared to the capabilities of the local collaborators and to the informational resources at their command.
- 6.7.2 In large countries with many systems and with variable local informational resources and capabilities, data based on selected sampling can be more accurate, timely and meaningful than total inventories.
- 6.7.3 Data reporting forms and procedures should be kept as simple as possible: 1) for reasons given in subitem 1 above; 2) to conserve manpower resources for more directly productive activities; and 3) in

the interest of reporting adequacy and accuracy. No data should be requested from collaborators which will not be currently and productively utilized, except for Basis of Design Data, which may be prepared in connection with construction projects. In any collaborative reporting system, all echelons in the data-reporting chain should be consulted in planning the content and procedure of a data-reporting system in order to avoid impracticality, undue interference with other important program activities, inaccuracy and incompleteness, and to develop cooperation.

6.7.4 All data programs should be planned and established as continuing institutions, if necessary at a modest initial level. It is only by a continuing program that the quality of data can be upgraded. Such data program continuity also encourages the systematic collection and retention of vital source records in central files and by collaborators, the lack of which in some countries is keenly felt.

6.7.5 Especially in countries with many community water and sewerage systems and where local sources of information are relied on to provide data, it probably will be found beneficial to classify systems into different "size" categories and to adopt different data programs and reporting forms for each principal category. In some countries, a possible classification might be: 1) 50,000 and over total population; 2) 10,000 to 50,000; and 3) rural and under 10,000. In some parts of the world, communities of 10,000 and under have the characteristics of villages and, in fact, are sometimes called villages. The type of detailed data to be obtained locally for such systems generally should be of the same order as for rural community systems.

6.7.6 The problem of obtaining community water and sewerage data for rural areas can vary from simple to very difficult and expensive. It can be simple where all rural systems are built and supervised or managed by State or National agencies, provided they have maintained records, or where all rural customers are served only by extensions of urban systems. Where there may be more or less indeterminate number of locally built and operated rural community water and sewerage systems or central water supply points, the water and sewerage data-collecting agency might well consider joining forces with the National Census Bureau for enhancement of community water and sewerage data as an element of Housing Censuses.

## CHAPTER SEVEN

### PROCEDURES FOR REVIEWING AND IMPROVING DATA COLLECTION PROGRAMS

#### 7.1 Foreword

This entire report is concerned with providing information and guidance to those concerned with evaluating existing data collection programs for community water and sewerage systems in Latin American countries and in their improvement where deficiencies exist. Chapters One through Five and Chapter Eight, together with the Appendix, provide background information and guidance. Chapter Six is directly concerned with the planning and designing of the data collection program. The present chapter is concerned with the procedure which might be followed in a hypothetical situation by a short-term consultant(s) during and following a visit to a host country and by PAHO Zone office staff, as applicable. The term "hypothetical" is used because each country should be considered individually from a procedural standpoint, with modifications made where indicated. Because PAHO Zone Office Staff already possess a background of experience in the host country, much of the content of this chapter is directed toward the short-term consultant who, in many or even all cases, may have had no experience with the water and sewerage systems and development program of the host country.

As a reference frame, an invitation by an appropriate agency in the host country and a demonstrated local interest in obtaining an evaluation of existing data collection activities and suggestions for their improvement where needed, are sine qua non.

#### 7.2 Procedural Steps

7.2.1 Development of a Perspective. It is essential that the review and planning of past, present and future data-collecting activities in a country not be carried out in a vacuum without general, comprehensive knowledge of the overall data-collecting environment.

Short-term consultants, accordingly, should acquire a reasonable knowledge and understanding of the history, economy, political structure and culture of the country as well as information on present water and sewerage system conditions and the nature and extent of development needs. In the water and sewerage area, knowledge to be acquired should include both quantity and quality factors pertaining to the overall systems and systems management, with respect to personnel and to involved organizations at local, national and intermediate levels.

Ideally, this perspective should be acquired before engaging in other activities in the country, but from a practical standpoint might be acquired partly at the onset, with expansion during the entire

period of the visit. Of primary importance is that it be gained before making final judgments and recommendations on the data collection program.

- 7.2.2 Program Stocktaking. As a second step, information should be obtained on all pertinent aspects of existing water and sewerage system management and development activities. This step represents a projection into more detail of the more generalized knowledge obtained in the first step (7.2.1) in the community water and sewerage sector. In particular, knowledge should be acquired on numbers and types of staff involved in all aspects of the water and sewerage program above the local operating level, and on the specific activity areas in which they are engaged.

In obtaining and digesting this information, the consultant(s) should keep in mind that improvements in present data collection programs generally will require additional manpower, or at least man-time which potentially can be supplied only by: 1) diversion of present staff from present activities; 2) improvement in staff productivity; 3) increase in budget; 4) present staff replacement; or 5) reassignment of organizational responsibilities. Consequently, recommendations made by consultant(s) on the data collection program are likely to be adopted only after an answer is reached on the question of how the manpower needs can be met. Also, manpower needs in other sectors of the water and sewerage development program should be taken into consideration in order to avoid program retrogression by diverting staff and/or future budgetary increases from a higher priority need to one of lower priority. In essence, data collection and utilization is part of a more comprehensive program and should be placed in proper context. This complicating aspect should be considered not only in relation to the recommended scope and detail of data-collecting activities, but also in their time-staging.

- 7.2.3 Stocktaking of Inventory Original Data Sources. As a third step, an appraisal should be made of existing data resources on water and sewerage systems, including any procedures which may be in effect for continuing data collection. As described in 5.5.1 - 5.5.3, original data sources consist primarily of: a) water and sewerage systems managements (including municipal officials outside of the water and sewerage department, where applicable) and b) design data files of one type or another. A third original data source might be added for rural and other small community water systems built over a long period of years by State and/or National agencies, namely, whether even a continuous simple record has been maintained on the number of systems built and their location.

Observations made during performance of Step Three can have important bearing on the evaluation, planning and design of any future inventory programs in terms of program feasibility and cost, type of data to be collected, data-collecting procedures and the completeness and accuracy of the data which may be expected to be obtained from data sources. The preliminary phase of Step Three would consist of central

office discussions and records review, with full performance taking in field visits to local systems of varying sizes to obtain an insight on source data resources and for general orientation. Consultants, PAHO Zone staff and collaborating country staff in making field observations of the data sources might be guided in some cases by Sir Josiah Stamp's aphorism of many years ago which still applies in principle today:

"The governments are very keen on amassing statistics. They collect them, raise them to the 'nth' power, take the cube root and prepare wonderful diagrams. But you must never forget that every one of these figures comes in the first instance from the village watchman, who just puts down what he damn pleases."

The central office files phase should include all national agencies and a sampling of all state agencies which are directly involved in any aspect of water and sewerage systems operation or development. The consultant(s) should not overlook the fact that the Latin American culture and temperament does not adapt itself readily to systematic record-keeping in the manner of the German scientist. Added to this basic characteristic (at least in the past) are the factors of part-time employment of professional staff and at times of clerical staff by government agencies and of inadequate budgets.

As a result of the foregoing state of affairs, some countries may have a resource of buried, uncompiled and perhaps "lost" basic data records on water and sewerage systems. While the resurrection and utilization of these records has little bearing on such factors as present population "served," these records provide a potential data resource on such basic data factors as the number of rural water systems in a country and their location, obtainable in some cases by clerical personnel with minimal drain on professional manpower and at minimal cost compared with that of field search and discovery procedures.

- 7.2.4 Appraisal of Data Utilization. As a fourth step, the consultant(s) et al might review how the data being presently collected is being utilized and propose future uses. Such uses include not only the direct utilization of the collected-compiled data per se but also its applied-projected utilization after further processing for such purposes as the preparation of countrywide capital development cost estimates.

This area of review and investigation should properly include consideration of: 1) the present status of any national planning agency which may exist; 2) its power and effectiveness in the direct or indirect control over the channeling of domestic and external capital development funds and import licenses; 3) the adequacy of water and sewerage needs data presently available for these planning and economic control purposes; 4) the recognition presently being given to water and sewerage development needs in national planning; 5) the vigor and effectiveness with which national agencies with vested interests in water and sewerage

development are utilizing available data and are presenting their cases before planning-economic control agencies; and 6) future prospects pertaining to 4).

This fourth step marks the completion of the preparatory stock-taking-assessment phase prior to the second phase of planning and designing the future data-collecting program.

7.2.5 Planning and Designing the Future Data-Collecting Program. The preparation of recommendations on planning and designing the future water and sewerage data-collecting program comprises the fifth and final main procedural step. The following guidelines and procedural substeps should be considered in this program planning-design operation.

1) As a first substep, the proposed future uses to which the collected data are expected to be put should be carefully reviewed and presented with the Recommendations as a reference frame. These uses might be subdivided into categories, such as Essential and Desirable, with this classification extended into other subsequent substeps, such as for the Manpower Requirements and Budget areas.

2) As a second substep, the administrative method(s) by which the data are to be collected on the future program should be determined and presented with the Recommendations or Findings. This second substep should take into consideration the agency presently basically responsible at the national level, the agency indicated for this role in the future program and whether the collection and supplying of data at the national level (to a central data office) should be the sole responsibility of a single agency or whether it should be carried on by a consortium of agencies. (For further discussion of this subject, see Section 6.5.)

Other aspects pertaining to the data program and the administrative methods of data collection are: a) whether the program should be collaborative or whether all data can be supplied internally by a single organization, such as a national water and sewerage authority; b) if collaborative, should the chain of data transmission include or exclude state (provincial) agencies and what agencies will be the supply sources for the original data; and c) administrative procedure to be followed in requesting and receiving source data - mail, personal visits or mixed. If mixed, what will be the relative proportions of the onsite and offsite procurement methods?

3) As a third substep, planning and design of the future data collection program should be approached from the standpoint of the following alternatives in terms of the Recommendations or Findings: a) Present program is satisfactory and should remain "as-is" to meet future conditions; b) Present program needs to be simplified, modified or reduced in scale but is otherwise satisfactory; c) Present program

requires modification involving expanded scale, scope and manpower allocation; or d) There is essentially no present program worthy of the name and the present program should be ignored as a reference frame for the future program.

4) As a fourth substep, the statistical "universe" for which the data should be collected should be defined. It is often thought that 100 per cent coverage of the geographic area of a country is sine qua non. This concept appears unrealistic in some Latin American countries, especially the Andean countries and Brazil. In the Colombia Health Manpower survey (Section 4.6), for example, only 53 per cent of the geographic area was surveyed, yet 98.7 per cent of the population was covered. The included area took in all 18 Departments but excluded all Intendencias and Subdelegations. Inclusion of these latter might well have required use of burros and helicopters for transportation.

5) This fifth substep stems from Item 7.2.4 and subitem 7.2.5(a) and deals with a particular utilization of the data to be collected. If it is determined within the country that the dominant purpose of the data program is to foster the capital development of water and sewerage systems, adoption of a program and procedure other than an inventory-type program should be seriously considered. In some Latin American countries, more realistic baselines as to the extent and cost of capital development needs can be obtained by utilizing available manpower resources on intensive studies of selected typical systems than by the broad-brush inventory method. To the extent available, carefully prepared preliminary engineering-feasibility reports which have been made by planning-designing engineers would also provide an informational resource for this purpose. These reports would be for projects recently completed, underway and proposed. Such intensive studies might help to develop sound feasible projects for capital development loans (lack of which has been the main obstacle to development), in addition to obtaining data, and might also help to improve the competency and adequacy of local systems management to a level which would make them future reliable sources of inventory-type data. Some further discussion of this subject is presented in Section 6.4 and Chapter Eight.

6) As a sixth substep in an inventory-type data program, consideration should be given to use of sampling procedures in lieu of 100 per cent coverage of the selected statistical universe. A number of different census-taking programs using sampling techniques are cited in various parts of this report, with the size of sample ranging from 0.3 per cent (Section 4.6-Clinical Examination Phase) to 50 per cent (Section 4.4-Birth Registration Phase). As cited in Section 6.4, such sampling could achieve substantial mantime savings in the larger countries, an index of which is given in Section 6.4. A possible optimal sample size for water and sewerage systems might be in the order of 20 to 25 per cent.



7) As a seventh substep, consideration should be given to the degree of detail to be obtained on the data-collecting program. This substep stems from Sections 7.2.3, 7.2.4 and Item 7.2.5(a). In this Methodology Report, information is given in Chapter Five and in Appendices 5-1 and 5-3 of two radically different water and sewerage data-collecting programs and data-reporting forms with respect to degree of detail. It is visualized that the degree of detail which should be obtained on data-collecting programs in any Latin American country would be intermediate between these two extremes, but should be as close as possible to the simpler of the two (see Item 6.7.3). The time lag involved in the processing and publication of collected data should not be overlooked as a factor favoring minimum detail.

8) As an eighth substep, consideration should be given to carrying out different types of data-collecting-compiling-publishing programs for systems serving population groups of different sizes, such as by using total local population of 10,000 as a dividing line, or 25,000, or by separating urban systems from rural systems. The program differences would involve both degree of reporting detail and method of collection, with consideration given to collaboration with the national housing census organization on rural systems. (See Sections 6.7.5, 6.7.6 and Appendix 5-1.)

9) As a ninth substep, consideration should be given to phased development of the data-collecting program and to the principle of program continuity. In some countries, data collection is an intermittent activity; in some others, current attainment of an optimal level of data-collecting may be unrealistic due to budgetary limitations, higher priorities and lack of reliable source data.

The histories of other types of data-collecting programs which are now firmly established and which publish a relatively superior quality of data show that gradual development with time and continuity of program are preferable to a full speed start.

10) As a final substep in program planning and design, an estimate of additional manpower requirements (if needed) should be provided in terms of table of organization and budget (or by the alternative solutions given in Section 7.2.2).

## CHAPTER EIGHT

### THE QUEST FOR A SUITABLE PER CAPITA COST COMMON DENOMINATOR

- 8.1 Preparation of any multi-year plan of community water and sewerage development inherently requires estimates of capital costs. The engineering procedure under which such cost estimates are developed is well known. Basically, it consists of selecting a common denominator or yardstick which can be used in applying the cost of current or recent construction or water and sewerage systems construction to future program costs. The procedures followed can be generalized on a country-wide basis for urban and rural systems or can be refined by establishing further categories of systems, such as by size of urban community, by type of supply source and/or in relation to regional labor and materials, climate, geography, topography or water use, but in any event some type of program unit value is needed to convert past and present cost experience into future plans.
- 8.2 Generally, some type of population unit value is used for this purpose and per capita costs are developed. Any discussion of the most suitable type of per capita unit can only be presented after knowledge of the general characteristics of current and future community water and sewerage development projects in Latin America. The following discussion is focused on the water project, but is also generally applicable to sewerage projects.
- 8.3 These general characteristics are: 1) except in small communities, the construction is almost totally concerned with the improvement and expansion of existing systems rather than new systems; and 2) most Latin American urban water systems are supplied by surface water sources, with the principal systems elements being: a) intake works; b) an aqueduct or transmission line; and c) a distribution system. Depending on local conditions, the improvements may also include the following additional elements upstream from the distribution system elements: d) main pumping stations; e) treatment; and f) major storage reservoirs. Also, the improvements are needed to correct present deficiencies as well as to provide for future needs.
- 8.4 The present deficiencies factor is due mainly to the practice of indefinitely extending distribution lines long after the capacities of upstream elements have become overtaxed. These upstream elements include trunk mains, distribution reservoirs and distribution pumping stations as well as all elements described previously other than the distribution system. This practice is largely the result of lack of sufficient capital in any year to carry out major improvements and of local political expediency. The situation is aggravated by the fact that much of the small mains extension work is carried out at private expense, which tends to increase the magnitude of this work and to impede planning.

- 8.5 As a result, from a population value standpoint, the following hypothetical situation occurs in which it is assumed that the capacities of the main elements of the existing system are, say, 50 per cent deficient for existing connected customers. Further particulars of the improvement project are also shown by mathematical symbol.

<u>Item</u>	<u>Present Population</u>	<u>Design Population (10 Future years)</u>
Total Population	1.0 X	1.6 X
Present Connected Population	0.5 X	-
10-Future Year Connected Population - 80%	-	1.3 X
To be Connected at End of Present Project 70% of 1.1 X	0.8 X	-
Present Supply Capacity - 50% of Needs for Present Connected	0.25X	-
Additional Capacity Needed (1.3-0.25)	-	1.05X
Additional Population to be Connected by Present Project (0.8-0.5)	0.3 X	-
Additional Future Population to be Eventually Connected Under Project Design Conditions (1.3-0.8X)	-	0.5 X

- 8.6 In the foregoing table, it is assumed that a construction project is to be currently started, taking about two years to complete; that during the course of the project the total population will increase to 1.1 X, of whom 70 per cent or 0.8 X will be connected during the present project period (0.3 X additional population); and that 0.5 X more population (mainly future population) will be connected during the ten-year design period, mainly by further distribution system work.

- 8.7 For purposes of establishing a per capita cost common denominator, several choices are potentially available. One procedure might deal with total population on the supposition that all present and future population within the project design period will be directly or indirectly benefited, regardless of whether they are presently connected, whether if connected they presently receive continuous or intermittent delivery or whether, as either present or future population, they ever will become connected. In this case, the per capita cost would be based on a denominator of up to 1.6 X. Properly, the numerator in this case should include all construction costs in the ten-year period, including the present project.

- 8.8 A second procedure would focus attention on the new connected population aspect. In this case, the population denominator value might range from 0.3 X to 0.8 X.

- 8.9 Depending on whether the first or second procedure is adopted and which population value is selected within these procedures, the per capita costs for a given project could vary over a maximum range of 5.33 to 1.
- 8.10 A third procedure would concentrate attention on present and future supply capacities and needs and is in effect a population-equivalent procedure. The basis for using a population-equivalent yardstick is that, although not ideal, it tends to provide a simpler and more reliable averaging effect for the many variables encountered in Latin American water system capital development than the preceding two procedures, or than undescribed procedures based on population "served" in lieu of "connected" population. (See Section 6.3 for a discussion of "served" population.)
- 8.11 An analogous situation which forced adoption of a "population-equivalent" (P.E.) yardstick for indices of per capita construction costs has been that of sewage treatment plant construction in the United States, where the per capita cost of a particular type of treatment is expressed in terms of population "norm" values, with adjustment in cost for size of plant based on population-equivalent served. The hydraulic P.E. norm in this case is 100 gallons (380 liters) of flow/capita-day and the organic norm is 0.167 lb. (0.076 kg.) of BOD5/capita-day. These population-equivalent norms were established because, in different communities, the per capita volume and strength of raw waste varies over a wide range.
- 8.12 Applied to Latin American water system conditions, a P.E. based on added capacity provided by a comprehensive construction project, or to be provided by a needed project in a multi-year program, might be, say, 200 liters/capita-day for small cities, 300 liters for middle-sized cities and 400 liters for large cities in terms of maximum day demand and with the assumed absence of undue leakage and other water waste. Thus a project for a middle-sized city designed to increase overall system capacity by 10,000 m<sup>3</sup>/day would represent a P.E. of 10,000/0.3 or 33,000.



INTERPRETING DATA - AN EDITORIAL  
From the Journal of the Water Pollution Control Federation  
March 1967 (Excerpted)

There are about as many different sets of statistics or data collected and distributed on any given subject as there are governmental agencies, plus several. Water and wastewater are not exceptions.

----It is apparent from even a superficial examination of any group of these studies that the information is far from complete and that there are major inaccuracies, or at least major discrepancies.

----The point is that information-collecting is a complex business and further that any meaningful collection of data has some judgement slipped into it before it can become meaningful. It is this judgement which attempts to smooth out the bumps in the data which may contain much bias or lack of resolution in interpretation.

----It is suggested that the technical judgement of the professionals will continue to be the key factor in translating the mass of data into practical usefulness.

## BRAZIL HOUSING CENSUS OF 1960

Both population and housing censuses in Brazil were taken in 1950 and 1960. The Final 1950 Housing Census Report listed data on water and sewerage service. Detailed, final population and housing census results of the 1960 census had not been published as of June 1967, but summaries have been published for three of the five major geographical regions of Brazil and for the nation, classified as to urban and rural. Some nationwide water and sewerage results were published in the 1965 Statistical Annual of the Census Bureau (IBGE) and were as follows for the water service aspect:

	<u>Urban</u>	<u>Rural</u>	<u>Total</u>
1960 Population - Brazil - millions	31.5	37.7	69.2
Per Cent Urbanized	-	-	45.5
Served with Public Water - population	13.1	0.5	13.6
"    "    "    "    - per cent	42.0	1.3	20.0
"    "    Wells or Springs - population	9.4	-	-
Other	9.0	-	-

The column heading "Urban" in the above table includes suburban population. Summarized data for the three major geographic regions were published in Censo Demográfico-Special Series-Vol. II - IBGE - Preliminary.

Preliminary results of the 1960 Population Census have been published for each Brazilian State. These reports give no direct information on water and sewerage service but do show the average number of occupants/dwelling unit (domicilio) for each local neighborhood (barrio) in at least one State (Guanabara). In those neighborhoods which are occupied by single-family detached dwellings and are served by a public water supply, this information permits converting the number of water and sewer connections into "population served" values.

One feature of census and inventory-taking in Brazil which is unusual, and perhaps unique, is the incorporation of the National Ministry of Health into the overall census-taking activities of the Census Bureau, with publication of results in the Statistical Annual of the Census Bureau. Under this system, the Ministry collects and compiles detailed inventory data by mail for urban water supplies and sewerage systems by States and separately for the capital of each State, in terms of the 12 column headings for "water" and the 11 column headings for "sewerage" shown in the attached tables. These results do not show populations served, but do show the numbers and types of building service connections and numbers of public water supply outlets (public fountains), as of the

end of 1965. These results show that 45 per cent of the 3,957 municipalities in Brazil had public water supplies and 32 per cent had public sewerage systems at that time. Included in this large number of municipalities (3,957) were an unknown proportion which did not have any urban nucleus meeting the IBGE definition of "urban." Nationwide totals amount to 3.51 million water service connections for urban domestic, commercial, industrial and public buildings plus an unknown, minor proportion of connections in suburban and rural areas adjoining urban areas. There were 1.31 million connections to public sewers and 0.79 million connections to individual private sewage disposal systems.



**URBANIZAÇÃO**  
**SERVIÇOS PÚBLICOS**

**I. ABASTECIMENTO D'ÁGUA — 1965**

**a) Especificação, por Unidades da Federação**  
**Captação, adução, rede distribuidora e ligações**

UNIDADES DA FEDERAÇÃO	NÚMERO DE MUNICÍPIOS EM 31-XII		ABASTECIMENTO D'ÁGUA EM 31-XII						Ligações à rede distribuidora				
	Total	Com abastecimento d'água	Mananciais captados	Extensão das linhas adutoras (m)	Número de estações elevatórias	Número de reservatórios	Extensão total das linhas distribuidoras (m)	Número de logradouros públicos com canalização	Hidrometros	Penas d'água	Ligações livres	Bicas, torneiras e chafarizes públicos	Hidrantes para extinção de incêndios
Rondonia.....	2	2	2	8 200	1	4	17 250	49	—	905	404	5	—
Acres.....	25	1	1	400	1	1	6 730	12	—	—	456	6	—
Amazonas.....	44	19	13	15 518	14	18	45 342	321	—	—	30 779	107	110
Roraima.....	2	2	3	4 750	2	2	12 932	30	—	565	55	9	—
Pará.....	83	25	50	35 355	22	26	53 760	322	10 316	1 876	29 538	293	—
Ceará.....	5	4	8	3 380	2	3	19 536	43	—	—	912	19	—
Maranhão.....	127	9	21	45 735	8	9	147 740	804	12 599	940	5 572	20	96
Piauí.....	114	14	26	22 586	22	25	180 901	160	2 181	—	3 609	100	—
Ceará.....	142	52	70	141 500	43	76	395 457	772	14 598	199	12 256	387	139
Rio Grande do Norte.....	150	12	36	35 203	15	26	228 934	506	19 817	1 702	526	2 036	85
Paraíba.....	172	29	44	173 472	23	44	333 744	736	3 910	27 351	4 135	240	76
Pernambuco.....	184	61	83	350 039	29	104	1 028 912	2 306	23 759	24 573	86 028	694	123
Alagoas.....	64	27	46	85 315	16	43	219 414	529	4 333	7 208	18 778	233	25
Sergipe.....	76	15	19	29 895	15	23	186 134	249	3 741	611	19 074	105	—
Bahia.....	335	101	138	303 259	76	156	915 951	2 133	12 742	90 718	18 611	896	191
Minas Gerais.....	722	580	1 392	1 953 255	392	1 133	5 225 332	13 991	68 323	353 714	49 739	2 164	512
Espírito Santo.....	53	45	63	169 913	26	85	535 917	1 724	205	24 614	33 827	387	44
Rio de Janeiro.....	63	63	166	811 135	79	174	2 073 763	3 973	15 131	203 584	62 091	369	389
Guanabara.....	1	1	33	623 000	66	40	4 399 210	6 930	90 065	150 000	—	—	—
São Paulo.....	573	414	1 130	2 121 399	513	939	16 531 935	19 199	748 309	226 999	499 555	1 298	6 525
Paraná.....	275	90	233	790 915	104	169	1 739 811	2 573	57 578	8 927	44 981	461	833
Santa Catarina.....	184	27	35	139 471	16	46	610 451	1 442	14 429	23 475	11 024	153	235
Rio Grande do Sul.....	234	118	210	417 396	215	319	3 610 975	3 832	116 143	6 390	198 707	1 125	4 282
Mato Grosso.....	83	34	52	48 144	37	53	499 216	642	1 845	2 033	28 451	108	—
Oceia.....	222	33	56	98 099	18	53	332 743	716	2 357	11 594	12 516	115	4
Distrito Federal.....	1	1	15	—	2	5	390 000	—	4 709	—	2 112	—	260
BRASIL.....	3 857	1 778	2 914	7 934 284	1 749	3 634	40 415 784	67 663	1 228 274	1 147 604	1 144 719	11 820	14 042

FONTES — Serviço de Estatística da Saúde.

**b) Especificação, por Municípios das Capitais**  
**Captação, adução, rede distribuidora e ligações**

CAPITAIS	ABASTECIMENTO D'ÁGUA EM 31-XII						Ligações à rede distribuidora				
	Número de mananciais captados	Extensão das linhas adutoras (m)	Número de estações elevatórias	Número de reservatórios	Extensão total das linhas distribuidoras (m)	Número de logradouros públicos com canalização	Hidrometros	Penas d'água	Ligações livres	Bicas, torneiras e chafarizes públicos	Hidrantes para extinção de incêndios
Pôrto Velho.....	1	1 600	1	3	13 950	37	—	905	40	5	—
Rio Branco.....	1	460	1	1	6 730	12	—	—	456	6	—
Mãnas.....	1	9 350	2	2	2 550	149	—	—	29 279	4	105
Bos Vista.....	2	4 600	1	1	10 883	28	—	665	5	4	—
Belém.....	3	7 600	6	—	443 000	—	8 543	—	23 000	105	—
Macapá.....	3	300	1	—	17 000	29	—	—	854	5	—
São Luís.....	5	20 030	2	1	114 900	415	12 000	—	3 421	—	96
Terreiros.....	5	8 175	5	3	152 000	83	1 956	—	3 300	4	—
Fortaleza.....	1	85 556	—	6	153 000	—	6 353	—	8 647	—	137
Natal.....	6	19 063	6	11	243 647	315	16 242	—	—	46	34
João Pessoa.....	3	19 000	3	7	136 940	—	—	17 246	—	46	8
Recife.....	5	22 000	—	10	711 512	—	20 000	—	50 759	112	—
Maceió.....	2	16 900	1	6	102 700	—	3 200	—	15 736	90	25
Aracaju.....	2	21 000	4	3	120 000	—	2 000	—	16 714	23	—
Salvador.....	8	39 650	6	16	411 020	—	10 090	43 606	233	155	150
Belo Horizonte.....	42	105 492	1	14	730 024	—	49 437	—	—	36	157
Vitória.....	2	23 863	1	3	140 257	406	4	—	16 716	350	42
Niterói.....	14	147 000	15	5	232 861	741	3 372	16 146	36 931	78	214
Rio de Janeiro.....	23	623 000	69	40	4 399 210	6 930	90 065	150 000	—	—	—
São Paulo.....	6	175 000	25	36	6 000 000	—	419 379	83 252	—	—	4 000
Curitiba.....	1	11 950	—	4	543 547	493	24 501	35	9 747	17	393
Foz de Iguaçu.....	4	96 100	1	3	112 250	478	1 268	13 819	1 268	30	60
Pôrto Alegre.....	2	13 143	53	43	925 571	—	33 034	—	67 104	460	680
Coimbra.....	1	8 600	1	10	100 000	—	—	—	6 390	20	—
Goiania.....	2	41 313	3	11	153 458	173	2 264	2 974	—	2	3
Brasília.....	13	—	2	5	560 000	—	4 709	—	2 112	—	260
CAPITAIS (1).....	172	1 544 502	212	235	16 612 679	10 237	703 923	343 876	292 639	1 683	6 642

FONTES — Serviço de Estatística da Saúde.  
(1) Com as imperfeições mencionadas.

## APPENDIX 4-1-B

## SERVIÇOS PÚBLICOS

## 2. ESGOTOS SANITÁRIOS — 1965

## a) Especificação, por Unidades da Federação

UNIDADES DA FEDERAÇÃO	NÚMERO DE MUNICÍPIOS EM 31-XII		CARACTERÍSTICAS DA REDE EM 31-XII											
			Extensão (m)			Número de letradores servidos		Número de prédios esgotados		Número de tanques fluxíveis	Peças de inspeção			
			Total	Servidos de esgotos	Da rede	Do emissário	Da rede de águas pluviais	De esgotos de despejos	De esgotos de águas superficiais		Por fossas	Pela rede	De visita	Luminares
Rondônia.....	2	2	6 045	805	...	11	15	813	195	...	...	...	...	...
Acre.....	25	—	...	...	...	...	...	...	...	...	...	...	...	...
Amapá.....	44	3	96 300	100	1 200	56	85	19 332	13 120	...	...	...	...	...
Bahia.....	2	1	...	...	3 830	...	6	...	...	...	...	...	...	...
Pará.....	83	12	63 855	...	7 438	18	85	14	88	...	...	...	...	...
Amazonas.....	5	2	13 550	800	6 000	25	52	...	...	1	145	...	...	...
Maranhão.....	127	4	49 322	200	5 760	12	731	...	8 872	...	1 932	...	...	...
Piauí.....	114	5	35 505	...	4 930	...	43	...	...	...	...	...	...	...
Ceará.....	142	25	55 325	7 550	51 231	107	451	850	7 206	103	222	...	...	...
Rio Grande do Norte.....	150	4	101 654	8 420	320	145	6	22 512	5 320	85	1 993	...	...	...
Paraná.....	173	14	95 117	8 425	19 651	482	207	10 507	11 370	35	822	...	...	...
Pernambuco.....	164	33	299 015	11 531	79 544	58	403	37 961	42 417	...	...	...	...	...
Alagoas.....	94	21	27 210	1 555	15 730	105	213	2 301	4 034	50	400	...	...	...
Sergipe.....	76	7	18 000	2 400	480	34	47	1 355	2 481	36	...	...	...	...
Bahia.....	335	77	147 808	14 652	153 705	972	1 081	8 695	31 094	149	149	74	...	...
Minas Gerais.....	722	399	2 746 862	323 161	1 033 605	9 240	6 439	223 894	79 094	692	12 094	516	...	...
Espírito Santo.....	53	23	183 213	14 032	62 011	1 153	455	15 721	25 400	9	211	...	...	...
Rio de Janeiro.....	63	51	659 938	34 356	314 652	4 033	2 304	85 591	123 126	623	4 114	18	...	...
Guanabara.....	1	1	1 718 000	8 110	...	...	...	...	...	...	28 626	...	...	...
São Paulo.....	573	352	8 691 630	654 534	1 639 852	14 944	8 695	292 606	813 250	1 334	49 276	727	...	...
Paraná.....	275	53	624 610	17 504	337 598	882	629	22 081	32 525	172	4 217	32	...	...
Santa Catarina.....	194	36	84 693	3 352	102 357	378	721	4 226	7 922	40	732	174	...	...
Rio Grande do Sul.....	234	60	769 291	75 359	637 178	1 000	851	27 008	63 800	992	4 503	840	...	...
Mato Grosso.....	84	11	85 565	7 014	29 070	167	86	13 323	8 443	13	...	...	...	...
Goiás.....	223	58	103 091	15 754	249 113	276	776	837	6 356	150	...	...	...	...
Distrito Federal.....	1	1	385 055	...	389 944	...	...	...	...	...	5 600	...	...	...
BRASIL (1).....	3 857	1 245	16 976 285	1 217 804	5 310 107	33 158	24 005	794 616	1 310 978	4 483	114 864	2 378	...	...

FONTE — Serviço de Estatística da Saúde.

(1) Com as imperfeições mencionadas.

## b) Especificação, por Municípios das Capitais

CAPITAIS	SISTEMA ADOTADO	CARACTERÍSTICAS DA REDE EM 31-XII												
		Extensão (m)			Número de letradores servidos		Número de prédios esgotados		Número de tanques fluxíveis	Peças de inspeção				
		Da rede	Do emissário	Da rede de águas pluviais	De esgotos de despejos	De esgotos de águas superficiais	Por fossas	Pela rede		De visita	Luminares			
Pôrto Velho.....	Separador absoluto	5 735	550	...	10	15	802	195	...	...	...	...	...	...
Manaus.....	Unitário	96 000	...	...	83	83	19 313	13 114	...	...	...	...	...	...
Boca Vista.....	Separador absoluto	...	...	3 830	...	6	...	...	...	...	...	...	...	...
Belém.....	Separador parcial	82 215	...	...	...	...	...	...	...	...	...	...	...	...
Macapá.....	Unitário	12 850	800	...	25	43	...	376	...	1	...	...	...	...
São Luís.....	Separador absoluto	49 322	200	4 570	12	722	...	8 872	...	...	...	...	...	...
Teresina.....	Unitário	6 656	6 656	...	...	...	...	...	...	...	...	...	...	...
Fortaleza.....	Separador absoluto	44 756	50	12 610	...	...	...	5 500	103	222	...	...	...	...
Natal.....	Separador absoluto	95 704	1 200	...	125	...	21 168	3 835	85	1 897	...	...	...	...
João Pessoa.....	Separador absoluto	51 443	1 900	...	11	...	10 144	7 102	...	407	...	...	...	...
Recife.....	Separador absoluto	258 843	300	...	...	...	36 435	31 394	...	...	...	...	...	...
Maceió.....	Separador absoluto	20 000	1 500	...	...	...	...	611	30	400	...	...	...	...
Assislandia.....	Separador absoluto	11 000	2 000	...	12	...	...	2 691	86	...	...	...	...	...
Salvador.....	Separador absoluto	25 310	4 200	...	...	...	...	8 300	...	...	...	...	...	...
Belo Horizonte.....	Separador absoluto	481 200	4 500	182 979	...	...	...	...	...	...	...	...	...	...
Viçosa.....	Separador parcial	35 900	120	...	483	37	2 046	9 000	...	129	...	...	...	...
Niterói.....	Separador absoluto	100 457	200	125 000	700	710	10 273	46 077	450	1 382	...	...	...	...
Rio de Janeiro.....	Separador absoluto	1 718 000	8 110	...	...	...	...	...	...	23 626	...	...	...	...
São Paulo.....	Separador absoluto	2 261 929	...	...	...	...	...	253 479	...	...	...	...	...	...
Curitiba.....	Separador absoluto	273 455	2 427	...	241	...	16 659	18 634	...	1 902	...	...	...	...
Florianópolis.....	Separador absoluto	40 594	892	...	197	...	3 290	4 625	29	421	174	...	...	...
Pôrto Alegre.....	Separador absoluto	245 235	23 558	165 105	344	...	...	31 242	...	314	...	...	...	...
Quaiá.....	Separador absoluto	...	800	...	16	...	...	...	...	97	...	...	...	...
Coiniã.....	Separador absoluto	105 159	13 074	...	...	...	...	5 304	...	...	...	...	...	...
Brasília.....	Separador absoluto	283 055	...	339 944	...	...	...	...	...	5 500	...	...	...	...
Capitais (1).....	...	6 449 747	72 795	1 134 638	2 229	1 618	119 125	450 934	754	43 387	174	...	...	...

FONTE — Serviço de Estatística da Saúde.

(1) Com as imperfeições mencionadas.

## COSTA RICA HOUSING CENSUS OF 1963

Description of Data Reported

The 1963 Housing Census (Housing Conditions Section) contains tables on water and sewerage-excreta disposal services. The data are subdivided for nationwide, urban and rural populations, but not by civil subdivisions. Data pertinent to this Methodology Report have been converted into percentages and are given below. These results indicate that the proportion of the urban and rural population in Costa Rica which is supplied with piped water is higher than in any other Latin American country. From other sources of information, this favorable status is known to be one of rather long standing, with the 1963 Housing Census data indicating that it has been maintained in the face of the highest national population growth rate in the Western Hemisphere. However, a majority of the public water systems have intermittent delivery.

According to the Housing Census, a high proportion of the urban and rural population is also provided with "sanitary service," but only a small proportion of those served are connected to sewer lines.

Data on electric services are also shown as a reference frame because of its extensiveness in Costa Rica.

Piped Water - Per Cent Served - Costa Rica

	<u>Urban</u>	<u>Rural</u>	<u>Total</u>
Piped Water - On-Premises	85%	43%	59%
- Off-Premises	<u>13%</u>	<u>7%</u>	<u>9%</u>
- Subtotal	98%	50%	68%
Without Piped Water	2%	50%	32%
Served by Wells and "Other"	(0.6%)	(33%)	(21%)
No Water Service	<u>(1.4%)</u>	<u>(17%)</u>	<u>(11%)</u>
Total	100%	100%	100%
<u>Type of Service</u>	<u>Urban</u>	<u>Rural</u>	<u>Total</u>

Sewage & Excreta Disposal - Per Cent Served - Costa Rica

Sewers	35%	0.4%	13%
Septic Tanks	29%	9.6%	17%
Privies	<u>34%</u>	<u>50%</u>	<u>35%</u>
Subtotal	98%	60%	75%
Without Service	<u>2%</u>	<u>40%</u>	<u>25%</u>
Total	100%	100%	100%

Electric Service - Per Cent Served - Costa Rica

	<u>Urban</u>	<u>Rural</u>	<u>Total</u>
Served	94%	31%	54%
Unserved	<u>6%</u>	<u>69%</u>	<u>46%</u>
Total	100%	100%	100%

## GUATEMALA HOUSING CENSUS OF 1964

Description of Data Reported

The 1964 Housing Census of Guatemala is only the second nationwide housing census made for that country. Tables 9 and 10 (attached) of the Section on Conditions of Housing give data on water and sewerage service by Departments and for the Republic, subdivided for urban and rural categories. These results are based on a 5 per cent sample. Further sub-classification of different types and conditions of water and sewerage service are as shown in attached Tables 9 and 10.

Some of the numerical results have been converted into percentage values in this methodology study and are given below:

Piped Water - Per Cent Served

Category		<u>Urban</u>	<u>Rural</u>	<u>Total</u>
<u>Republic -</u>	On-Premises Service	46%	2%	17%
	Service within a Block	<u>24%</u>	<u>6%</u>	<u>12%</u>
	Total	70%	8%	29%
High Dept. (Guatemala D.)	On-Premises Service	65%	5%	20%
	Service within a Block	<u>25%</u>	<u>21%</u>	<u>22%</u>
	Total	90%	26%	42%
Low Dept. (Peten D.)	On-Premises Service	9%	1%	5%
	Service within a Block	<u>1%</u>	<u>1%</u>	<u>1%</u>
	Total	10%	2%	6%

Sewerage - Per Cent Served - Republic of Guatemala

Connected to Public Systems	34%	1%	12%
Sewerage/Water-Connected Ratio	0.74	0.50	0.71

CUADRO NO. 9

SEGUNDO CENSO DE VIVIENDA, 1964

VIVIENDAS PARTICULARES OCUPADAS EN LA REPUBLICA, SEGUN CLASE DE SERVICIO DE AGUA Y FUENTE DIRECTA DE ABASTECIMIENTO, POR DEPARTAMENTO URBANA Y RURAL  
BASE MUESTRA 5X

DEPARTAMENTO URBANA-RURAL	TOTAL VIVIEN- DAS PARTI- CULARES	A G U A C O R R I E N T E					FUENTE DIRECTA DE ABASTECIMIENTO				
		DENTRO DE LA VIVIEN- DA	FUERA DE LA VIVIEN- DA PERD EN EL EDIFICIO	FUERA EDIFICIO PERO A MENOS DE UNA CUADRA	SIN AGUA CORRIEN- TE	NO IN- FORMA- RON	RED PUBLICA	P O Z O	RIO LAGO MANAN- TIAL	O T R O	NO IN- FORMA- RON
<u>REPUBLICA</u> .....	804 940	90 960	47 620	99 060	567 300		263 780	266 380	270 440	4 280	60
URBANA .....	277 760	82 940	44 960	66 760	83 100		216 360	40 920	19 980	460	40
RURAL .....	527 180	8 020	2 660	32 300	484 200		47 420	225 460	250 460	3 820	20
<u>GUATEMALA</u> .....	144 560	49 400	29 020	32 160	33 980		119 960	12 440	11 900	160	20
URBANA .....	118 300	48 220	28 960	26 660	14 460		111 060	5 300	1 840	80	20
RURAL .....	26 260	1 180	60	5 500	19 520		8 900	7 140	10 140	80	
<u>EL PROGRESO</u> .....	12 800	1 000	160	900	10 820		2 920	2 660	7 300		
URBANA .....	3 600	800	140	740	1 920		2 320	340	940		
RURAL .....	9 200	200	20	160	8 900		600	2 320	6 360		
<u>SACATEPEQUEZ</u> .....	14 980	1 900	1 120	5 640	6 320		11 180	2 420	1 280	100	
URBANA .....	10 740	1 760	1 020	4 340	3 620		9 000	1 300	420	20	
RURAL .....	4 240	140	100	1 300	2 700		2 180	1 120	860	80	
<u>CHIMALTENANGO</u> .....	32 800	2 520	380	8 320	21 580		12 300	10 000	10 340	160	
URBANA .....	12 320	2 220	340	6 360	3 400		11 040	840	440		
RURAL .....	20 480	300	40	1 960	18 180		1 260	9 160	9 900	160	
<u>ESCUINTLA</u> .....	52 080	4 820	3 620	5 240	38 400		13 740	28 660	9 660	20	
URBANA .....	13 920	2 840	2 380	2 020	6 680		7 900	5 080	940		
RURAL .....	38 160	1 980	1 240	3 220	31 720		5 840	23 580	8 720	20	
<u>SANTA ROSA</u> .....	29 960	1 640	460	4 380	23 480		7 960	10 580	11 380	40	
URBANA .....	7 160	1 420	380	2 440	2 920		4 780	1 080	1 300		
RURAL .....	22 800	220	80	1 940	20 560		3 180	9 500	10 080	40	
<u>S O L O L A</u> .....	20 940	800	200	3 600	16 340		5 560	8 100	7 260		20
URBANA .....	7 620	720	180	2 400	4 320		4 180	560	2 880		

APPENDIX 4-3-A

DEPARTAMENTO URBANA-RURAL	TOTAL VIVIEN- OAS PARTI- CULARES	A G U A   C O R R I E N T E					FUENTE DIRECTA DE ABASTECIMIENTO				
		DENTRO DE LA VIVIEN- OAS	FUERA DE LA VIVIEN- OAS PERO EN EL EDIFICIO	FUERA EDIFICIO PERO A MENOS DE UNA CUADRA	SIN AGUA CORRIEN- TE	NO IN- FORMA- RON	RED PUBLICA	P O Z O	RIO LAGO MANAN- TIAL	O T R O	NÓ IN- FORMA- RON
RURAL .....	13 320	80	20	1 200	12 020		1 380	7 540	4 390		20
<u>TOTONICAPAN</u> .....	26 700	600	200	2 100	23 800		4 900	15 100	6 700		
URBANA .....	3 960	580	200	1 200	1 900		2 900	1 000	60		
RURAL .....	22 740	20		900	21 820		2 000	14 100	6 640		
<u>QUEZALTENANGO</u> ...	50 520	5 460	1 540	7 700	35 820		20 400	19 100	10 960	60	
URBANA .....	17 780	4 920	1 500	2 900	8 460		11 880	5 340	540	20	
RURAL .....	32 740	540	40	4 800	27 360		8 520	13 760	10 420	40	
<u>SUCHITEPEQUEZ</u> ...	37 100	3 000	2 860	5 580	25 660		9 580	14 240	10 880	2 380	20
URBANA .....	11 120	2 440	2 440	1 780	4 460		7 020	3 120	960		20
RURAL .....	25 980	560	420	3 800	21 200		2 560	11 120	9 920	2 380	
<u>RETALHULEU</u> .....	22 780	1 620	1 280	1 200	18 680		3 980	12 340	6 360	100	
URBANA .....	6 620	1 380	1 160	460	3 620		3 060	3 120	420	20	
RURAL .....	16 160	240	120	740	15 060		920	9 220	5 940	80	
<u>SAN MARCOS</u> .....	61 600	3 120	760	4 440	53 280		8 200	31 220	22 180		
URBANA .....	7 460	2 440	620	1 200	3 200		4 480	2 560	420		
RURAL .....	54 140	680	140	3 240	50 090		3 720	28 660	21 760		
<u>MUEHUETENANGO</u> ...	51 860	1 320	560	2 220	47 760		4 860	17 640	29 320	40	
URBANA .....	8 480	1 280	500	2 060	4 640		4 500	2 000	1 980		
RURAL .....	43 380	40	60	160	43 120		360	15 640	27 340	40	
<u>QUICHÉ</u> .....	46 800	1 700	540	2 860	41 700		5 840	28 780	12 000	180	
URBANA .....	7 220	1 620	520	2 480	2 600		5 120	1 600	480	20	
RURAL .....	39 580	80	20	380	39 100		720	27 180	11 520	160	
<u>BAJA VERAPAZ</u> .....	18 300	860	140	880	16 420		2 060	3 840	12 400		
URBANA .....	2 920	840	120	760	1 200		1 900	540	480		
RURAL .....	15 380	20	20	120	15 220		160	3 300	11 920		
<u>ALTA VERAPAZ</u> .....	47 900	1 180	500	1 860	44 360		3 980	17 540	26 100	280	
URBANA .....	4 980	920	480	1 200	2 380		2 860	1 220	900		

DEPARTAMENTO URBANA-RURAL	TOTAL VIVIEN- DAS PARTI- CULARES	A G U A C O R R I E N T E					FUENTE DIRECTA DE ABASTECIMIENTO				
		DENTRO DE LA VIVIEN- DA	FUERA DE LA VIVIEN- DA PERO EN EL EDIFICIO	FUERA EDIFICIO PERO A MENOS DE UNA CUAORA	SIN AGUA CORRIEN- TE	NO IN- FORMA- RON	RED PUBLICA	P O Z O	RIO LAGO MANAN- TIAL	O T R O	NO IN- FORMA- RON
RURAL .....	42 920	260	20	660	41 980	1 120	16 320	25 200	280		
<u>P E Y E N</u> .....	5 160	220	20	40	4 880	240	1 280	3 620	20		
URBANA .....	2 240	180	20	20	2 020	220	500	1 500	20		
RURAL .....	2 920	40		20	2 860	20	780	2 120			
<u>I Z A B A L</u> .....	24 220	2 120	1 220	1 800	19 080	5 120	8 580	10 280	240		
URBANA .....	7 060	1 360	1 160	1 240	3 300	3 980	2 580	340	160		
RURAL .....	17 160	760	60	560	15 780	1 140	6 000	9 940	80		
<u>Z A C A P A</u> .....	19 400	1 680	1 560	1 620	14 540	4 900	1 800	12 640	60		
URBANA .....	5 640	1 480	1 380	1 340	1 440	4 280	540	820			
RURAL .....	13 760	200	180	280	13 100	620	1 260	11 620	60		
<u>C H I O U I M U L A</u> .....	29 760	2 760	700	1 600	24 680	5 580	5 100	19 080			
URBANA .....	6 140	2 640	700	1 420	1 380	5 300	260	580			
RURAL .....	23 620	140		180	23 300	280	4 840	18 500			
<u>J A L A P A</u> .....	18 880	1 280	120	1 760	15 720	3 400	5 760	9 720			
URBANA .....	5 260	1 220	100	1 620	2 320	3 180	1 300	780			
RURAL .....	13 620	60	20	140	13 400	220	4 460	8 940			
<u>J U Y U A P A</u> .....	35 760	1 940	660	3 160	30 000	7 120	9 200	19 000	440		
URBANA .....	7 220	1 660	660	2 120	2 780	5 400	740	960	120		
RURAL .....	28 540	280		1 040	27 220	1 720	8 460	18 040	320		

APPENDIX 4-3-C

CUADRO NO. 10.

SEGUNDO CENSO DE VIVIENDA, 1964

VIVIENDAS PARTICULARES OCUPADAS EN LA REPUBLICA, SEGUN CLASE DE SERVICIO SANITARIO Y DESAGUE  
POR DEPARTAMENTO URBANA Y RURAL

BASE, MUESTRA 5%

DEPARTAMENTO URBANA-RURAL	TOTAL VIVIENDAS PARTICU- LARES	CLASE DE SERVICIO SANITARIO							CLASE DE DESAGUE			
		N O D O R O		EXCUSADO LAVABLE		POZO CIEGO		NO HAY O NO REP.	RED MU- NICIPAL	PUZO AB- SORBENTE	FLORA DE TIERRA	NO HAY O NO REP
		EXCLU- SIVO	COMPAR- TIDO	EXCLU- SIVO	COMPAR- TIDO	EXCLU- SIVO	COMPAR- TIDO					
REPUBLICA .....	804 940	58 160	19 080	26 420	21 960	92 440	28 140	556 740	99 040	19 080	8 100	678 720
URBANA .....	277 760	53 600	17 880	20 160	20 760	58 760	25 020	81 580	95 140	12 620	5 040	164 960
RURAL .....	527 180	4 560	1 200	6 260	1 200	33 680	3 120	477 160	3 900	6 460	3 060	513 760
GUATEMALA .....	144 560	39 740	14 760	8 080	13 600	23 740	16 640	28 000	67 320	7 460	1 700	68 080
URBANA .....	118 300	38 840	14 760	7 120	13 600	17 660	16 080	9 640	66 660	6 940	1 580	43 120
RURAL .....	26 260	900		360		6 080	560	18 360	660	520	120	24 960
EL PROGRESO .....	12 880	240		140	20	1 640	240	10 600	120	220	60	12 480
URBANA .....	3 600	180		120		1 040	220	2 040	120	120	60	3 300
RURAL .....	9 280	60		20	20	600	20	8 560		100		9 180
SACATEPEQUEZ .....	14 980	1 000	340	540	260	5 940	620	6 280	1 740	480	100	12 860
URBANA .....	10 740	960	340	480	260	4 460	540	3 700	1 720	420	100	8 500
RURAL .....	4 240	40		60		1 480	80	2 580	20	60		4 160
CHIMALTENANGO .....	32 800	820	180	1 000	160	3 340	380	26 920	1 480	500	200	30 620
URBANA .....	12 320	700	180	740	160	2 600	340	7 600	1 460	260	40	10 560
RURAL .....	20 480	120		260		740	40	19 320	20	240	160	20 060
ESQUINTLA .....	52 080	2 920	1 560	3 420	1 920	7 040	1 720	33 500	5 360	3 380	1 160	42 180
URBANA .....	13 920	1 620	540	1 240	1 540	3 940	1 600	3 440	3 360	1 180	420	8 960
RURAL .....	38 160	1 300	1 020	2 180	380	3 100	120	30 060	2 000	2 200	740	33 220
SANTA ROSA .....	29 960	460	120	500	120	2 680	220	25 860	800	340	80	28 740
URBANA .....	7 160	400	120	380	120	1 680	200	4 260	780	180	60	6 140
RURAL .....	22 800	60		120		1 000	20	21 600	20	160	20	22 600
S O U L A .....	20 940	380	40	260	80	2 080	280	17 820	500	220	80	20 140
URBANA .....	7 620	320	40	160	80	1 440	140	5 440	500	100	40	6 980

APPENDIX 4-3-D



DEPARTAMENTO URBANA-RURAL	TOTAL VIVIENDAS PARTICU- LARES	CLASE DE SERVICIO SANITARIO						CLASE DE DESAGUE					
		I N O D		D R O		EXCUSADO LAVABLE		POZO CIEGO		RED HU- NICIPAL	POZO AB- SORBENTE	FLOJ DE TERRA	NO HAY O ND REP.
		EXCLU- SIVO	COMPAR- TIDO	EXCLU- SIVO	COMPAR- TIDO	EXCLU- SIVO	COMPAR- TIDO	NO HAY O NO REP.	NO HAY O NO REP.				
KUHAL .....	13 320	60		100		640	140	12 380		120	40	13 160	
<u>TOYUNICAPAN</u> .....	26 700	160	20	320	180	1 160	260	24 580	540	120	40	26 000	
URBANA .....	3 960	180	20	300	180	860	200	2 220	540	100	40	3 280	
RURAL .....	22 740			20		300	60	22 360		20		22 720	
<u>QUEZALTENANGO</u> ...	50 520	3 540	320	1 900	860	9 540	1 600	32 680	4 980	1 360	60	44 120	
URBANA .....	17 780	3 180	300	1 380	860	5 600	1 620	4 640	4 900	720		12 160	
RURAL .....	32 740	360	20	520		3 940	60	27 840	80	640	60	31 960	
<u>SUCUTEPEQUEZ</u> ...	37 100	1 480	340	2 000	1 280	3 620	600	27 780	3 620	660	740	32 080	
URBANA .....	11 120	1 240	320	1 400	1 160	1 080	560	4 560	3 380	280	420	7 040	
RURAL .....	25 980	240	20	600	120	1 740	40	23 220	240	380	320	25 040	
<u>NEPALIMULU</u> .....	22 780	1 080	260	480	480	2 240	1 180	17 060	1 960	340	40	20 440	
URBANA .....	6 620	940	240	360	460	1 260	980	2 380	1 840	180		4 600	
RURAL .....	16 160	140	20	120	20	980	200	14 680	120	160	40	15 840	
<u>SAN MARCOS</u> .....	61 600	760	160	1 620	640	10 180	1 680	46 360	1 740	880	700	58 280	
URBANA .....	7 460	500	140	960	360	3 400	560	1 540	1 660	240	20	5 540	
RURAL .....	54 140	260	20	860	280	6 780	1 120	44 820	80	640	680	52 740	
<u>HUEHUETENANGO</u> ...	51 860	440	160	680	100	1 600	240	48 640	980	140	280	50 460	
URBANA .....	8 480	420	160	620	100	1 060	180	5 960	940	100	260	7 180	
RURAL .....	43 380	20		60		540	80	42 680	40	40	20	43 280	
<u>O U I C H E</u> .....	46 800	600	40	960	40	1 020	20	44 120	1 420	80	160	45 140	
URBANA .....	7 220	580	40	920	40	720		4 920	1 400	60	120	5 640	
RURAL .....	39 580	20		40		300	20	39 200	20	20	40	39 500	
<u>BAJA VERAPAZ</u> .....	18 300	100		240	40	1 680	100	16 140	220	60	140	17 880	
URBANA .....	2 920	100		200	40	1 480	80	1 040	220	20	100	2 580	
RURAL .....	15 380			40		220	20	15 100		40	40	15 300	
<u>ALTA VERAPAZ</u> .....	47 900	620	60	420	100	4 640	540	41 520	460	560	140	46 740	
URBANA .....	4 980	400	60	240	80	2 440	280	1 480	440	220	60	4 260	
RURAL .....	42 920	220		180	20	2 200	260	40 040	20	340	80	42 480	

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APPENDIX 4-3-E

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DEPARTAMENTO URBANA-RURAL	TOTAL VIVIENDAS PARTICU- LARES	CLASE DE SERVICIO SANITARIO							CLASE DE DESAGUE			
		T N D O R O		EXCUSADO LAVABLE		POZO CIEGO		NO HAY D NO REP.	CLASE DE DESAGUE			NO HAY D NO REP.
		EXCLU- SIVO	COMPAR- TIVO	EXCLU- SIVO	COMPAR- TIVO	EXCLU- SIVO	COMPAR- TIVO		RED MU- NICIPAL	POZO AB- SORBENTE	FLOR DE TIERRA	
<u>P E T E N</u> .....	5 160	100		80		2 480	160	2 320	40	220	40	4 860
URBANA .....	2 240	80		40		1 500	80	540	40	160		2 040
RURAL .....	2 920	20		40		980	109	1 780		60	40	2 820
<u>I Z A B A L</u> .....	24 220	1 600	480	1 620	1 360	2 560	540	16 060	1 700	1 280	2 080	19 160
URBANA .....	7 060	900	380	1 100	1 000	1 580	420	1 680	1 180	680	1 540	3 660
RURAL .....	17 160	700	100	520	360	980	120	14 380	520	600	540	15 500
<u>Z A C A P A</u> .....	19 400	480	80	520	380	2 160	480	15 300	1 240	200	120	17 840
URBANA .....	5 640	480	80	480	380	1 580	440	2 200	1 220	180	100	4 140
RURAL .....	13 760			40		580	40	13 100	20	20	20	13 700
<u>C H I Q U I M U L A</u> .....	29 760	600	60	740	180	1 160	220	26 800	1 340	160	40	28 220
URBANA .....	6 140	600	60	680	180	1 020	200	3 400	1 340	120	20	4 660
RURAL .....	23 620			60		140	20	23 400		40	20	23 560
<u>J A L E P A</u> .....	18 880	480		420	40	740	140	17 060	760	140	60	17 920
URBANA .....	5 260	460		380	40	640	140	3 600	760	80	20	4 400
RURAL .....	13 620	20		40		100		13 460		60	40	13 520
<u>J U T E P A</u> .....	35 760	540	100	280	120	1 200	180	33 340	720	280	80	34 680
URBANA .....	7 220	520	100	260	120	940	180	5 100	680	280	40	6 220
RURAL .....	28 540	20		20		260		28 240	40		40	28 460

APPENDIX 4-3-F

CUADRO NO. 11

SEGUNDO CENSO DE VIVIENDA 1964

VIVIENDAS PARTICULARES OCUPADAS EN LA REPUBLICA, SEGUN CLASE DE ILUMINACION Y MEDIO PARA COCINAR,  
POR DEPARTAMENTO URBANA Y RURAL.  
BASE: MUESTRA 52

DEPARTAMENTO URBANA-RURAL	TOTAL VIVIENDAS PARTICULARES	I L U M I N A C I O N					M E D I O S P A R A C O C I N A R					
		ELECTRI- CIDAD	CANDELA	GAS-KEROSENE- GASOLINA	OTRO	NO INFORMARON	ELECTRI- CIDAD	PROPANO	CARBON	LEÑA, PALD, ETC.	GAS-KEROSENE- GASOLINA	NO INFORMARON
REPUBLICA .....	804 940	177 080	123 560	414 120	90 140	40	8 720	14 340	39 520	679 860	51 640	10 860
URBANA .....	277 760	155 660	49 120	69 040	3 940		6 060	13 600	32 460	174 960	42 480	6 200
RURAL .....	527 180	21 420	74 440	345 080	86 200	40	660	740	7 060	504 900	9 160	4 660
GUATEMALA .....	144 560	101 300	29 280	13 380	600		7 100	11 560	26 080	63 480	33 140	3 200
URBANA .....	110 300	98 120	15 920	4 180	60		4 920	11 380	25 140	40 240	31 620	3 000
RURAL .....	26 260	3 180	13 360	9 200	520		180	180	940	23 240	1 520	200
EL PROGRESO .....	12 880	2 480	1 060	7 520	1 820		60	20	140	12 280	340	40
URBANA .....	3 600	1 660	380	1 560			20	20	60	3 320	160	20
RURAL .....	9 280	820	680	5 960	1 820		40		80	8 960	180	20
SACATEPEQUEZ .....	14 980	3 240	5 360	6 320	60		40	100	720	13 340	620	160
URBANA .....	10 740	2 920	3 460	4 360			40	80	680	9 260	560	120
RURAL .....	4 240	320	1 900	1 960	60			20	40	4 080	60	40
CHIMALTENANGO .....	32 800	3 680	8 100	17 200	3 820			20	640	31 620	520	
URBANA .....	12 320	2 760	4 080	5 320	160			20	480	11 440	380	
RURAL .....	20 480	920	4 020	11 880	3 660				160	20 180	140	
ESCUINTELA .....	52 080	12 340	8 320	31 280	140		320	580	1 480	44 820	2 340	2 340
URBANA .....	15 420	6 580	3 420	3 900	20		180	380	760	9 860	1 680	1 060
RURAL .....	36 660	5 760	4 900	27 380	120		140	200	720	34 960	660	1 480
SANTA ROSA .....	29 960	1 980	11 560	15 300	1 120		60	60	580	28 600	660	
URBANA .....	7 160	1 540	3 000	2 600	20		40	60	220	4 420	420	
RURAL .....	22 800	440	8 560	12 700	1 100		20		360	22 180	240	

APPENDIX 4-3-G

## HONDURAS HOUSING CENSUS OF 1961

Description of Data Reported

The 1961 Housing Census of Honduras gives data on water and sewerage-excreta disposal service in its Section on Housing Conditions. Results are reported nationwide for each of the 18 Departments and for urban and rural categories, but not for smaller civil subdivisions.

Water service is classified as "Inside the Vivienda-Particular," "Outside" and "Without Service." The term "Outside" appears to include both courtyard service (or equivalent) and public outlet service. An urban area is defined as a center with 1000 persons or more which also has a six-grade school and one or more of the following: postoffice, public telephone, telegraph office, railroad station, port, public water supply or electric service.

The Housing Census contains no data on dwelling units connected to public sewers per se, but does report on those served by two types of water-carriage excreta disposal devices (inodoros and excusados), plus privies and those "without service."

Some of the numerical data have been converted into percentage values in this Methodology Study and are given below, "Inodoros" and "excusados" have been combined as a rough equivalent of "sewer and septic tank" service.

Piped Water - Per Cent Served

		<u>Urban</u>	<u>Rural</u>	<u>Total</u>
Nationwide -	Inside Connected	43%	3%	12%
	Outside Access	<u>34%</u>	<u>6%</u>	<u>13%</u>
	Total	77%	9%	25%
High Dept. (Cortes D.)	Inside Connected	54%	11%	33%
	Outside Access	<u>35%</u>	<u>14%</u>	<u>25%</u>
	Total	89%	25%	58%
Low Dept. (Gracias a Dios) (no Urban Population)	Total Access to Piped Water	-	1%	1%
Water Carriage Disposal		51%	3%	15%
Privies		<u>16%</u>	<u>2%</u>	<u>5%</u>
Subtotal		67%	5%	20%

## MEXICO HOUSING CENSUS OF 1960

General Description of Data

The 1960 Population Census of Mexico reports an urban population of 17.705 million, a rural population of 17.218 million and a total population of 34.923 million. Urban areas are communities with 2,500 population or over, and on this basis Mexico was 51 per cent urbanized. A total of 89,612 localities (population centers) were reported, of which 1,461 were classed as Urban and 88,151 as Rural.

Water and sewerage service aspects in the Housing Census were reported only by major civil subdivisions (State - 32 in number) and without distinction between Urban and Rural. These aspects were reported on an "occupants" basis and also on a "dwelling units" basis.

Water service characteristics were reported as: 1) Piped water within the dwelling unit; 2) Piped water outside the dwelling unit but within the "edificio"; and 3) Without water service. Thus, data on On-Premises water service are available but not data for service from public outlets (public fountains). The entry heading for sewerage-excreta disposal service was: Have drainage or common sewer (Drenaje o albanal tienen).

Results for Mexico's total national population by percentage are summarized as follows:

	<u>Per Cent</u>
Piped Water Within Dwelling Unit (Vivienda)	23%
Piped Water Within Building but Outside D.U.	<u>8.5%</u>
Total Served with Water On-Premises	31.5%
Sewerage - Drainage or Sewers	28.5%

As one approximation of the percentage of the total urban population with on-premises water service which has uncertain validity, if it is assumed that 90 per cent of the water service is among the urban half of the population and 10 per cent in the rural half, the per cent Urban-Served is 57 per cent and the per cent Rural-Served is 6 per cent.

## PANAMA HOUSING CENSUS OF 1960

Description of Data Reported

The "Housing Conditions" portion of the Housing Census for Panama does not give water and sewerage service data by urban and rural categories, but does report by Provinces (9), by Districts (64), and for some of the 440 Corregimientos and 8593 Lugares Poblados. By analyzing these detailed listings, it is possible to extract data for the nine urban areas of the country exceeding 2,500 population and for the Republic. This information is given below.

Based on the 1960 Population Census, Panama had a total population of 1.076 million, an urban population of 0.446 million and was 41.5 per cent urbanized. Panama City had 61.3 per cent of the total urban population of the nation. The "Nine-Cities" table below comprises 84 per cent of the total urban population. The definition of "urban" in the 1960 Population Census report is: "Communities of 1500 or over with the following characteristics: public water and sewers, lights, paving, etc." By provinces, urbanization in 1960 varied from 9 per cent to 78 per cent of the total population and was located in 21 localities (municipalities).

Per Cent Served - Water and Water-Carried Waste Facilities

	<u>With</u> <u>Potable Water</u>	<u>Water-Carried</u> <u>Waste</u>
Panama - Rural and Urban (95% of total national population)	59%	26%
Cities - Colon	100%	98%
Puerto Armuelles	96%	82%
Bajo Boquete	87%	92%
Concepción	90%	77%
Chitre	100%	85%
Las Tablas	99%	88%
Panama City	97%	95%
Santiago	95%	76%
Sona	90%	43%
Average - 9 cities - based on population	97%	94%

Remarks: Because the percentages "served" look artificially high for the nine cities, it is noted that these computed values were based on abstracted figures obtained at another location from the Panama Housing Census Report and could not be rechecked for further verification. Values for Per Cent Served with Potable Water were computed by dividing the number of Viviendas "Sin Agua Potable" by the total number of Viviendas. Values for Per Cent Served with Water-Carried Waste Facilities were computed by dividing the combined number of Viviendas "Sin Servicio Sanitario" and "Con Piso de Tierra" by the total number of Viviendas.

POTABLE WATER SYSTEM INVENTORIES AND EVALUATIONS DEVELOPED AND PUBLISHED  
ON COLLABORATIVE PROGRAMS INVOLVING THE U.S. PUBLIC HEALTH SERVICE, STATE  
AGENCIES AND LOCAL WATER DEPARTMENTS

A. History and General Description

This collaborative program has been underway for about 40 years, with expansion in scope during the passage of time. The type of data involved on this nationwide program is uniform throughout the United States, being comparable in this respect to that of the U.S. decennial population census and population censuses in Latin American countries. In addition to data provided on the collaborative program, State agencies and local and metropolitan water departments and authorities publish much additional data and other information, commonly in annual reports.

B. Interstate Carrier Water Supply Certification Program (ICWSCP)

This program is described first because it was the first step in developing the overall collaborative data collection program in its present state. The ICWSCP had its genesis in Federal legislation requiring approval by the Federal Public Health Service of the sanitary quality of drinking water served to passengers on interstate trains, ships, buses and, subsequently, airplanes. The approval procedure established included the sanitary evaluation of local water systems serving as supply sources for the interstate passenger carriers.

From the beginning, the Federal Public Health Service relied on state health departments for the performance of nearly all of the field work and bacteriologic laboratory services needed for carrying out the program with the state agencies submitting reports to the Federal Public Health Services as a basis for certification or non-certification and with the Federal agency responsible for data compilation and publication.

This certification program resulted in the publication of an inventory of water systems serving interstate carriers. Although the number of systems involved, totalling 766 in 1963, comprises only a tiny fraction of the total number of water systems in the United States, they supplied 76 million resident population, or about 57 per cent of the total population, in that year. However, from an inventory-data collection standpoint, the greatest significance of the ICWSCP was in paving the way for a much more comprehensive collaborative nationwide program of data collection for municipal water systems. Currently, both the ICWSCP and the comprehensive programs are operating, but the data published for the ICWSCP are much more limited than those for the General Water System Inventory Program, which for this reason is described in greater detail in this Appendix.

Summarized nationwide listings are generally published by the ICWSCP once every three years. The latest publication was issued in 1964 and was for the beginning of 1963, taking in additional listings which had accumulated since 1960. The data contained in these summaries consist of:

name of local water system, type of ownership, population served, type and number of interstate carriers served, and approval status with respect to sanitary safety of the system and water quality.

Special publications of a selected list of local supplies are also issued sporadically by the ICWSCP. Recently, these have included the results of detailed laboratory analyses of water for 176 water systems serving inter-state carriers, made in 1960-2. The analytical data published include results of: 1) conventional physical-chemical analyses, 2) spectrographic analyses, 3) radiochemical analyses and 4) miscellaneous analyses. Thirty-nine different determinations were involved in the analyses, including, for example, synthetic detergents (ABS), carbon chloroform extractables and carbon alcohol extractables.

### C. General Inventory of Municipal Water Facilities

#### 1. General Description

During the course of operation of the ICWSCP, it became apparent that a broader inventory of municipal water facilities were needed for purposes extending beyond the statutory requirements met by the ICWSCP. Accordingly, a general inventory program was initiated in 1939. As with the ICWSCP, since 1958 the general inventory program has been a collaborative operation involving the Federal Public Health Service, state and local health departments or in some cases, other state agencies and local water departments and authorities, with the Federal Service responsible for the nationwide assembly of state reports and for their publication.

The data are collected by the State agencies by mail and by field inspections when needed, with the larger part of the field inspections performed by local and district personnel within the state. However, any collaborative data collection program of this type is basically dependent on local water system management for the adequacy and accuracy of the data. While some information can be obtained by other personnel through field inspections, most of the data collected must, of necessity, be supplied by local system personnel. For this reason, the quality and completeness of the data ultimately published directly reflect the effectiveness and adequacy of local system management. As a result, these local management characteristics, plus willingness to cooperate, provide a basis for determining the degree of detail of the data to be collected and toward predicting whether the program will be successful or even worthwhile. While this observation is most pertinent to those countries, such as the United States, in which water systems are managed by local government agencies or by private owners, even state and national water authorities which may directly build and operate local water systems, must rely on local staff for important elements of the inventory data. The entire water supply (and sewerage) inventory operation was transferred at the Federal level in 1966 to another Federal Department (U.S. Department of Interior).



## 2. Types of Publications

The Federal Public Health Service has published these general inventory data in two sets of printed, paperbound reports.

Report "A" consists of compilations for all water system facilities "serving places of 100 persons or more which have been reported by the responsible state agencies and, in a few states, places smaller than this size." Because of this very low population baseline, small systems, including many privately-owned systems for residential subdivisions, comprise a great majority of the systems reported.

Report "A" is published every five years and is released one to two years after the final year of the period. The most recent report was dated 1964 and gave inventory results accumulated through the end of 1962, representing updating from the end of 1957. Thus, there is a total lag period of up to seven years. Report "A" is issued in nine volumes, one for each administrative region of the Federal Public Health Service.

In spite of the small size of most water systems in the report, the types of data are relatively detailed, considering the small median size of system. For this reason, entries under some column headings are more often omitted than reported for individual systems, which are shown as line items in the report format. These omissions are denoted by the letter "X". A dash "-" signifies that the column heading item does not apply to the line item. The most frequently omitted data are: 1) Type of Improvements Needed; 2) Year Operation Started; 3) Maximum Dependable Draft (mgd); and 4) Average Plant Output.

Data column headings for Report "A", as well as for Report "B" which follows, are shown later in this Appendix.

Report "B" in the report series gives inventory data for municipal water facilities in communities of 25,000 population and over and has twice as many data column headings as Report "A". Considering the more detailed and more complete nature of the data requested, Report "B" has far fewer omissions than Report "A", but there are still many omissions under some column headings of secondary importance from some points of view. To a limited extent, some omissions are an inherent element of the report format, which requires that each source of supply within a system be listed as a separate line item across the width of the tabulation. This procedure is desirable for some of the data items requested, such as volume of supply and provision of, or type of, treatment, but creates problems in attempting to report by source of supply such items as "number of meters" and "number of service connections" in an integrated distribution system served by several supply sources. This difficulty can be, and at times is, overcome by listing systemwide data on a separate line from source of supply data.

Since 1954, Report "B" has been issued biennially, most recently through the end of 1965 (1966 Edition, released in 1967). Since the last previous report extended through the end of 1963, the lag period of Report

"B" is between three and four years, compared with up to seven years for Report "A". In the interest of apportioning workload, Report "B" is published in different years than Report "A".

Repo

In the interest of simplifying the task of publication and of improving readability, Reports "A" and "B" rely extensively on code letters and symbols wherever they can be used. For example, code letters are used in Report "B" to denote eight different categories of "Improvements Needed" and 73 different types of Treatment or Disinfection. These code letters and symbols are defined in the report introduction.

Statistical Summaries: Statistical Summaries of the Inventory Data in Reports "A" and "B" are published separately from the Inventory Reports themselves and appear a year later. Thus, the lag period is a year greater in each case. Separate summaries are published for each Inventory Report.

These summaries contain tables which summarize the content of the Inventory Reports and a narrative pointing out recent trends and levels of development.

Magnitude of Inventory Operations: As an index of the magnitude of these Inventory operations in the present 50 States of the United States, the 1965 Summary of the 1964 Edition of REport "B" (representing conditions through the end of 1962) reported on 1514 water systems serving populations of 25,000 or over in 938 communities. The total served population was 111 million.

By comparison, the 1965 Summary of the 1964 Edition of Report "A" (representing conditions through the end of 1962) reported a total of 19,236 water systems with a served population of 151 million.

Data Headings: Table data headings contained in Inventory Reports "A" and "B" are listed on the following page as information on the scope and detail of the two inventories. As previously noted, some column headings are further subclassified by the use of code letters which, for example, permit identification of 73 different types of treatment. The two Summaries are similar in scope to the Inventory Reports on which they are based.

DATA HEADINGS CONTAINED IN U.S. PUBLIC HEALTH SERVICE WATER  
SYSTEM INVENTORY REPORTS

REPORT "A" (All Systems)	REPORT "B" (Over 25,000 Population)
1. State	1. State
2. Community or Facility	2. Same as Report "A"
3. Population - Last Decennial Census	3. "
4. Estimated Population Served	4. "
5. Year Operation Started	5. "
5. Present Supply	6. "
6. Present Treatment Plant	7. "
7. Ownership	8. "
8. No. of Services	9. "
9. No. of Meters	10. "
10. Source of Supply	11. Raw Water Storage - After Trans.
11. Safe Yield Impounded (Surface Water)	12. Safe Yield Impounded (Surface W.)
12. Max. Dependable Draft (Grnd. Water)	13. Max. Dependable Draft (Grnd. W.)
13. Rated Plant Capacity	14. Transmission Capacity
14. Average Daily Output	15. Treatment Plant - Rated Capacity
15. Treatment - Types of Distribution Storage	16. " " - Overload Capacity
16. Pumped to Mains	17. Treatment - Type
17. Gravity to Mains	18. Plant Output - Average
18. Improvements Needed	19. " " - Maximum Day
	20. " " - " Month
	21. " " - " Hour
	22. Average Output - Domestic
	23. " " - Commercial
	24. " " - Industrial
	25. " " - Public & Other
	26. Laboratory Control
	27. Pumping Capacity - Raw Water
	28. " " - Finished Water
	29. Pumped to Mains
	30. Gravity to Mains
	31. Will Distr. System Satisfy Max. Demand?
	32. Improvements Needed
	33. Remarks

### Discussion of Reports "A" and "B"

1. Reports "A" and "B" have had a relatively long history of development in reporting practice by the collaborating agencies (28 years). The two inventories were much less detailed when first introduced, extending to their present complexity as the reporting machinery improved in effectiveness and as local water system managements established more complete and more adequate internal records. Another noteworthy characteristic of these reports is that, where information is lacking for a particular inventory item in a local water system, the item is commonly omitted from the local system report, rather than guessed at. Thus, accuracy tends to be maintained at the expense of adequacy, with a net beneficial effect.

2. In spite of the length and detail of Report "B", it contains no information on the financial aspects of water department operations, such as annual income and expenses on a total, unit and categorical basis or the estimated cost of improvements needed. This is also true of the more abridged Report "A" form. Improvements needed are classified only as to type and not as to magnitude. Such data, however, are collected and published in part by other agencies and organizations, either on a nationwide basis or within individual states. Some of these other data resources are cited elsewhere in this Methodology Report.

3. Data in Reports "A" and "B" on "Total Population" and "Population Served" differ in their significance from these items in all or most Latin American countries, where important proportions of the population in communities of all sizes lack on-premises piped service from local water systems. Under these latter conditions, "Percent Served" data have important socioeconomic significance and some bearing on capital needs for water system development.

In order to illustrate U.S. Inventory results on "Population Served," data in Reports "A" and "B" for the State of Alabama were analyzed. Alabama was selected for mixed reasons--it is the first state in alphabetical listing and has an above-average rural and small town population and below-average per capita income. Thus, a higher unserved population percentage might be expected than in most other states. In this analysis, the total population of communities based on the 1960 Population Census were compared with the population served at the end of 1962 in Report "A" and of 1963 in Report "B", since the e were the population values given in the respective reports.

In Report "B" (25,000 population and over), 16 community water systems were listed, with 1.6 million population "served" and a total population of 1.1 million. To a limited extent, this excess of 0.5 million population "served" represents three years of population growth. Primarily, however, it represents the tendency of many larger city systems in the United States to deliver water at a higher price to nearby smaller municipalities and suburban and rural areas, along with an essentially "100% Served" status with the core city. In only a single city in Report "B" was the population served less than the total population (31,400 total, 31,000 served).

In Report "A" (communities of all sizes extending down to 90 population), in only 59 of 333 communities listed was the served population less than the total population. The following summary is for these 59 community systems:

Total Population	90,845
Average Population	1,540
Median Population	715
Minimum Population	90
Maximum Population	17,742
Population Served	77,385
Per cent Served	85%

The actual per cent served was undoubtedly higher than 85 per cent in view of the small median size (715 population) and because the populations of small communities of this class in rural Alabama declined in 1960-2 as part of a long-term continuing trend. Thus, their populations in the 1964 reporting year was lower than in the 1960 Census baseline year.

**GEORGIA WATER QUALITY CONTROL BOARD  
DIVISION FOR GEORGIA WATER QUALITY CONTROL  
47 Trinity Avenue S. W.  
Atlanta, Georgia 30334**

**SEWAGE TREATMENT PLANT—BASIS OF DESIGN DATA**

Fill out such portions of the following blanks as relate to the proposed treatment plant. Submit in duplicate with engineers report, and complete plans and specifications.

Date.....

**GENERAL**

1. Name of municipality or institution.....
2. Designing engineer.....
3. Total population of municipality or institution.....
4. Number of sewer connections.....
5. Number of discharge outlets.....
6. Total daily sewage discharge.....
7. Present method of disposal.....

**PROPOSED SEWAGE TREATMENT PLANT**

Designate by number corresponding with that on sewer map the outlet to which the following information applies.

Number.....

1. Raw Sewage Data:
  - a. Population of area tributary to proposed plant.....
  - b. Ultimate population for which plant is designed.....
  - c. Design flow, per capita..... total.....
  - d. Industrial wastes: character.....  
 quantity..... describe preliminary treatment received.....
  
2. Site of Treatment Plant:
  - a. Distance and direction from center of municipality.....
  - b. Distance and direction from nearest habitation.....
  - c. Distance from public highway.....
  - d. Area to be owned for treatment works..... acres
  
3. Stream Data:
  - a. Watershed area above point of sewage discharge.....
  - b. Estimated minimum daily flow of stream..... Duration..... Frequency.....
  - c. Stream free flowing or sluggish.....
  - d. Distance downstream to nearest community..... name.....  
 population.....
  - e. Distance downstream to nearest water supply intake:.....  
 name..... population.....
  - f. Name of receiving stream..... tributary to.....
  - g. High water elevation at treatment plant site.....
  
4. Treatment Devices:
  - a. Give complete list of proposed treatment devices in proper order; screens, tanks, filter, etc.....  
 .....

APPENDIX 5-2

5. Grit Chambers:

- a. Number of units.....
- b. Method of cleaning (hand or mechanical).....
- c. Disposal of grit.....

6. Coarse Screens:

- a. Number of screens (or other device).....
- b. Total effective screen area..... square feet
- c. Spacing of bars..... inches
- d. Method of cleaning.....
- e. Disposal of screenings.....

7. Fine Screens:

- a. Number..... type..... size openings..... inches
- b. Disposal of screenings.....

8. Primary Settling Tanks:

- a. Type..... number of units.....
- b. Capacity of settling compartment (each unit).....
- c. Detention period, average flow (24-hour basis).....
- d. Velocity through tanks, average flow.....
- e. Settling rate or surface loading..... gallons / day / square foot
- f. Total effluent weir length.....
- g. Sludge removal method.....
- h. Head available on sludge outlets (gravity removal).....

9. Sludge Digestion:

- a. Type (Imhoff or separate tanks).....
- b. Number of digesters (if separate).....
- c. Sludge capacity, cubic feet per capita..... total cubic feet
- d. Will heating equipment be provided?.....
- e. Disposal of supernatant.....

10. Sludge Drying Equipment:

- a. Type.....
- b. Number of drying beds (or other device).....
- c. Area, square feet per capita..... total square feet
- d. Filtering material:
  - Sand, depth.....
  - Gravel, depth each layer.....
- e. Material used for underdrains.....
- f. Disposal of sludge bed effluent.....

11. Dosing Chamber:

- a. Number of units..... capacity of each.....
- b. Number of siphons..... size.....

12. Trickling Filters:

- a. Number of units..... area of each..... depth.....
- b. Filter medium, kind..... size.....
- c. Normal rate of filtration..... gallons / day / square foot
- d. Biochemical oxygen demand load..... pounds / day / 1,000 cubic feet
- e. Will effluent be recirculated?..... If so, give full details in separate report or in space for remarks on this form.
- f. Type of distributor..... type of underdrains.....

- 13. Activated Sludge:
  - a. Number of aeration tanks.....
  - b. Aeration period (average flow)..... hours
  - c. Biochemical oxygen demand load..... pounds / day / 1,000 cubic feet of aeration tank
  - d. Type of aeration..... type of diffuser.....
  - e. Maximum aeration rate..... cubic feet / gallon

- 14. Final Settling Tanks:
  - a. Type..... number of units.....
  - b. Capacity (each unit).....
  - c. Detention period, average flow (24-hour basis).....
  - d. Velocity through tanks, average flow.....
  - e. Settling rate or surface loading..... gallons / day / square foot
  - f. Total effluent weir length.....
  - g. Sludge removal method.....
  - h. Disposition of sludge.....

- 15. Chlorination:
  - a. Purpose.....
  - b. Type of chlorinator.....
  - c. Total capacity (lbs. per 24 hours)..... maximum dose, milligrams / liter.....
  - d. Points of application.....

- 16. Measuring Device:
  - a. Describe measuring device (weir, Venturi tube, etc.).....

- 17. Laboratory Equipment:
  - a. List tests for which equipment will be provided.....

- 18. Special Treatment Devices:
  - a. Other types of treatment devices can be used and will require special description.....

REMARKS



TO: Chiefs of Zone

FROM: Dr. Abraham Horwitz, Director

SUBJECT: Four-year projections - community water supply and sewerage system basic data

At the meeting of the Zone Chiefs and on other occasions, we have emphasized the importance of developing a document on the status and projected needs in Latin America for community water supplies and sewerage systems. The goals established in the Charter of Punta del Este will be used in four-year projections for the period 1968-1971.

The preparation of the four-year projections of the needs in the Region is dependent on the compilation of certain basic data. During the recent meeting of the Zone Engineers in the Washington office, agreement was reached on the minimum information required for preparation of the projections and which could be obtained in all of the countries of the Region. It was also agreed that this information would be collected and forwarded to the W.O. by the end of October 1967.

Attached is a form for tabulating the data with an explanation of the various items included. It is extremely important that the data be tabulated in the categories requested and that the forms be complete.

Your fullest cooperation is requested to assure that the forms are filled out for each of the countries in your Zone, reviewed by the Zone Engineer for completeness, and forwarded to reach W.O. Washington before the end of October 1967.

Guidelines for tabulating basic data requested on Form I

1. All data should be latest available in 1967 (specify month on table).

2. All data should be complete and tabulated in accordance with these guidelines. The data should be developed by the PAHO engineer with the nationals most intimately related with the particular classifications so that if information is not available the nationals will be able to provide the best estimate for the data which is missing. The tabulated information shall be approved by the appropriate government representative prior to transmittal to Washington.

3. Total 1967 (Column No. 1)

(a) Urban Population - the generally used classification of an urban population is a community with a population in excess of 2000, and it is expected that the information will be tabulated on this basis. If the country for which the tabulation is being prepared used a different limit and it is impossible to tabulate the data on the basis of the 2000 limit, the established limit should be indicated on the form and the data tabulated accordingly.

(b) Rural Population - all population not listed as urban should be tabulated as rural.

4. Served with Water - 1967 - Connected to Public System

(a) Column No. 2 - tabulate the number of people served from a public water supply system by house connections.

(b) Column No. 3 - tabulate the number of people who are close enough to a water supply system to have ready access to it but are not presently connected to it.

(c) The sum of Column No. 2 and No. 3 subtracted from No. 1 will give the number of people lacking water service or easy access to such service.

5. Served by Sewers (Column No. 4) - tabulate the number of people who are connected to a sewerage system or for whom such a system is reasonably accessible to which they could easily be connected.

## BASIC DATA ON WATER SUPPLY AND SEWERAGE

COUNTRY \_\_\_\_\_

DATE OF STATISTICS \_\_\_\_\_ 1967

	TOTAL 1967 (1)	SERVED WITH WATER - 1967		SERVED BY SEWERS - 1967  (4)
		Connected to Public System (2)	Reasonably Accessible (3)	
URBAN POPULATION				
RURAL POPULATION				
TOTAL POPULATION				

See Guidelines for tabulating data.

**ANNEX B**

**FINANCING SANITARY ENGINEERING PROJECTS**

## FINANCING SANITARY ENGINEERING PROJECTS

### 1. The Problem

The Latin American countries have established a list of priorities in the long row of public utilities needs, recognizing that water supply should come first, for it is generally accepted that a safe and adequate water system is, in most instances, the single most important measure which can be taken to prevent disease and at the same time to improve the standard of living of people.

Figures for 1969 show that of a total population of 272,447,000 in Latin America, 46 per cent was served with water by house connection or easy access and 22 per cent of the population had sewage disposal facilities. There remains a high incidence of morbidity or mortality due to enteric diseases, most of which is considered to be water-borne.

Very few countries all over the world are building new water and sewerage systems, or are expanding existing ones at a rate higher than the rate of growth of the population. As pointed out in the WHO Chronicle of August 1968, "Although it is difficult to produce statistical evidence in support of this statement, the experience of the governments and agencies concerned indicates that today more people are in need of an adequate water supply than a few years ago."

We are aware of the problem, particularly in the rural areas, where the situation as a whole is becoming more difficult every day. At the same time, as sanitary engineers we are conscious of the availability of the technological tools to solve the problems. Efforts are being developed to simplify, standardize and increase the rate of construction of new systems in the rural environment, so that in the near future more people will be served in less time with smaller investments. However, water supply and sewage disposal technology is but one aspect of the manifold complex involved in national, regional or local programs.

Dr. Abel Wolman, the eminent professor of the Johns Hopkins University, recently commented on the basic ingredients of any successful sanitary engineering program:

Manpower  
Money  
Management  
Motivation

He thus simplified what we normally consider the seven pillars of water supply and sewage disposal: technology, administration, management, financing, legal, economical and social aspects. If any of these supports fail, the program will be endangered.

## 2. Objectives and Goals

The general objective of the program in Latin America is the provision of the benefits of water supply and sewage disposal services to the greatest number of people at costs which are in balance with the social and economic realities of the people served. Mr. Harold Shipman, Chief Engineer of the Water Supply Division, Public Utilities Projects Department of the World Bank, has said: "As a long range objective it would seem reasonable to suggest that in every country of the world, all people should have access to a source of safe water for drinking, cooking and personal hygiene and that the disposal of body and household wastes should be by methods which are neither injurious to the public health nor destructive to the environment. Ideally, this would mean potable water piped to each home and with each home equipped with plumbing which is connected to sewerage systems that conduct the liquid waste to treatment plants for ultimate disposal or re-use. It is obviously impractical to establish a goal of 100 per cent on-premises water service in urban areas for any time in the foreseeable future on a global basis. It is equally unrealistic to expect that each house can be equipped with inside plumbing connected to public sewers."

Each country should set its own objectives and goals, now that the end of the Alliance for Progress Decade is close. In doing so, it will be necessary to take into account the existing limitations in manpower, the financial and economic restraints and, above all, the operational capacity of the institutions which have the responsibility of the programs.

## 3. Needs for Investment

The following figures are approximate. They represent a rough estimate of the capital investments needed in the field of water supply and sewage disposal for Latin America during the next two years. According to investment programs of the Latin American countries of this Hemisphere, an annual expenditure of \$500 million would produce the following results by the end of 1971:

Population served	Water	Sewerage
Urban	70%	42%
Rural	23%	3%
Total	49%	25%

In other words, \$1.0 billion should be spent by the Latin American governments in the next 14 months to build new water supply and sewage disposal systems, as well as to maintain and expand existing ones. Of this amount, \$700 million should go to the urban areas and \$300 million to the rural communities. It is interesting to compare these staggering figures with those of the recent past. In 1966, 1967 and 1968 an average of \$290 million was used by the countries in their water supply and sewage disposal programs. National funds amounted to \$200 million every year and \$90 million was provided annually by international credit institutions. If the same proportion

prevails in the next two years, then the countries will have to provide each year \$330 million of their own national funds and \$170 million will have to come from international credit agencies. This means that, to reach the proposed goals, financial operations will have to be stepped up substantially, both at the national and at the international levels.

It is also of interest to point out that in the last three years 44 per cent of funds for urban water supply and sewerage disposal were provided by international multilateral and bilateral agencies, whereas international credit for rural programs corresponded to less than 11 per cent of the total expenditure of the countries in this area.

#### 4. Sources of Funds

Even though very accurate figures are available for loans and credits of international multilateral credit institutions in the field of water supply, data is incomplete or inadequate for credits and loans of national governments, suppliers, bilateral agencies, states and municipalities. In most cases water authorities maintain a good record of funds generated from services rendered to the consumers, but this is a minor part of the money used by the institutions in their new programs.

The different government levels and suppliers make up the highest percentage of funds used in the water supply and sewage disposal programs, the central government being normally the most important contributor to the financing of the activities. Fortunately, as noted by the IDB, "current revenues of central governments have expanded at a faster rate than the Region's gross domestic product, indicating an increased capacity in the countries to mobilize domestic resources."

Statistical data about the contribution of bilateral financing sources is not complete. It is generally believed, however, that they represent a large share in the funds available for construction and expansion of water supply systems. Also it is expected that the multilateral investment agencies will absorb greater commitments in the near future, perhaps becoming more important than the bilateral agencies as source of credit.

#### 5. International Credit Agencies

The Inter-American Development Bank (IDB) is the outstanding international credit institution in the water supply field. Between 1961 and the end of 1969 \$455 million was provided by the IDB to finance 78 projects in Latin America. Twenty-four member countries sponsor this agency, whose main objective is to promote and orient, with its own capital and with resources from other sources, the investments which will stimulate, individually or collectively, the economic and social development of its member countries.

The Bank was established in December of 1959. It is directed by the Assembly of Governors, the Executive Directory, the President and the Vice-President. Six departments constitute the administrative structure of the institution:

Operation  
Finance  
Technical  
Legal  
Administration  
Secretary

The Department of Operations has three branches: Loans, Loan Administration and Project Analysis.

The Submanagement for Loans deals with all the procedures which precede the approval of a loan. The responsibility is then shifted to the Submanagement of Loan Administration. These two branches are divided into areas which have a geographic connotation. The Submanagement of Project Analysis provides technical support to the Bank. Technical, institutional and financial studies and analyses are made by this branch, which renders its services to the other two main branches. It has four divisions:

Infrastructure and Industrial Development  
Social Projects  
Agricultural Development  
Institutional and Financial Analysis

The Section of Sanitary Engineering is one of the three sections of the Social Projects Division.

The World Bank and its affiliate, the International Development Association, are specialized self-supporting agencies of the United Nations. Their main purpose is to assist the economic development of the 110 member countries and, in doing so, to raise the standards of living of the people. The Bank's main activities, besides loans for projects, are technical assistance and advisory services. The Bank is the executing agency for many UNDP-financed projects.

Structurally, the WB has five Area Departments of Operations according to the geographic grouping of member countries. One of these areas covers the Western Hemisphere. The Area Departments are assisted by other departments of the Bank in the development of plans for loans, examination of loan applications, appraisal of development programs, coordination of operational, economic and technical missions and reports. In joint actions with the Development Services Department, the Area Departments of Operations plan and direct technical assistance activities.

The Department of Technical Operations is responsible for the assessment of the merits of projects submitted to the Bank and also for the follow-up of projects.



The Development Services Department coordinates technical assistance to countries and maintains liaison with the U.N. and other international organizations. This Department has four units:

- Development Advisory Services (Short-Term Consultants)
- Technical Assistance (Permanent Consultants)
- Economic Development Institute (Training)
- Planning and Liaison (Liaison U.N. and Int. Org.)

The most important body within the Bank's structure is the Staff Loan Committee, which coordinates the Bank's operations in all departments and which is composed as follows:

- Chairman (Vice-President)
- Directors of Area Departments
- Director of Technical Operations
- General Counsel
- Director of the Economic Staff
- Director of the Development Services Department
- Treasurer
- (Director of Marketing)

There is a Water Supply Division in the Public Utilities Projects Department.

The Agency for International Development and the Export-Import Bank are institutions financed by the U.S. Government. AID promotes multilateral trade, technical assistance and economic development. EXIMBANK assists in the financing as well as in the export-import activities of U.S. goods and related services.

Other international institutions, such as the Canadian International Development Agency, UNDP, UNICEF, and CARE, have participated in water supply and sewerage programs of the Western Hemisphere with loans, grants and subsidies.

## 6. Lending Policies

The following is a summary of the lending policies of IDB, WB, AID and EXIMBANK:

6.1 Inter-American Development Bank - The Bank makes loans to governments of its member countries, to any of the political subdivisions or autonomous agencies, and to private enterprises within member countries. It helps finance public and private projects which make a direct contribution to the economic and social development of the countries. In evaluating the projects it finances, the Bank considers the multiplier effects on the general economic activities of the country concerned, the assistance the project renders toward national development, the impact resulting on the balance of payments by replacing imports or increasing exports, the expansion of employment, and the economic integration of the Region. The Bank extends loans only for projects in which the borrower has made or will

make a substantial investment from its own funds. Usually, this is one-half of the project cost, unless special circumstances justify a smaller portion. It does not finance projects which can be financed from private sources on reasonable terms, nor does it make loans for the purpose of purchase of established enterprises, for investment of corporate shares, for balance of payment purposes, for working capital or to suppliers. Its policy does not allow it to make loans for projects to increase the supply of basic commodities which are in world surplus.

6.2 World Bank and IDA - The lending operations of the World Bank are conducted on the basis of three main principles: first, that the borrower will be in a position to repay the loan; second, that the project to be financed is well designed and will be well operated; and third, that the project will be of such benefit to the economy of the country as to justify the investment required. Economic analysis is a continuous process based on work at head office, visits to borrowing countries to gain first-hand knowledge of their economies, and frequent contacts with government and other officials. Before making a loan, the Bank satisfies itself that the borrower will be able to service the debt. The main consideration in arriving at a judgment on that question is the country's foreign exchange situation, because Bank loans are made and must be repaid in currencies other than that of the borrower. It also makes a general appraisal of the merits and priority of the proposed project. If satisfied on these points, the Bank investigates the project in detail, the plans for its design and construction, the economic and financial returns expected, and the provision for management when it comes into operation. The Bank seldom lends the total amount needed for a project. It normally limits its financing to the foreign costs involved in the purchases of goods and services. Most local costs, often more than half the total, are met by the borrower out of other resources. IDA makes loans to countries of low per capita income with a favorable foreign exchange balance. The countries, in turn, relend the money to the water institutions.

6.3 Agency for International Development - The lending policy of AID is based in the following points:

- a) Financing unavailable from other sources.
- b) Demonstration of economic and technical soundness of the project.
- c) Contribution to the economy of the country.
- d) Demonstration of self-help by the country.
- e) Effect on U.S. economy and balance of payments.

Loans are made in U.S. dollars or local currency to the Governments, which in turn, relend the funds to the national institutions. Whenever the cost of the project is above \$100,000, feasibility and technical studies should be made by U.S. consulting engineering firms or local firms associated with American enterprises.

6.4 Export-Import Bank - Basically the lending criteria of the EXIM-BANK call for a reasonable prospect of repayment on the terms agreed upon.

This means an extremely flexible policy, which can be adjusted to each case. Funds provided by the EXIMBANK are intended to supplement and not to compete with other financing sources. Governments and their agencies or corporations which have the support of the national government are eligible for loans.

## 7. Procedures for Loan Applications and Administration

7.1 Inter-American Development Bank - There are no special forms for loan applications. Upon receipt of an inquiry or request for loan, the Bank enters into discussions with the borrower to develop the economic feasibility of the project, its position in priority for lending within the country, the size of the loan required, the total estimated cost of the project, including local cost and foreign exchange cost and the general viability of the entire operation. The project and the borrower are analyzed in complete detail by the Bank's staff or by specialists employed for this purpose. A complete review of the project is prepared by the staff of the Bank for the President for his action. If he approves, the project is referred to the Board of Executive Directors for action. If the Board approves the project, a loan contract is negotiated with the prospective borrower; the contract is eventually signed and goes into effect.

7.2 World Bank and IDA - There does not exist a uniform pattern in the procedures for loan application and administration in the World Bank. Nevertheless, there are standards which were established by the Bank as a consequence of the experience accumulated. These are described in the following paragraphs.

a) Exploratory discussion and preliminary investigation - Normally the Bank discusses informally with the prospective borrower the possibilities of a new loan, indicating the information needed concerning the economic situation prevailing in the borrowing country and also those pertaining to the project.

The processing of a loan request is a two-step procedure: First, the Bank studies the economic situation and prospects of the borrower and the relation of the project under consideration to the economic needs and potentialities of the country. Then a critical examination of the engineering, financial and other aspects of the project is performed, having in view the establishment of appropriate conditions for the loan. Staff specialists or consultants are called upon to make a critical examination of the technical aspects of the project, as well as of the plans for financing of the part of the project which should fall within the responsibility of the borrower.

b) Formal negotiations - Once the exploratory discussions are performed and the preliminary investigations are translated into a satisfactory project report, the Bank informs the borrower of its readiness to start

formal negotiations for the loan. These procedures are then carried out by the staff which, in turn, advise the Executive Directors of the progress made. If the negotiations lead to an agreement about the project, the terms and conditions of the loan, as well as all supporting documentation, is submitted to the Executive Directors, together with the recommendation of the President for approval.

Several months pass until it is possible for the borrower to make the first disbursement. During this period the borrower must comply with a series of prescribed conditions.

7.3 Agency for International Development - There are no established procedures for loan requisites. Normally, the AID Mission in the countries selects projects which could lead to a loan, if they are considered to be self-financing. Also, organizational aspects of the borrower must satisfy certain conditions before the loan application is studied. Loans are made to Governments, which, in turn, relend the money to the institutions.

A loan paper is prepared by the local engineering staff of AID, which originates a feasibility study. This paper is reviewed by a Loan Committee consisting of the Deputy Director, the Economic Advisor and the Engineer. Economic benefits of the project are evaluated by the Committee, having in view its impact in the country's development. A summary of the loan paper is then sent to Washington with the recommendations of the Mission, for study and comments. The document is reviewed by the Bureau of Engineers on its technical aspects and by economists and financial analysts. If the Central Loan Office approves the application, it is returned to the country with suggested changes. If the borrower agrees with the terms of the draft agreement, it is formally signed. Before the first disbursement, many conditions must be fulfilled by the government and the borrower.

7.4 Export-Import Bank - A direct contact is established between the EXIMBANK and the prospective borrower, leading to a series of discussions on the proposed loan application. All pertinent information related to the loan must be prepared and submitted to the Bank by the borrower, until a final agreement is reached on the conditions of the loan. The borrower participation in the project is expected to be of the order of at least 40 per cent, often accompanied by a guarantee of repayment from a responsible guarantor.

The procedures for loan administration are similar in all lending institutions. They imply the disbursement of loans funds only when expenditures are made for specified goods and services. It is then possible to follow each item financed, from the determination of the specifications and the placement of an order, to the delivery of the item and its actual use in the project. Records are required on the progress of the project through periodic reports prepared by the borrower. These reports cover the advance in engineering activities, in placing of contracts for goods and

services, their manufacture and delivery, as well as the course of expenditures in the project. Both physical progress and actual expenditure are plotted in relation to original working schedules and cost provisions.

Information submitted to the lending agencies by the borrower is supplemented by visits of the credit institution's staff. The main objective of these periodic visits is to have a direct contact with the work being done, to examine the accounting records and observe the use and maintenance of goods and equipment. Special attention is dedicated to the administration and management of the project. Changes in the specifications and construction schedule are made according to needs and must be mutually agreed upon.

#### 8. Technical Assistance

Some years ago Mr. Eugene Black, President of the World Bank, said: "Our experience continues to confirm that shortage of capital is not the only, and indeed not the principal, obstacle to more rapid economic progress in less developed countries. Inexperience and lack of trained manpower at every level are even more serious handicaps. I believe that the lending activities of the Bank and its affiliate, the International Development Association, can be carried out successfully only if they are accompanied by a major program of technical assistance and training."

The World Bank and the Inter-American Development Bank render technical assistance to their member countries in three fields:

- a) Technical assistance for specific projects - These activities involve:
- Cooperation in pre-feasibility studies and project preparation.
  - Know-how and technical information in the development of projects.
  - Establishment or improvement of operational procedures to increase the productivity of the institutions responsible for the projects financed by the credit agencies.
- b) Special studies and promotion
- Analysis of the economic development of countries, and studies of national, sectoral or specific plans.
  - Identification of problems and establishment of priorities.
  - Evaluation of projects financed by the Bank.
  - Support to national planning agencies.
- c) Training
- Support to training programs sponsored by other international organizations and/or national institutions.
  - Special courses.

The Agency for International Development operates in the field of technical assistance for specific projects and training, even though it does not offer courses of its own.

8.1 IDB Financing of Technical Assistance - Technical assistance activities may be part of a loan contract, or may be the object of a separate agreement. The Bank contributes to the financing of technical assistance with resources which may be:

- a) Reimbursable
- b) Non-reimbursable
- c) Mixed
- d) Of contingent recuperation.

Reimbursable technical assistance costs should be paid by the borrower. In the non-reimbursable type of technical assistance the borrower has the responsibility of covering local costs. This type of technical assistance is exceptionally used by the Bank whenever the economic situation of the borrower calls for a grant.

The mixed type of technical assistance involves one part which is reimbursable and another non-reimbursable.

Technical assistance of contingent recuperation involves a non-reimbursable operation subject to the contingency that if the technical assistance leads to the signature of the loan contract, then the cost of the assistance is included in the loan, thus becoming a reimbursable technical assistance.

8.2 Technical Assistance, World Bank and International Development Association - In the recent past very few Latin American countries had an office responsible for the preparation of a framework of development plans and capable of appraisal of proposed projects within such a framework. The World Bank has performed an important role in changing this situation through technical assistance.

Many countries have requested and obtained the advisory services of the Bank to collaborate in the formulation of long-range development programs. The basic criteria adopted in the preparation of development plans can be summarized in three points:

- a) An estimation of the order of magnitude of those investments the country can undertake with available resources.
- b) The establishment of priorities for public investment in the different economic sectors.
- c) The adoption of economic and financial policies as well as of administrative procedures needed for the success of the program.

The Bank pays the salaries of its staff assigned to the missions and travel and living expenses of the members of the group outside the country. It is the country's responsibility to defray the costs of consultant's fees and local expenses.

Another important aspect of the technical assistance provided by the World Bank to its member countries is the creation of development banks in a number of member countries. As a net result of this type of assistance, the problem of mobilization of local capital has been substantially simplified. The Bank maintains a close relationship with specialized agencies of the United Nations, particularly with the UNDP, collaborating in the pre-investment studies which normally precede the financing of the projects.

#### 9. PAHO's Role in Financing Sanitary Engineering Projects

A summary of the problem, objectives and goals in the field of water supply and sewage disposal in Latin America has been presented. Estimates for the expenditures in the near future, sources of funds and lending policies of international credit agencies were briefly covered. Now, what is PAHO's role in the financing of the projects?

At the project level our engineers should be helping the nationals in the identification of new projects, as well as in the normal activities related to the disbursement of loans already approved. Informal contacts with the local credit institution's representatives or technical missions of the international agencies must be maintained to provide our personnel with an intimate knowledge of the projects and also an acute perception of the Bank's and the client's attitudes. Frequently, supplemental technical assistance is needed by the country in the preliminary studies or during the construction phase. The project engineer should inform the Zone and, if the situation justifies, ask for specialized short-term consultants.

At the Zone level, a collaboration in the overall planning (national, regional or local), a continuous evaluation of the progress of the projects and, again, a close association with the credit institution's officials is expected.

The Washington Office has an excellent working relationship with the international lending institutions which have, as a common characteristic, a heavily centralized structure. This means that most decisions, especially those related to financial, technical, administrative and managerial aspects of the loans and its related activities, are taken in Washington. Also, changes in internal procedures, policies and general operational patterns are instantly detected by our Central Office.

This duality of actions of PAHO, being a collaborating agency with the borrower and with the credit institutions, invests us with the responsibility of becoming a catalyst of actions which may result in tangible benefits to the countries.

ANNEX C

ADVISORY SERVICES FOR THE INSTITUTIONAL DEVELOPMENT OF  
WATER SUPPLY AND SEWERAGE AGENCIES

June, 1969



ADVISORY SERVICES FOR THE INSTITUTIONAL DEVELOPMENT OF  
WATER SUPPLY AND SEWERAGE AGENCIES

I. Introduction

The advances made by public water and sewerage services in the countries of Latin America plainly reveal the necessity of instituting changes in organizational structures, operating procedures, standards, and criteria, both in the orthodox fields of sanitary engineering and in the sphere of management and administration, in order to attain institutional goals, to insure performance, and to apply the principles of economics and management.

In recent years, a new methodology for providing advisory services has been developed. This methodology has proven effective, not only with respect to the primary objective of the Organization - whose goal is to achieve the acceptance and application of an ever-increasing number of recommendations - but also with regard to the reactions and receptivity shown by the countries. This is best illustrated by the growing demand for this new type of services which has reached unprecedented proportions.

With a view to meeting this demand satisfactorily and carrying out those requests for services assigned highest priority by the governments, a manual\* has been prepared. This manual defines the objectives, policies, and procedures to be followed in promoting, requesting, preparing, implementing, reviewing, and evaluating the advisory services which the Organization is capable of providing to its member governments.

II. Objectives of the Advisory Services

Group advisory services are aimed at the reorganization, reform and rationalization of public water supply and sewerage services through the application of economic and management criteria and the establishment of the policies, procedures, and practices necessary to facilitate the attainment of institutional goals.

Specifically, the objectives of the advisory services are:

1. To study, analyze, and evaluate existing administrative systems, policies, and procedures with a view to recommending the improvements, changes, and reforms necessary to permit the introduction of new systems and to provide for greater managerial flexibility through the rationalization of processes and procedures.
2. To study, analyze, and evaluate the policies and procedures followed in the design, construction, and operation of public services in order to develop guidelines and criteria to foster the effective and timely

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\* Operating Manual: Utilization of Advisory Teams for Technical Assistance and Institutional Development of Water Supply and Sewerage Agencies. PAHO, June 1969.

application and use of resources, the standardization of methods and procedures, and the introduction of the economic and managerial criteria needed to provide the most convenient service to consumers.

3. To foster the development of sound administrative services conforming to commonly accepted standards and principles of public administration and capable of insuring the most economical use of resources.

4. To train responsible personnel in the application and use of the recommended methods and systems, including their conceptual and philosophical aspects, with a view to insuring the effective implementation of the program.

5. To prepare operating manuals and instructions for each of the areas studied in order to insure the standardization of criteria, uniformity of action, and the orderly process required for administrative activities. Such manuals and instructions should be tailored to fit the local needs and should consider the scope of the work of the institution advised, its future plans, and its potential growth.

6. To facilitate the planning, implementation, and control of projects financed with loans from IDB and other international credit agencies, the preparation of reports, the presentation of financial information, and other aspects involved in loan administration.

### III. Criteria for Providing Advisory Services

The new approach to provide advisory services required the establishment of certain innovating criteria which are illustrated in Charts 1, 2, 3 and 4.

#### 1. General Considerations

1.1 Full advantage of the experience and knowledge accumulated by the institutions advised must be made. The procedure by which this is accomplished is described below.

1.2 Likewise, experience has shown that advisory services provided in a vertical manner by a single advisor, who generally has contact with only one or two of the institution's highest ranking personnel, do not produce the desired results. To obtain the greatest impact and provide for a dynamic system by which recommendations may be readily implemented, a new procedure has been introduced whereby a concerted effort is made in a multi-frontal saturation operation undertaken through teams of advisors specialized in the various disciplines of the wide managerial and administrative spectrum.

1.3 The use of teams, in addition to facilitating the study in depth of these disciplines, makes it possible to analyze their effects and the interrelationships necessary to establish coordinated action and effective management.

1.4 The work of teams is aimed at the operational level with a view to attaining the formulation and establishment of practices and procedures and acquainting the largest number of employees with the new systems. The advisory services are also directed to the higher management levels in order to formulate and establish policies and criteria leading to the desired goal. Management must be sensitized and brought into complete agreement in order to put administrative principles into practice and bring about changes in attitudes consonant with institutional reform.

1.5 The degree of specialization required in each of the disciplines of the technical and managerial fields calls for the utilization of highly qualified advisors in each of the areas studied to render services of the highest quality tailored to the needs of the agency and consonant with its economic and manpower capabilities to absorb and apply the recommendations made.

1.6 Agencies advised must introduce structural and procedural changes in accordance with the expediency required by the investment and programs and development plans. The Inter-American Development Bank requires, for instance, the most expeditious action to bring about the administrative reform, as the loan disbursements are subject to the fulfillment of conditions which include the administrative rationalization. As a consequence, it has been necessary to apply a system which would produce the most efficient results in the shortest time possible and which will facilitate the channeling of existing resources towards the most economic solution of the problems of water and sewerage.

1.7 The dynamism of the advisory methods and the impact produced by the combined efforts of teams composed of highly specialized officials and advisers has its decisive effect in successfully introducing those structural and procedural modifications and the changes in attitude so necessary to attain the institutional reform within the context of integral development.

1.8 Experience has also demonstrated the need for establishing a continuing responsibility in connection with the implementation of recommendations. The majority of efforts in this field are weakened due to the lack of a consistent effort to follow up and assist the agencies advised in the application of the recommendations and the solution of the problems which this involves. Consequently, the new approach establishes a requirement for the

continued association with agencies advised through follow-up services for a period of time adequate to insure the implementation of the proposed changes.

1.9 In the past, advisory efforts which did not include training of personnel have proven fruitless; therefore a major concern of teams is the training of personnel to enable them to use the new procedures and the operational machinery established as a result of advisory services.

1.10 The efforts of the Organization alone are insufficient to carry out its mission. For this reason the multiplying effect produced by training public service officials so that they, in turn, may serve as advisers in other countries is highly sought after. Results in this area have fostered a broader outlook toward the concept of advisory services and toward the introduction of reforms and improvements.

## 2. Policies

To satisfy the foregoing considerations, the following policies shall be observed during the negotiations leading up to the advisory services as well as during their performance and evaluation. Particular importance shall be placed upon advisory services financed with funds from IDB loans, in which case the procedures outlined in this Manual shall be applied.

2.1 The Organization shall provide team advisory services to public service institutions requesting such services in writing. When the advisory services are to be financed with the IDB funds, the agency responsible for administering the loan shall inform the IDB of this request.

2.2 The Organization shall carry out the advisory services based upon a preliminary study in which the formulation of a diagnosis and a program of assistance will be based.

2.3 The agency advised shall indicate its agreement and approval in writing of the program of assistance and shall also be responsible for obtaining approval from the IDB.

2.4 In view of the limited resources of the Organization and the fact that the new approach to advisory services requires the teamwork of a considerable number of advisors whose recruitment represents a greater expense than the Organization is able to absorb in its regular budget, the provision of these services shall be subject to the negotiation of a contribution to partially defray the cost of missions. This contribution may be made from resources generated by the agency with funds from credits from the IDB or other credit institutions.

2.5 The provision of services shall be subject to the formalization of the advisory activities in an agreement or, when a current Project-2200 agreement exists, in a letter-agreement.

2.6 The budget for the advisory missions shall include sufficient funds to finance the direct and indirect costs of the missions and the assistance and technical support of the various levels of the Organization. The amount of the contribution shall cover the cost to PAHO of contracting the advisory team, including the estimated cost of the "follow-up" services or other complementary services needed. The cost of the services of permanent PAHO staff members not included as members of the team (Country Engineer, Zone Engineer, and other regional or central-level staff), including any technical guidance and supervision required, shall be considered as the Organization's contribution to the realization of the project.

2.7 The institution advised shall pay its contribution in United States dollars. Because of the need to have funds available prior to initiating recruitment of personnel and with a view to financing the services required for each mission, the following form of payment is most acceptable to PAHO:

50% payable upon signature of the Technical Assistance Agreement between PAHO and the country; and

50% upon delivery and approval of the final report.

Because this is a contribution which finances part of the costs of the advisory services (see 2.6 above), PAHO is not obligated to render financial statements or reports on the utilization of the funds.

2.8 The payment schedule outlined above shall be submitted by the borrower for the approval of IDB when applicable.

2.9 In accordance with the clauses set forth by the IDB in its loan contracts and in the documents outlining conditions for disbursements, the financing of contributions with funds from IDB loans is contingent upon the signature of a technical assistance agreement between the Bank and the country.

2.10 The Evaluation Department of PAHO shall prepare the letter-agreement and obtain the approval of this agreement from the agency advised and the IDB.

2.11 The agency advised shall complete the questionnaire in the present status of services based upon instructions from PAHO.

2.12 To facilitate obtaining the greatest possible amount of information concerning the country and the institution in question, terms of reference shall be prepared. These terms of reference shall be transmitted to team members upon their recruitment.

2.13 Due to the need to coordinate the use of advisors in the various missions, the final selection of team members will be made by ES (in mutual agreement with the Zones), in accordance with their availability and capabilities.

2.14 PAHO form 562 for initiating recruitment of the advisors shall accompany the terms of reference.

2.15 Should the country so require, the tentative list of consultants, together with copies of their curriculum vitae, shall be submitted. The final selection, however, shall be made in accordance with paragraph 2.13.

2.16 Once all the previous conditions have been complied with, PAHO shall proceed to contract consultants. In IDB loans, this compliance is sometimes contingent upon the fulfillment of the conditions precedent to the first disbursement.

2.17 Advisory services shall be planned, in accordance with the availability of advisors, on a date which in no case shall be less than three months subsequent to compliance with the requirements outlined in this Manual (2.7 to 2.10). This includes those steps which require the approval of the IDB.

2.18 PAHO shall prepare progress reports required by the IDB and the agency advised, as well as the final report and the operating manuals. These shall be presented in conformity with the stipulations of the technical assistance program prepared for each individual case.

2.19 The greatest possible number of permanent staff members shall be used to form advisory teams.

2.20 The performance of the advisory activities shall be subject to the standards and procedures set forth in this Manual. Any modification or deviation shall be communicated to the Central Office with a view to introducing changes in the provision of these services according to the dictates of experience.

2.21 The Zone Offices and the Country Representatives of the Organization shall be responsible for the application of this Manual and the progress of the advisory programs. To this end, they shall have the support of specialized PAHO personnel and of the short-term consultants appointed specifically for this task.

2.22 The channels to be followed in communicating and in performing those operations necessary to the conduct of the advisory services shall be those established by the Organization through its Country Representatives and Zone Chiefs. The latter officials shall be responsible for the negotiations leading up to the advisory services as well as for their performance and evaluation.

ANNEX D

PAN AMERICAN CENTER  
FOR  
ENVIRONMENTAL SCIENCES AND ENGINEERING



PAN AMERICAN CENTER FOR ENVIRONMENTAL SCIENCES  
AND ENGINEERING

This document reviews briefly some of the background relating to the Center: its functions; its present stage of development; and plans for the future.

Background

The increasing difficulty of providing a healthful living environment in cities continues to attract world attention. Mass migrations of populations from rural to urban areas have proceeded at a rate greater than our technology and our institutions can cope with, even in the most highly developed countries. These migrations are still proceeding - at rates even beyond those predicted. Coupled with population growth and rapid industrialization, these migrations are producing particularly serious problems of water supply, sewerage, water pollution, air pollution, solid waste collection and disposal, and housing. Occupational hazards, radiation, noise, and food contamination are accompanying developments which require increased attention. The general contamination of the environment with toxic substances also is creating rather widespread public concern. A number of these problems are closely related and can be attacked efficiently only on a coordinate basis.

Major programs have been developed in several of the economically more advanced areas in an effort to meet these massive urban problems. New departments of government have been created, new research and training centers have been established, and new incentives have been provided to both public and private enterprise in an effort to halt the degradation of the urban environment.

In areas where economic development is more recent, as in much of Latin America, resources have not been mobilized as extensively to alleviate existing problems or to prevent new ones. Further, the situation in developing countries is more critical because the onrush of urbanization is more rapid than it was in previous developing areas of the world. Thus it is more urgent to provide the resources for guiding urban environmental planning and development.

By late 1965 the need for the Organization to improve its capability to meet its emerging environmental engineering responsibilities was becoming very evident. Realignment of some of the existing resources to create a core structure that would concentrate on environmental problems in urban areas was proposed. This consolidated operation was to concentrate its energies to serve Member Governments on a Regional basis. Its functions would emphasize technical assistance and would include:

1. Central intelligence on urban problems, including the collection and dissemination of basic data and information.
2. The development of procedures for analyzing urban problems and the application of these procedures in preparing master plans, determining priorities and producing sets of program approaches.
3. Production of technical information materials.
4. Conduct of selected seminars and symposia in new areas of development.
5. Providing expert technical consultation on request of Member Governments.
6. Stimulation and support of high-quality teaching, research and service programs in the major universities of the countries.

(While the newer urban problems are stressed here, it is recognized that there are major and difficult rural problems that also must receive attention.)

This new resource would be a supporting arm of the Zone Offices just as the Zone Offices support the Country Offices and they in turn the countries. It would complete our technical support structure. Its services would be available on request of the Zone Offices to meet requests from the Member Countries that the Zones could not meet with their staff or with short-term consultants. Emphasis would be on providing specialized assistance in the development of national programs rather than on specific technical problems. Some consultation of the latter type would be provided especially where it has broad significance, but the "fire-fighting" type of request would be discouraged in view of the highly limited resources. The type of services provided would be those that could not be afforded on other than a Regional basis.

Further discussions of this proposal resulted in the concept of a Regional Sanitary Engineering Center, whose initial functions would be as outlined. In subsequent stages of development, the Center would engage in technical training and research activities.

#### The Present Stage of Development

The present status of the Center is as follows:

1. A small group of specialists has been assembled in Lima, Peru. One specialist is provided in each of the following subject areas:
  - a. Industrial Hygiene
  - b. Air Pollution
  - c. Housing and Urbanization

Specialists in three additional areas are to be provided in 1968:

- a. Water Supply
- b. Sewerage and Industrial Wastes including Water Pollution
- c. Education and Training.

Space sufficient for the present staff of three professionals is being provided in an auxiliary building at the location of the Zone Office. This space is not very adequate and provides no room for additional staff. Space is needed to accommodate the additional staff planned for 1968, to begin the assembling of a library and to initiate production of technical information materials. Accommodations for small seminars and technical conferences would be very desirable.

Establishment of a Center now is considered timely. The meeting of the Presidents at Punta del Este emphasized strongly the need to strengthen Latin American capability in science and technology. Subsequent establishment of the Regional Scientific and Technological Development Program and establishment of a Latin American Group of Experts on Science and Technology have given effect to the recommendations of the Presidents.

Many proposals for multinational programs and centers have been developed as a result of this stimulus. The mechanism for selection and funding of proposals has not yet been established. We believe the need for a Center of Science and Technology in the environmental field is sufficiently urgent and lasting to justify going ahead with our own resources.

#### Environmental Science and Engineering in Latin America Today

A review of the present status of science and technology in the environmental field in Latin America indicates the need for significant improvement.

The improvements needed coincide closely with the principal goals of the Regional Scientific and Technological Development Program, namely "to advance science and technology to a degree that would contribute substantially to accelerating the economic development and well-being of their peoples and make it feasible to engage in pure and applied research of the highest possible quality."

Emphasis is placed on the production of scientific and technical manpower, expansion of research, and extension of technical assistance.

Sanitary engineering manpower in Latin America is still far below the estimated needs and "real demand," especially at advanced academic

levels. Various estimates of need range from five to ten thousand additional sanitary engineers and related scientists. Very few good graduate programs exist, but the potential for activating several more is considered very good. Stimulation and support by the Center should yield gratifying results.

For all practical purposes sanitary engineering research may be considered to be at a baseline level of near zero. A few very modest applied research projects have been started, largely with PAHO and United Nations Development Program assistance, in the last two years. But in relationship to the opportunities and needs the research effort has to be considered negligible. The important thing is that the potential is much improved. The establishment of graduate programs with full-time faculty and laboratory facilities makes research possible. In turn, research will produce the new designs, methods and innovations that will accelerate development in and attract support from the public agencies responsible for environmental facilities and services. The importance simply of fostering and developing the research point of view can hardly be over-emphasized here. Latin America is still largely using designs and methods developed for European and North American conditions rather than ones suited to its conditions and contributing in the fullest possible way to Latin American development. Sound, high quality indigenous teaching and research institutions are an absolute necessity for full economic and social development.

The Sanitary Engineering Center would be expected to play a key role in bringing about the improvement needed. As a multinational scientific and technological center it would strengthen national scientific and technological institutions. Most of these in the sanitary engineering field need supplementing; a number of new ones need to be created. The framework for support and for interchange of ideas and staff already exists in the Latin American training network which PAHO has developed with the Universities.

As a multinational institution, the Center can bring to the attention of political heads the importance of national institutions and of international collaboration by laboratories, universities, and other institutions. Increased national strength also can result from international affiliation. These and other benefits have been identified in discussions of "centers of excellence."

#### Future Plans

Hopes and aspirations for the Center are not bounded by nor rooted in conventional sanitary engineering activities. There is the need, of course, to stay in touch with reality and to serve tangible purposes - but the success of the Center will depend more on its ability to generate unconventional approaches, different and better ways of meeting traditional problems, and imaginative ways of solving new problems.

In addition to the technical assistance functions which constitute the Center's initial activities, it would be desirable to undertake some other tasks. First among these is a quantitative and qualitative study of existing scientific and technological teaching and research programs, and a projection of their potential. The information assembled is not sufficient for specific planning to meet future manpower or research needs. In the course of this study, a reasonably accurate picture of the need for textbooks and teaching aids should be obtained. Similarly, research resources and research needs would be assessed. An appraisal of research facilities and an estimate of fellowship needs for graduate teaching and research staffs at the universities would be part of this assessment.

Much work needs to be done also in the development and application of standards. This activity is closely related to revision of designs for both large- and small-scale public works in the sanitary engineering field. It is important also in stimulating the development of new industry such as for plastic pipe and fittings, since these products will not be used widely nor move freely in commerce until accepted standards of quality and performance, and accompanying certification procedures, are developed. The collaboration of professional groups such as the Inter-American Association of Sanitary Engineering would be important to the success of such an undertaking.

Beyond the sponsoring of selected symposia in new areas, training courses would be sponsored in such subject areas as comprehensive pollution control planning, organization and management of sanitary engineering works and services, environmental aspects of river basin development, and systems engineering. Training methodology and programs for training PAHO professional staff are other potential areas for attention.

Several worldwide reference center programs such as air pollution measurement, radiation monitoring and water supply research are being activated by WHO headquarters at Geneva. The Center would be expected to be the focal point in this Region for such programs. Likewise, there are being established throughout the world new centers under the Water for Peace Program. For Latin America this Center could serve naturally as the Regional resource for the sanitary engineering aspects of water.

Finally, the Center should have a facility that will enable it to engage in a respectable program of in-house research. The firm conviction is that the Center will not achieve real leadership in research until it is engaged in research and has a true reciprocal base for communication with national research institutions in Latin America and with international research institutions throughout the world.

The rate of growth of the Center, beyond that scheduled for 1968 and 1969 (essentially out of existing funds), will depend both on internal and external support.

With respect to internal financing we propose to pursue two paths. The first is the one that is being used to get the Center started - redeploying existing resources. To the extent practical, this would be extended. However, this cannot be expected to carry the development much farther. The second is to seek orderly increases in the regular budget. The plan is to place major emphasis on the Center in the 1970 budget and to provide reasonable increments in the subsequent years until a level of support that can be sustained is reached.

At the same time external funds will be sought. It is realized that it is necessary to reach a sort of "critical mass" level of activity in order to attract certain kinds of external support (such as research grants). This makes initial support of the Center a highly critical item.

At this time a firm target for the size of the Center has not been set, nor its morphology highly described. This outline is intended to convey something of the need, the form, and the substance of what is proposed.

ANNEX E

PRESENT STATUS OF SEWERAGE SYSTEMS AND SEWAGE TREATMENT FACILITIES  
IN LATIN AMERICA

1961

PRESENT STATUS OF SEWERAGE SYSTEMS AND SEWAGE TREATMENT FACILITIES  
IN LATIN AMERICA

1961

I. Introduction

On the occasion of the present Symposium on Methods of Waste Treatment, the Pan American Sanitary Bureau deemed it necessary to undertake a preliminary investigation of the present status of sewerage systems and waste treatment facilities in Latin America. This survey is to be considered preliminary because, in the short time available, it was only possible to collect general data which would enable the Symposium to form an overall view of the present situation in Latin America, before going on to study methods presently in use in the most advanced countries in this field.

In addition to those mentioned above, this preliminary survey has the following purpose:

1. The information collected will facilitate the long-term planning of some aspects in accordance with the goals of the Charter of Punta del Este.
2. This information will also facilitate the planning of a more complete and detailed survey on this subject in the near future.

II. Survey Methods

- A. After discussing the matter with officials of the United States Public Health Service responsible for collecting similar data in the United States, a simple questionnaire was prepared.
- B. The blanks and instructions for their use were distributed, through the PASB Country Representatives and the AID Missions, to the participants from each country invited to the Symposium.
- C. The forms were completed by the participants with the assistance of the appropriate sanitation agencies.
- D. Once completed, the forms were returned to the Headquarters of the Pan American Sanitary Bureau, where a preliminary tabulation was made. The tables, also provisional, prepared from the information received are being issued separately.

III. Results

- A. Completed forms were received from 17 countries and one territory. Out of the 20 Latin American countries covered by the survey,



no forms were returned from Costa Rica, Cuba, and Ecuador by the time the preliminary tabulation was made and this summary was prepared.

- B. The information included in the questionnaires returned from Brazil and Mexico did not cover the entire country. The information relating to Peru is incomplete.
- C. Considerations based on a rapid examination of the provisional tables:
1. Table 1 and 2 show the kinds of agencies in each country responsible for the planning, financing, design, construction, operation, and maintenance of sewage disposal and waste treatment facilities.
    - a. Planning. Fourteen countries reported that planning is carried out at the national level, three that it is done at either the municipal or state (departmental or provincial) level, and one at all three levels. One country reported that there is no planning at any level.
    - b. Financing. Eight countries state that it is the responsibility of the national level whereas, in eight others, it is the responsibility of all three levels (national, municipal, or provincial). One country reports that it is solely the responsibility of the municipal level, and another that there is no financing at any level.
    - c. Design and Construction. Fourteen countries report that both activities are undertaken at the national level; two, that it is undertaken at all three levels; and one states that it is undertaken at the municipal level. Another country reports that it is not undertaken at any level.
    - d. Operation and Maintenance. Seven countries state that it is undertaken at the national level, and another seven that it is undertaken at the municipal level. In three countries, these activities are undertaken at all three levels, and one country reports that it is not undertaken at any level.
  2. Table 3 shows the number of communities with sewerage systems in each country and the size of the population served by them. The data collected in 17 countries and one territory show that 1,683 communities have sewage disposal facilities serving a total of 29,059,970 persons, or 49 per cent of the

total population of those communities. The population provided with sewage disposal facilities is roughly 32 per cent of the urban population of the 17 countries and one territory covered by the survey or approximately 90,375,000 persons.

3. Table No. 4 shows the per capita cost of construction of sewerage systems, methods of financing them, and sewerage rates.
  - a. Per Capita Construction Cost. It ranges from \$9.41 in Guatemala and \$10.00 in Brazil to a \$130.00 in Trinidad.
  - b. Methods of Financing. Twelve countries obtain funds at the national, provincial, or municipal level. Three countries use national funds of the central government. Five countries obtain funds at the national, provincial, or municipal level. Three countries state that they obtained internal or external loans, whereas one country reports the sale of bonds in the case of its capital city.
  - c. Sewerage Rates. Six countries report that they collect a percentage, tax or fee calculated on the basis of the property value whereas four countries include the sewerage rate in the water rate. Five countries do not have any system of sewerage rates, while two countries have sewerage rates in only some communities. One country gave no information on this aspect.
4. The following may be seen from Table No. 5:
  - a. Eleven countries report that they have no official standards for the design of sewerage systems and sewage treatment facilities, while five report that they have such official standards. Three countries report that they have standards for sewerage system facilities but not for treatment.
  - b. Only five countries report that they make routine BOD determinations in sewage and treated waste.
  - c. Ten countries had undertaken or are undertaking some kind of investigation or study of waste treatment.
5. Table No. 6 shows that, of the 1,683 communities with sewerage systems, 879 or 52 per cent have separate systems, whereas 306 or 80 per cent have a unified system. No information was received on this aspect from the remaining 498 communities.

6. Finally, Table No. 7 shows the number of localities with some kind of waste treatment facility, the type of treatment used, and mode of discharge of the effluent.
  - a. Only 157 communities or 7.4 per cent of the communities covered in the survey report that they have some kind of waste treatment. Of these 157 communities, 116 have primary treatment and 36 secondary treatment, whereas only seven localities in three countries report that they use stabilization ponds.
  - b. With respect to the point of discharge of the effluent, 1,068 communities (63 per cent of those surveyed) discharge their untreated waste into rivers. Of the remainder, ten do so into lakes, 82 into the sea, nine into irrigation systems, and 20 into ravines or storm runoff channels.
7. Most of the countries report that they have serious river pollution and contamination problems caused by the discharge into them of sewage from their main cities. In some cases, beach pollution is reported, and it is prejudicial to the tourist industry in some places. In one case, the pollution of a lake is reported. One country reports that the river into which the sewage from its capital is discharged provides sufficient dilution.

#### IV. Conclusions

- A. For the first time in Latin America, a survey, albeit provisional, has been made, enabling us to gain some idea of the present situation with respect to sewage disposal and waste treatment facilities in the Hemisphere.
- B. The findings of the survey are that in most countries the planning, financing, design and construction is primarily carried out at the national level, and that central government funds are used for construction purposes. With respect to the operation and administration of these services, major responsibility is vested in the municipalities, although a good percentage of the services are always administered by the central government.
- C. Only 32 per cent of the urban population of the countries and territories surveyed have any sewerage systems.
- D. Sewerage rates vary considerably. Seven countries report that no arrangements exist for the collection of such a rate. Ten countries report that their sewerage rates are based on the value of the property or are a percentage of the water rate.

- E. Only five countries report that they have any official standards for the design of sewerage systems and sewage treatment.
- F. A very small percentage of the communities surveyed (7.4 per cent) report that they have any kind of waste treatment facilities. Of those communities, about 74 per cent have only primary treatment.
- G. Only seven localities in three countries report that they use stabilization ponds as a method of eliminating waste.
- H. Most of the countries are faced with serious water contamination and pollution problems. This may be possibly one of the main problems deserving more attention in the future, especially the determination of the degree of pollution and its effect on water supplies.

TABLE NO. 1

Types of Agencies Responsible for the Various Phases of Sewerage  
And Sewage Treatment Facilities, by Country

Country	Agency Responsible for			
	Planning	Financing	Design and Construction	Operation and Maintenance
Argentina	National	National and Municipal	National	National
Bolivia	National	National and Municipal	National Municipal	Municipal
Brazil	State	National State Municipal	State Municipal	Municipal
Chile	National	National Municipal Private	National	National
Colombia	National Municipal	National	National	Municipal
Dominican Republic	National	National State	National	Municipal
El Salvador	National	National	National	National
Guatemala	National	National Municipal	National	None Municipal
Haiti	None	None	None	None
Honduras	National	National	National	National
Mexico	National Fed. District	National State Municipal	National Fed. District	National Municipal
Nicaragua	National	National Municipal	National	Municipal
Panama	National	National	National	National
Paraguay	Municipal	Municipal	Municipal	Municipal
Peru	National	National	National	National Municipal
Trinidad	National	National	National	National Municipal
Uruguay	National	National	National	National
Venezuela	National	National	National	National

TABLE NO. 2

Summary of Table No. 1

Agency	Responsible for			
	Planning	Financing	Design and Construction	Operation and Maintenance
National	14	8	14	7
Municipal	1	1	1	7
State (Provincial)	1	-	-	-
National + Municipal + State	1	8	2	3
None	1	1	1	1

TABLE NO. 3

Number of Communities with Sewerage Systems, Total Population  
and Population Served, by Country

Country	No. Communities with Sewerage Systems	Total Population of Communities	Population Served with Sewerage Systems
Argentina	56	9,827,030	6,245,100
Bolivia	11	671,408	360,890
Brazil	616	16,950,689	4,180,000
Chile	126	4,286,504	3,133,454
Colombia	469	6,051,493	4,081,450
Dominican Republic	4	522,962	345,324
El Salvador	53	728,265	531,315
Guatemala	55	687,480	256,542
Haiti	0	699,000	0
Honduras	28	335,728	113,928
Mexico	32	6,366,338	4,269,782
Nicaragua	7	336,830	115,000
Panama	14	419,483	272,390
Paraguay	1	271,900	150,000
Peru	93	4,679,000	2,500,000
Trinidad	4	90,000	45,000
Uruguay	23	1,483,900	867,910
Venezuela	91	3,924,675	1,571,285
<b>TOTAL</b>	<b>1,683</b>	<b>58,332,685</b>	<b>29,039,370</b>

TABLE NO. 4

Cost of Construction, Methods of Financing,  
and Rates, by Country

Country	Per Capita Cost of Construction	Method of Financing	Sewage Rates
Argentina	25.00 US\$	National, Provincial & Municipal Funds	Percentage of rental value
Bolivia	14.00 US\$	National, Departmental & Municipal Funds	Percentage of property value
Brazil	10.00-30.00 US\$	National & State Funds, Loans	Tax on property value
Chile	26.50 US\$	National Funds	Tax on property
Colombia	17.00 US\$	National Funds	Percentage of water rate
Dominican Republic	50.00 US\$	National Funds	None (not collected)
El Salvador	---	National Funds	None
Guatemala	9.41-88.11 US\$	National Funds Municipalities Loans	None
Haiti	---	None	None
Honduras	52.00 US\$	National	30% of the monthly water rate
Mexico	16.00 US\$	Loans National Funds	Included in the water rate (not in all cases)
Nicaragua	---	National Funds	None; only connection is paid for.
Panama	35.00 US\$	National Funds	None; in two cities included in water rate
Paraguay	11.00 US\$	National Funds	-
Peru	13.50 US\$	National Funds	Percentage of water rate
Trinidad	70.00-110.00 US\$	National Funds Loans	4% of the annual property value
Uruguay	---	Bonds (Montevideo) National Funds	Tax on property value
Venezuela	106.00-20.00 US\$	National Funds	Only in 3 communities by number of pieces installed



TABLE NO. 5

Official Design Standards, BOD Determinations, and Research,  
by Country

Country	Standards for Design of Sewerage System Facilities	Routine BOD Determinations	Investigations and Studies
Argentina	No	Yes	Yes
Bolivia	No	No	Yes
Brazil	Yes	Yes	Yes
Chile	Yes	Yes	-
Colombia	Yes (sewerage) No (treatment)	No	No
Dominican Republic	No	No	No
El Salvador	Yes	No	Yes
Guatemala	No	No	No
Haiti	No	No	No
Honduras	No	No	No
Mexico	No	Yes	Yes
Nicaragua	Yes	No	No
Panama	No	No	Yes
Paraguay	No	No	No
Peru	Yes (sewerage) No (treatment)	No	Yes
Trinidad	No	No	Yes
Uruguay	No	Yes	Yes
Venezuela	Yes (sewerage) No (treatment)	No	Yes

TABLE NO. 6

## Type of Sewage Disposal Facility, by Country

Country	No. of Communities with Sewerage Systems	Type of Sewerage Systems	
		Unified System	Separate Systems
Argentina	56	2	44
Bolivia	11	5	6
Brazil	616	2	251
Chile	126	23	61
Colombia	469	211	258
Dominican Republic	4	1	3
El Salvador	53	-	52
Guatemala	55	38	19
haiti	0	0	0
Honduras	28	-	28
Mexico	32	17	20
Nicaragua	7	-	7
Panama	14	1	14
Paraguay	1	1	-
Peru*	93	-	-
Trinidad	4	-	4
Uruguay	23	1	22
Venezuela	91	4	90
TOTAL	1,683	306	879

\*Information incomplete.