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WATER SUPPLY AND WASTE DISPOSAL  
TO LOW-INCOME URBAN SETTLEMENTS  
IN LATIN AMERICA AND THE CARIBBEAN

For Presentation at the  
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Tim Campbell, Ph.D  
Institute of Urban and Regional Development  
316 Wurster Hall  
University of California, Berkeley

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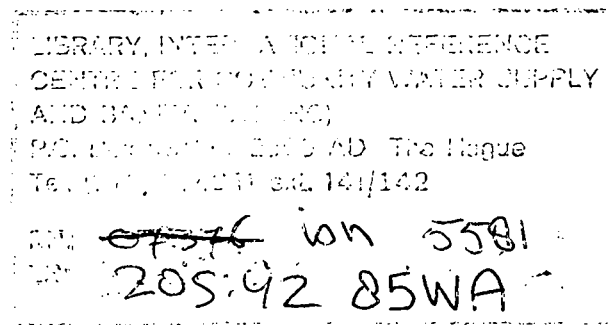
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## I. EXECUTIVE SUMMARY

The decreasing prospect for meeting water and basic sanitation goals for 1990 in Latin America and the Caribbean require major revisions in the conventional strategies for investment. The most recent projections of urbanization in the region reveal a burgeoning urban system of over 220 million people, in giant, intermediate, and small size cities, growing in step and outpacing national and international efforts to improve service levels. Low-income settlements, today representing perhaps 40 percent of this new urban growth, are subject to the most serious health risks. Under conventional approaches, extending water and waste facilities could cost \$40 billion US by 1990, \$50 billion more by the year 2000 (in 1980 prices, World Bank, 1983b). These resources are not likely to be available. A more realistic "socio-technical" approach could lower costs by half through revised standards, a strategy of phased upgrading, and extensive community participation.

Low-income settlements comprise a wide variety of settlement types ranging from slums to squatter settlements to quasi-legal real estate developments. They display various degrees of elaboration, differing background and history, and a range of socioeconomic conditions. The common factor to these settlements is that shelter and services are sub-standard, and households have intermittent, uneven and uncertain incomes. But, low-income settlements may also be seen as "resource transforming systems" which refers to the proven ability of low-income residents to generate resources given the right conditions. Resource mobilizing is common in self-help housing improvement and in the "informal" employment sector. The conditions of wealth generation are sensitive to, and may be unleashed by, policy prerogatives open to local and national officials. The most important of these conditions is that of uncertainty. Perceptions of risk and uncertainty govern a household's use of time, acquisition of knowledge, creation of monetary and material resources, and commitment of investment.

A number of cases and criteria are described in this paper to suggest that a long range strategy of a socio-technical nature starting with community participation and self-reliance and incorporating revised standards, phased investments, and new technology, is a feasible way to significantly improve the health conditions of low-income settlements. Community participation is required because of the need to coordinate service changes and improvements with household economic and resource conditions. Local participation is also the best way to protect water and waste systems thereby allowing national investments to go further. Participation of low-income settlements is an opportunity which has only scarcely been tapped in Latin America. Many prevailing assumptions and standards are far too expensive, and technical solutions are already available. A first step in this socio-technical strategy, briefly explored later in this paper, is to understand the national and local contextual conditions which favor or threaten to defeat service strategies based on community participation.

## II. DIMENSIONS OF THE CHALLENGE

### A. Projected Population

Although population growth rates have fallen, in some cases dramatically, over the past intercensal period, the total urban population in Latin America by the turn of the century could be significantly larger than the entire Latin American population today (Fox, 1982). Three times as many urban residents will require water and waste disposal as are served today. The result of the 1980 census data obtained from eight Latin American countries now confirms a trend in which the broad urban base is consolidating and in which all cities are retaining their relative proportion to one another as the entire system expands. The consequences of this growth are profound. In the first place it means that the locus of policy and financial attention must be recentered on cities. Second, more attention must now go to medium sized cities. Third, strategies to keep rural populations in place and to forestall rural to urban migration have failed or at least are now moot. Migration accounts for far less than half of the urban growth in the past intercensal period and will continue to decline in next three decades. The challenge now for basic services in urban Latin America must clearly shift to the urban stage. Table 1 illustrates the rates of growth and absolute population sizes for Latin America.

### B. Service Levels

Nearly 61% of the overall population is served with water in the region in 1980. 68 percent of the urban population, 46 percent of the rural. In some places these service levels represent dramatic

Table 1  
POPULATION AND SERVICE LEVELS

	1980	1990	2000	2025
<b>Population (Millions)</b>				
Total Population	341	467	551	845
Urban	227	318	420	714
Rural	114	149	131	131
<b>Service (Percent)</b>				
Total	49	87	100?	100
Water	68	90	100?	100
Waste Disposal	56	75	100?	100

Source: World Bank and CELADE.

Table 2  
NET NEW POPULATION AND IMPLIED INVESTMENT COSTS

	1980	1990	2000	2025
<b>New Population (Millions)</b>				
Water	154	132	134	
Waste Disposal	127	111	182	
<b>Cost (US\$ Billions. 1980)</b>				
Total (1970-1980)	20.7			
Water		16.8	17.3	
Waste Disposal		19.8	32.4	

Source: World Bank and author's estimates.

improvements over the past ten years. Brazil, for instance, added millions of new users during the 1970s. But, as Table 1 shows, service levels are still far from the goals set for 1990 which are to serve 90 percent of the urban population with water, about 75 percent with waste disposal. By convention, nations can aim for these high service levels but in practice have agreed to achieve "as many as possible" by the turn of the century. In practical terms this means not only will the 90 and 75 percent service goals probably not be met by the year 2000, but it also means that the largest fraction of low-income populations in Latin American cities will be among those still unserved by the turn of the century. This conclusion is based on simple arithmetic and a logic of commercial operations to which water companies and agencies are progressively advancing throughout the hemisphere. As budgets are cut and financial resources constrained, service improvements, extensions, and expansion are directed to areas where business is best.

Table 2 indicates the net new urban populations to be added between now and the turn of the century. By 1990 over 130 million new urban residents will require water hookups, if the International Water Decade goals are to be met. An additional 134 million will be added by the year 2000. A total of 293 million will require waste disposal. Calculated at long term average per capita investment cost in 1980 dollars, these incremental populations by 1990 alone could signify a 37 billion dollar expenditure, most of which would be required in the cities. An additional 50 billion must be added after 1990. These levels are from between two and five times the average annual level of investment carried out during the 1970s.

### C. Health Prospects

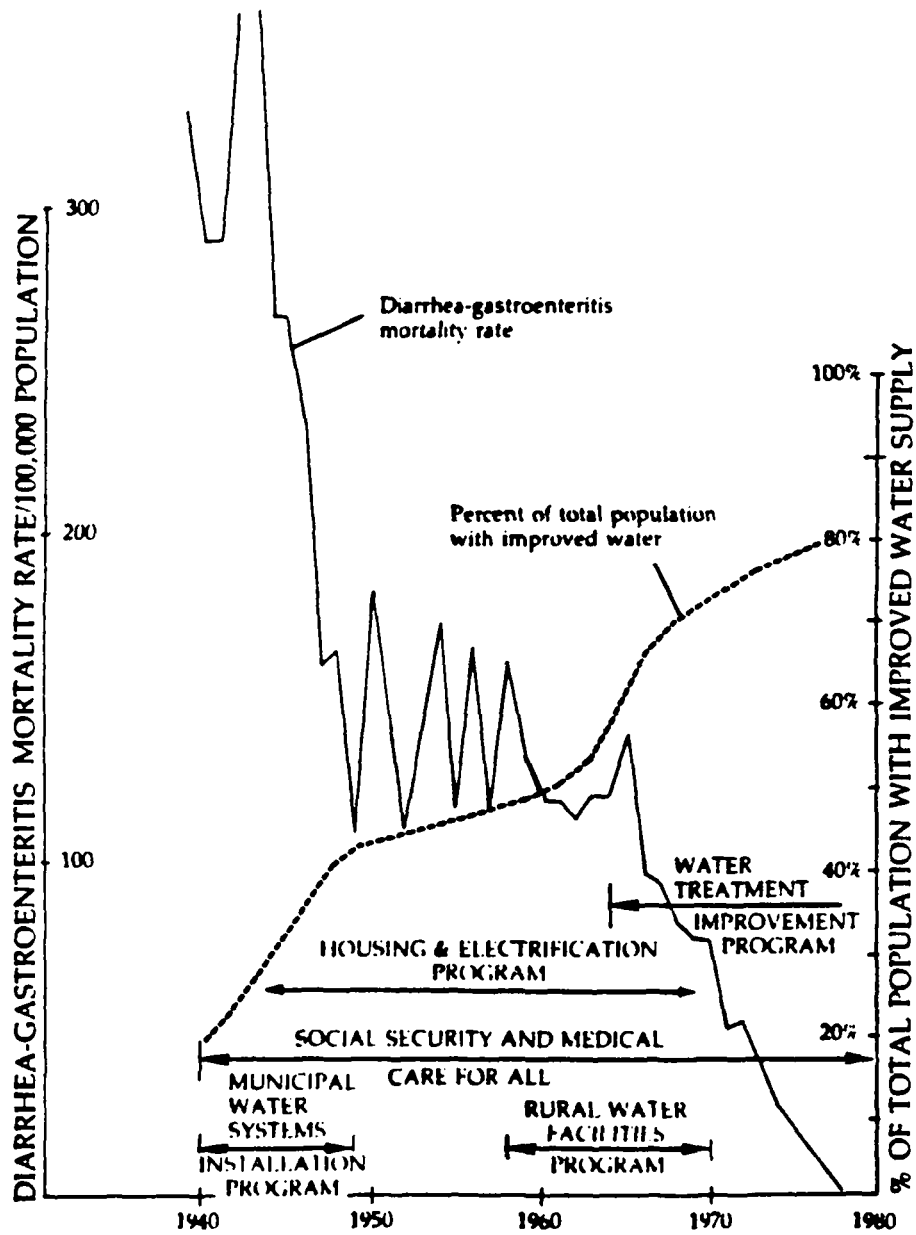
The strong relationship between water facilities and health usually underpins investment decisions (see McJunkin, 1982 for a review of the evidence and Figure 1 for a graphic demonstration of the case of Costa Rica). This argument must now also be applied to the large concentration of urban poor still without water. In the general population, mortality rates due to gastrointestinal infection among children under the age of five have improved substantially over the past decade. Death rates for children (age 1-4) as reported or calculated for 1982 in Latin America range from above 15 per thousand in Haiti and Bolivia, to between 5 and 15 for all the rest of the countries in Latin America with the exception of Panama, Chile, Brazil, Mexico, Argentina, Uruguay, Venezuela and Trinidad Tobago, all of which are under 5 per thousand (World Bank, 1984). These rates are down by 50 percent and more from 1960. But health conditions depend also on morbidity. WHO figures suggest that about 130 cases of diarrhea are reported for each death. Conditions can be expected to deteriorate in large sections of cities as waterborne diseases increase due to the rising number of urban populations served with impure drinking water.

### D. A Socio-Technical Approach

The conclusion of this brief review of numbers is clear. The Latin American nations are faced with a fiscal and health challenge of large proportions affecting vast numbers of urban populations over the next several decades. An increasing fraction of these populations will be living in low-income settlements. What strategic approach can be taken



Figure 1  
WATER SUPPLY AND HEALTH CONDITIONS IN COSTA RICA



Source: McJunkin, 1982

in order to improve the sanitary conditions of low-income settlements?

This paper argues that to meet water and health objectives, a "socio-technical" strategy is required involving a fundamental change in the approach normally taken by governments and water institutions. Appropriate technology itself is not enough. Rather, the "socio-technical" strategy must incorporate extensive community participation, reduced standards, and phased investments. Participation is required to help build, operate, and maintain neighborhood facilities. Reduced standards must be put in effect in order to increase local control in selected low-income areas. This approach is a logical extension of the self-help housing strategy. Resources are not available to provide adequate housing and infrastructure. Standards and assumptions must be revised in accordance with individual and community ability to pay. The time frame for investments must be stretched out, at least as far as conventional service standards are concerned. At the same time, less elaborate services of low per capita cost may be installed much sooner. Experience with self-help housing provides a basis for understanding and assessing the key circumstances and conditions of low-income settlements.

### III. LOW-INCOME AREAS--SIZE AND CHARACTERISTICS

Low-income areas may be defined in a variety of ways. The World Bank employs a definition based on the minimum income required to support a nutritionally adequate diet. Naturally, the number and location of people living below the poverty income varies from city to city, even within countries. A second definition is based on settlement types such as those provided by Leeds (1974 see below). Both definitional bases are adequate but, as we shall see, they lead to dramatically different operational and policy challenges. On the one hand, a large fraction of the absolutely poor urban residents are in practical terms difficult to reach with water and waste services; while on the other, targeting by housing types can make it easier to implement self-help and self-run programs but harder to extend service to all who need it.

#### A. Growth and Diversity

Leeds has identified eight settlement types in Rio, Lima, Bogota, and other cities. These include, a) squatter settlements, which everywhere share an ambiguous or outright illegal jural status; b) rooming houses (cabeca de porco, or casas subdividas); c) one and two room rental units with shared facilities (in Mexico, callejón, in Chile, conventillo); d) temporary government housing; e) multi-unit developments (unidades vecinales in Lima, and conjuntos in Rio); f) proletarian or popular housing (vilas in Brazil and Ciudad Kennedy in Bogota); g) suburbios, privately owned houses on official streets (the "quasi-legal"); and h) slums proper (or tugurios). Taken together, these various settlement types in the early 1970s covered up to 25 percent of the

Rio conurbation area, 40 percent of Lima, and nearly 50 percent of Caracas (see also Table 3 giving slum and squatter settlement populations for selected cities). Harth-Deneke (1981) estimates that quasi-legal housing in the decade of the seventies mushroomed to comprise between 30 and 70 percent of the major capitals. Quasi-legal housing results from the questionable or illegal acquisition of housing by land speculators and developers who then arrange contractual sale with buyers in lower and middle income brackets without proper inscription or registration with local authorities. Rather, title continues to be held with the developer. Quasi-legal units, sometimes known as pirate settlements in El Salvador and Colombia, may or may not include water, sewerage, paved streets, lights, and the like, depending on the force of local government intervention.

By a poverty definition, low-income populations represent about 40 percent of the urban settlements in Latin America, and upwards of 50 to 60 percent in specific instances (e.g., see Mohar, 1984). Table 4 displays this data for 1981. Population data observed in the preceding chapter suggests that low-income settlements may be growing several percentage points faster than cities as a whole, even though migration is decreasing overall. This growth over the next ten years could swell low-income urban populations by more than 40 million.

The sheer magnitude of numbers presents only part of the policy challenge to this sector. The problem is made at once more simple and more complex by the qualitative differences in social, economic, political and legal aspects of various low-income settlement types. To simplify this variety, low-income settlements are collapsed into three

**Table 3**  
GROWTH OF SLUMS AND SQUATTER SETTLEMENTS, SELECTED CITIES

Country or Area, Urban and Cities	Year	Urban Population		Population in Slums and Squatter Settlements		Population in Slums and Squatter Settlements as Percentage of City Population
		Inhabitants (in 1000s)	Annual Growth Rate	Inhabitants (in 1000s)	Annual Growth Rate	
BUENOS AIRES	1970	2,972	—	149	—	5
Belo Horizonte	1970	1,106	4.9	—	—	—
Rio de Janeiro	1970	4,855	4.4	1,456	5.5	30
BOGOTA	1969	2,294	7.3	1,376	—	60
Cali	1969	905	7.4	272	7.4	30
SANTO DOMINGO	1964	670	—	48	—	72
Guayaquil	1969	701	—	343	—	49
GUATEMALA CITY	1971	817	5.3	245	28.0	30
TEGUCIGALPA	1970	232	5.2	58	5.2	25
MEXICO, CUIDAD DE	1966	3,287	2.3	1,500	12.0	46
PANAMA CITY	1970	418	5.9	71	5.9	17

Source: U.N., 1976.

**Table 4**  
POPULATION BY COUNTRY AND REGION  
Estimated Totals, Urban and Poverty Levels 1970-1980

Country and Region	Totals		1980 Urban	1981 Urban Poverty <sup>c</sup> %	Total
	1970	1980			
Bolivia	4.3	5.6	1.8	~60	1.1
Colombia	21.3	26.7	18.7	34	6.4
Chile	9.4	11.1	8.9	~35	3.1
Ecuador	6.0	8.0	4.0	40	1.6
Peru	13.5	17.4	11.7	49	5.7
Venezuela	~14.0	15.6	13.1	~20	2.6
Argentina	23.2	27.2	22.8	~35	8.0
Brazil	95.3	118.7	80.2	55 <sup>d</sup>	44.1
Paraguay	2.3	3.2	1.3	19	.2
Uruguay	2.8	2.9	2.4	30	.7
Central America <sup>b</sup>	16.4	22.1	9.4	~40	3.8
Mexico	51.2	69.8	46.6	~45	21.0
Caribbean <sup>b</sup>	10.3	12.8	5.2	~50	2.6
<b>Total Latin America</b>	<b>270.0</b>	<b>341.1</b>	<b>226.1</b>	<b>~45</b>	<b>100.9</b>

<sup>a</sup> Includes Panama; excludes Belize. <sup>b</sup> Includes Bahamas, Dominican Republic, Haiti and Jamaica only. <sup>c</sup> Based on income needed to purchase a minimal nutritionally adequate diet plus nonfood requirements as calculated by the World Bank for 1981, except where " " appears, in which cases estimates are provided based on relative economic conditions. <sup>d</sup> Below three minimum salaries.

Source: World Bank and author.

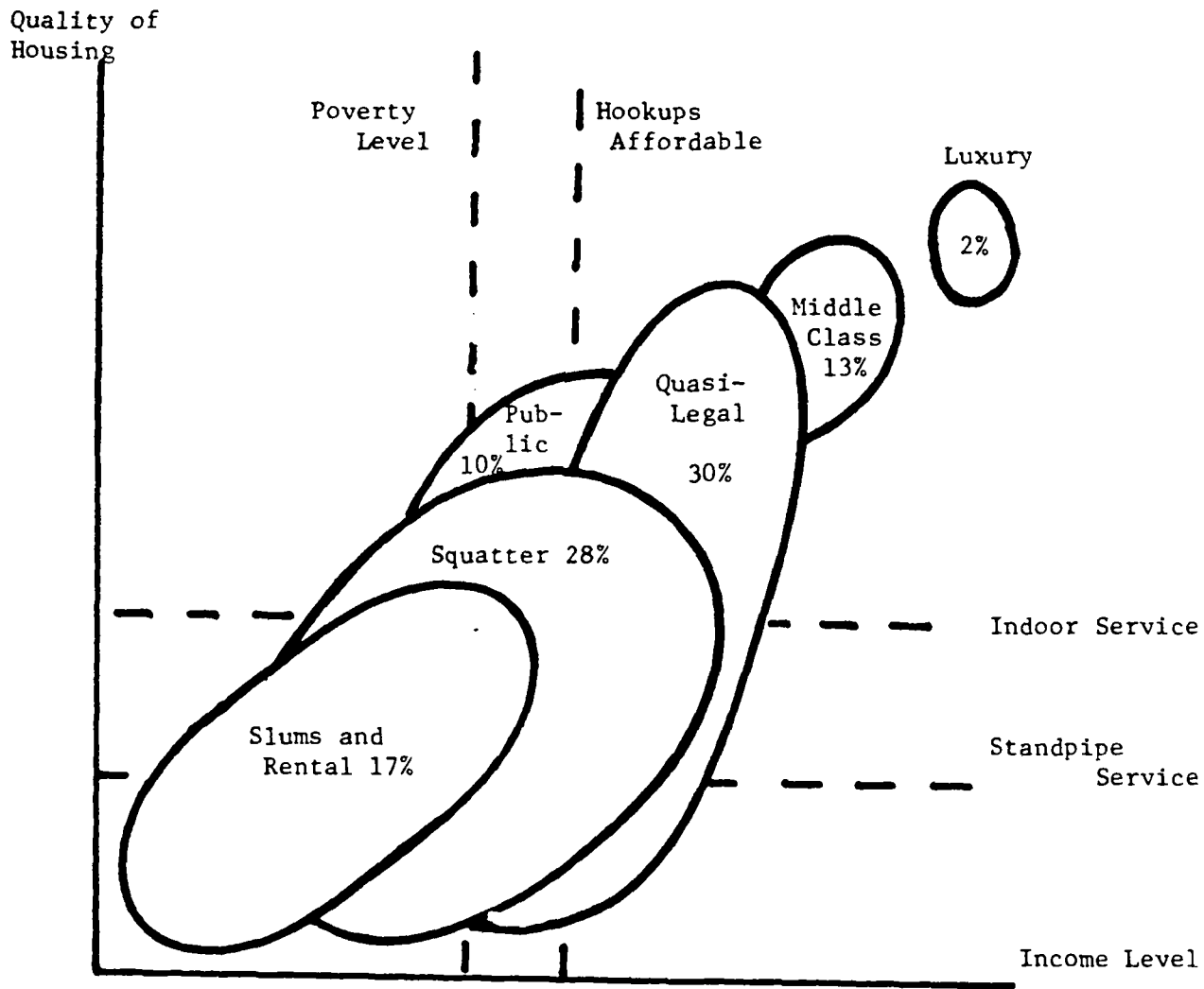
clusters in Figure 2: 1) slums, including most rental units and those not exhibiting developmental features such as capital investments and substantial shelter improvements; 2) squatter settlements where some sort of monetary or exchange value of housing and land is maintained by occupants; and 3) quasi-legal settlements in which local governments lend a collaborating hand, by omission or commission, in the founding of settlements. Other major settlement clusters are also represented. These clusters are superimposed over a simplified grid showing approximate service and income levels for shelter types and households, respectively. Figure 2 is not a rigorous "mapping" of settlements. More detailed research would be required to produce such a breakdown.\* Rather the figure presents visually the policy challenge involved in attacking basic sanitation problems in low-income urban settlements.

Intuitively, it might appear that a strategy of attacking the "quasi-legal" cluster first might benefit from the leverage already available in the administrative and "police" powers of local government. Normally, local governments are empowered to set conditions on land developments or building permits regarding basic infrastructure such as sanitation facilities. Such a strategy might hope to reach maybe 10 to 15 million urban residents without indoor water or standpipe service. However, the "quasi-legal" first strategy will result in increased housing costs in monetary terms. An argument will be made later on to suggest that the organizing energies intrinsic to most squatter communities offers a more just, and possibly a more effective, basis upon which to

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\* Available census data frequently do not cover all the relevant parameters. Even the most recent data are now likely to be inaccurate by 40 percent.

Figure 2  
SCHEMATIC MAP OF HOUSING AND  
FACILITIES BY INCOME LEVEL



Source: Author

formulate a service strategy. A broader range of households in the squatter and quasi-legal clusters would benefit.

E. Planning, Engineering, and Investment Perspectives on Low-Income Settlements

Water and waste disposal services to low-income urban settlements are usually the responsibility of state, county, or local water companies. The limited technical and financial resources available to these companies puts them in a position roughly analagous to housing agencies two and three decades ago, before self-help and upgrading strategies were formulated. For housing institutions then, and water companies now, low-income settlements are seen variously as urban cancers, "disordered," rapidly growing places of unfortunate, poor "marginal" populations, incapable or unwilling to pay for services. Frequently, low-income populations are seen as much as contributors to a poor sanitary environment--open drainage systems carrying human excrete and solid wastes--as victims of it. Occasionally, low-income residents are perceived as victims, the objects of political manipulations by local politicians seeking to perpetuate a problem that can be exploited for votes. Still, low-income settlements are the focus of lost water and revenues through clandestine connections. They are perceived as bad investment risks due to theft and the poor prospects of cost recovery, and the areas in which operations and maintenance are most difficult to carry out because of vandalism, difficulties of access, irregularity of layout, personal threats, and the like.



At the same time in a growing number of instances, innovative water supply and human waste disposal projects--either in upgrading, sites and services, or in integrated projects utilizing some form of citizen participation--have been successful. Many or all of the problems cited above in slightly exaggerated form, have been offset, overcome, or proven unfounded. The secrets for success in attacking head-on low-income, "marginal" settlements are beginning to be exposed after several decades of research, pilot projects, and experimentation. Self-help housing, sites and services, and upgrading schemes in Latin America and other parts of the world offer the main insights. In the next section we shall explore some of the contextual factors and conditions which have spelled the difference between success or failure in community participation in low-income areas.

### C. Low-Income Settlements as Resource Transforming Systems

Perhaps the most important insight into low-income settlements in the past several decades is to see the range of settlement types as flexible socio-economic systems comprised of households capable of adapting to generally adverse economic, monetary, employment, and housing conditions. Academic and institutional research has covered many facets of low-income settlements--migration, dependence, adaptation, assimilation, integration, marginality, and mobility (See Campbell, 1980, for a review of this literature). A common theme in this research is the means by which housing, employment, and basic needs are secured or compromised in accordance with circumstances and opportunities particular to individual locales, states, economic situations, and governmental conditions. Household, as the decision-making units in low

income settlements, may be seen as resource transformers similar to households in human settlements anywhere. The key distinguishing characteristics in low-income settlements are a) the variety of resources brought into the household economy, and b) the uncertainty surrounding the household unit, especially in squatter settlements. Low-income households entrain a multiplicity of resources, but rely to a relatively high degree on nonmonetary resources such as kinship networks, goods, materials, information, and individual time and effort. Uncertainty refers to the unknown and unknowable aspects of resource flows such as the intermittent nature of income, vagaries of chance in health, welfare and natural catastrophes, and, in squatter settlements, the possibilities of losing house and home with eviction. Households transform monetary and nonmonetary resources to achieve many objectives, but stated succinctly, objectives are to create wealth and offset uncertainty (see Campbell, 1980 for a discussion of theory and data).

The history of low-income settlements in Latin America and the Caribbean proves that significant monetary and nonmonetary resources are mobilized over time. Experiments have shown that a burgeoning of effort, investment, and expenditure by households is released under the right circumstances, yielding higher property values, housing quality, and environmental health conditions. Upgrading of squatter settlements in Manila resulted in 60 to 85 percent increases in property values according to statistical calculations (Keare, 1983; see also Jimenez, 1982). By gradually refining its approach, World Bank participation in 36 projects between 1972 and 1981 led to a doubling of the average size of its projects during this time period (Cohen, 1983). Similar projects have been sponsored in urban and rural areas by the Inter-American

Development Bank, and other multi-lateral and bi-lateral lending institutions, leading to significant improvements in environmental conditions and increased satisfaction (Burns, 1983).

The key to success in self help projects is frequently obscured behind a knot of complex, interrelated contextual variables, often making it impossible to discern why one project succeeds and another fails. To untangle these variables it is useful to think of the household as a decision-making unit with a variety of instruments--number of members, kinship networks, expenditures--manipulable to achieve household needs. Households operate in an environment of uncertainty layered with immediate and less direct conditions and circumstances, such as other households, physical terrain, governmental and bureaucratic institutions and the local and national economies.

Viewing households as resource transforming systems, like small businesses or factories, makes it easier to discern policy and technology options which may be helpful to improve water and basic sanitation. With constraints on resources and information, the objectives of households may be synthesized as follows: transforms what resources are abundant, but of perhaps limited exchange or market value, into something more liquid or widely needed. The typical pattern in this transformation in squatter households is to wait and watch for settlement and investment opportunities, learning by trial and error and the grapevine what is risky and what is sure, and then after establishing a settlement bridge head somewhere, gradually transforming ones personal effort and labor into shelter and facilities (or businesses or rental space), or some other capital goods with a market or at least an

exchange value. Two variables are central to this process: personal time and knowledge or information. Ironically, materials and tools are not decisive in this wealth-creation process. Therefore new and appropriate technologies, even if cheap, do not normally trigger development, although lowering costs always helps. The decisive factors are a) the knowledge that whatever commitment of resources is made will not be lost, say, with malfunction, eviction, or worse and, 2) that the "cost" in terms of one's personal time and effort fits the household budget and organization. This fit means that the technology--cement floor, porcelain fixtures, zinc roofing etc.--constitutes an investment that does not strain normal household operations. Toilets that are capital intensive, or even do-it-yourself sanitation systems that require fastidious maintenance, will fail if they disrupt the internal allocations of tasks, jobs, money and time within a household.

Thus, households in low-income situations, as businesses, bureaucrats, and tycoons constantly adjust, activate, or withhold from expenditure their resources, job options, and investment decisions in accordance with uncertainties, perceptions of risk, and availability of time and resources to reduce risks or remove uncertainties. In this sense squatters may be said to be basically "conservative" (see Marris, 1974). A squatter's decision to illegally occupy inner-city land is predicated on a balance of knowledge and uncertainty as to whether the household will be forcibly removed and its material assets destroyed. Subsequent investments in finishing detail, cement floors, and the like are similarly subject to a perception of uncertainty and calculated risks (e.g., see Elmendorf, 1980: 41). These decisions must be made by households before the various moves through the domestic housing cycles are carried

out as described by Turner (1968, see Figure 2) and modified by Edwards (1982) in the case of Bucaramanga.

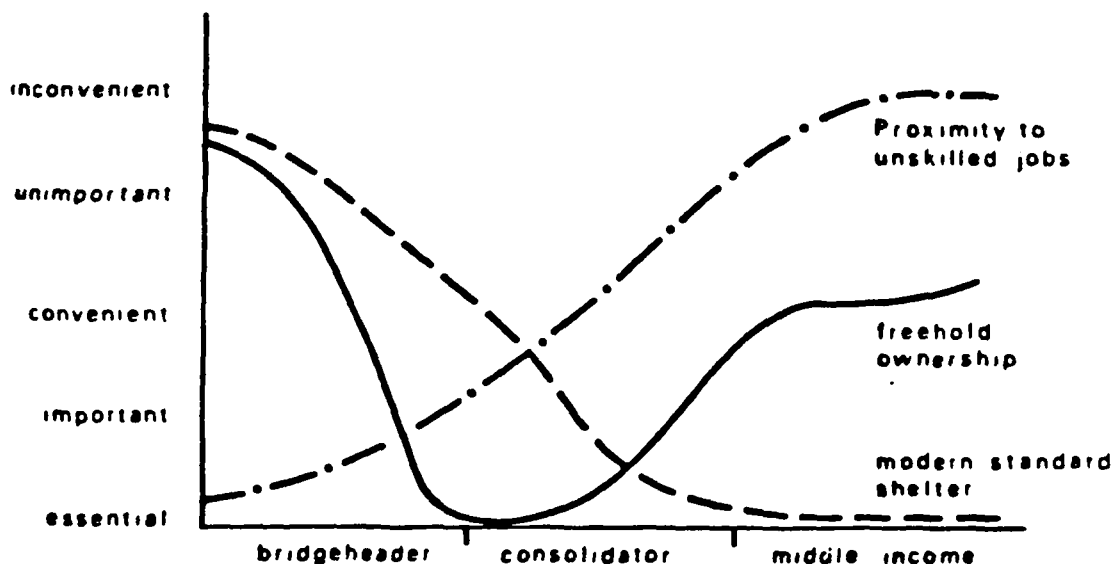


Figure 3

CHANGES IN HOUSEHOLD PRIORITIES THROUGH THE DOMESTIC CYCLE

Source: Turner, 1968

Household decisions to move from the central city to the periphery, or to make improvements in housing or amenities, depend not only upon resources at hand, but also upon the householders' perceptions of the possible reactions by authorities and new resources potentially available in a new location, e. g., new job opportunities, or kin relations, among other things. A similar pattern of calculation, removal or offsetting of uncertainties is found in the informal labor market and small businesses. Sometimes by trial and error, sometimes by shrewd insight, individual entrepreneurs barter or trade resources, get them on credit, obtain raw materials through kin networks of exchange, and seek

outlets and marketing niches subject to fewest controls either by informal competitors or local authorities (Peattie, 1980).

To repeat, the single most important conditioning factor at the local level governing the decision to mobilize resources dormant in the household system is uncertainty and the risk of losing resources so committed. No stronger evidence may be presented for this assertion than the observed flourishing of household investments in housing and infrastructure once security of tenure has been obtained. This phenomenon has been observed over and over again and now represents the single most important insight in improvement of housing and infrastructural conditions in low-income settlement areas (UN Habitat, 1981). Security of tenure is not the only policy variable open to authorities and sponsoring institutions to facilitate the mobilization of resources and investments. Numerous other policy variables are available including symbolic recognition of settlements, partial or wholesale investments in infrastructures, such as water, basic sanitation, power, and paved roads; and by the open engagement of officials or authorities with local settlements through meetings, letters of acknowledgement, and in the most diluted form, neglect or at least decisions by authorities not to remove settlements over a long period of time.

It is not surprising that squatters and official institutions which "sponsor" or program housing projects have divergent opinions about what is important in their investments. These two groups are engaged in an implicit dialogue concerning the conditions for acceptance or rejection of the settlement in the first place, and subsequent investments in housing and infrastructures. The monetary or exchange value created by

self-help and household investments in housing and infrastructures are of course, highly valued by both sponsoring institutions and self-help households. On the one hand, cost recovery, construction speed, physical appearance, adherence to building codes and standards, and other factors are important for the sponsoring institution but of low priority for self-help households. On the other side, security of tenure, proximity to central city, and proximity to friends, family, and other networks of exchange are highly important to the self-help household, and not important at all to sponsoring institutions.\*

How can the substantial resources dormant in low-income settlements be liberated and guided into water and waste infrastructure? The relative success of self-help efforts in expanding housing quality and infrastructure in the past serves as a guide for extending this strategy in the water and waste sector. Experience of some self-help efforts suggests that water and waste investments are not among the most important for residents, and not realized to the extent expected, in sites and services and upgrading projects. However, Elmendorf (1980) found that urban residents are willing to work, even specifying with whom they would collaborate (networks of kin, friends, associates) specifically on sanitation facilities. A review of selected experiences in Latin America over the past ten years helps to illustrate the contextual conditions and circumstances around which the resources of low-income households can be and have been mobilized, and to identify for both the household and sponsoring organizations which conditions must be met for the transformation process to be set in motion.

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\*This observation was developed by Campbell, et al. (1977) and cited by Perlman (1981).

#### IV. CASE STUDIES IN UPGRADING

Nine case studies have been compiled and summarized in Table 5 in order to illustrate the range of contextual issues in successful and unsuccessful experiences at upgrading in lower income settlements in Latin America. For each of the cases and places described, the kind of sponsorship or institutionalized authority, or backing, official or otherwise, at the national, state, or local levels are described briefly, together with the financial channels, resources, and, if appropriate, nonmonetary resources invested in the upgrading. Technical help and community participation are also described principally in terms of responsible agencies or individuals. The outcome of each experience is denoted and comments are also provided on the contextual history of each case. The cases illustrate that neither technical, financial, legal, institutional, products or outcomes per se is the important explanatory factor in success. Rather the character of sponsorship, the nature of policy regarding the backing for and support of strategies of improving housing or infrastructure are the critical variables in these representative cases. These cases illustrate the argument that backing at the local or national level are the decisive factors in success because they appear to have the greatest effects on reducing the uncertainties and therefore risk of loss governing investments by individual household investments.

##### A. Cases of National and Local Sponsorship

Cases in Peru and El Salvador both illustrate the ready mobilization of local institutional and squatter settlement resources to improve



Table 5  
CASE STUDIES  
SUMMARY DATA

Project Name/ Place	Sponsorship	Finance	Technical Support	Community Participation	Product/ Outcome	Context/ History
1. CODESCO/ Rio de Janeiro 1966	state agency	state	state	moderate, decision making	upgrading and expan- sion, basic facilities	Supportive policy only at state level
2. FPVM/ San Salvador 1967	community cooperative	private church	professional donated, Peace Corps	worker brigades	30 totally serviced units	Supportive policy only at city level
3. FPVM 1972	National Housing Ministry	govern- ment, IBRD	Housing Ministry	limited self-help	thousands of units	accommodating national government
4. Lima, (El Salvador) 1971	cooperative with support of state & national government	community resources, state national treasury	local & state	extensive, open-ended	housing, services, jobs, com- merce	national ideology of participation and mobilization

Table 5  
SUMMARY

cont.

Project Name/ Place	Sponsorship	Finance	Technical Support	Community Participa- tion	Product/ Outcome	Context/ History
5. COPASA/ Belo Horizonte	COPASA (state)	state	state	minimal	substitution of meters	state water company program to cut losses
6. Rural Basic Sanitation Program (RBSP)/ Colombia	National Health Institute	national	national & regional	moderate to extensive	rural water systems opera- ted and main- tained by communities	15 years experience organi- zing and supporting rural water systems.
7. EMCALI Cali (Agua- blanca)	EMCALI City water company	local, IBRD	EMCALI	moderate	upgrading of water facili- ties	extremely rapid growth of squatter settlement with extensive clandestine hookups.
8. Quasi- Legal Bogota, also Mexico, San Salvador elsewhere	private developers, sometiems city inter- vention.	private	private sometimes city	none, ex- cept for up- grading	services and housing	fantastic returns on investments, city of Bogota intervening with good results.
9. Alto Solar & Ruth Ferreira/ Rio de Janeiro late 1960s	private (squatters)	local	local hired plumbers	total	irregular services, some- times retailed	typical clandestine ar- rangements for house connections and sales to other squatters

housing and infrastructure once national political and policy support is directed in its favor. The El Salvador project in Peru and the Foundation for the Promotion of Minimal Housing (Fundación Pro-Vivienda Mínima (cited by Skinner and Rodell, 1983, pp. 125-150) provide the most robust examples of the opening of financial, technical, and other channels into which international as well as national resources could flow in support of squatter efforts. In both cases community participation was extensive from the outset, although in Lima participation carried far beyond housing and infrastructural improvements to include services, job creation, commerce, and even a local bank. The Lima project occurred in an era (c. 1971) in which a national campaign of participation and mobilization was fostered by the government. The same is true in the FPVM in San Salvador, although interestingly, the earliest stages of the FPVM, as with Codesco in Brazil in 1966, community participation was elicited by local, state, or private entities without support from the national level.

The Codesco project in Rio de Janeiro was fostered by a state agency with state financing and technical assistance. Moderate decision making and labor was provided by residents. This was a clear departure from accepted practice at the time. The same is true of the FPVM in San Salvador. Sponsored by the Mayor's office in San Salvador, the FPVM was elevated to high status and its efforts greatly magnified. Within a four year period, the FPVM grew from a local middle class voluntary organization to an official program executed by the Ministry of Housing with World Bank financing and government guarantees for the construction of thousands of housing units.

These cases illustrate the powerful effects of national backing in the form of sponsorship or support as a conditioning factor in the success or failure of community participation in self-help programs. Such backing is not necessary to launch a program but is necessary for it to continue or to grow. Of course, there are also cases in which national authorities come to play an overbearing role in the direction and efforts of local cooperatives or community organizations once they are formed, as Collier for instance has reported in the case of Peru (Collier, 1976).

P. Water and Waste: Cases of Official Sponsorship

Cases from Brazil and Colombia illustrate entirely different characteristics of participation and sponsorship directed primarily at improvements in services for water and basic sanitation. In the first case the Rural Basic Sanitation Program (RBSP) in Colombia has been operating for 15 years successfully organizing over 2,000 rural water boards for the construction operation and maintenance of local water systems in communities of 50 - 2,500. The RBSP is a dependency of the Ministry of Health, financed by treasury revenues and community participation. Technical support is provided to communities in the construction, operation and maintenance. The RBSP is a model effort mobilizing community resources to improve local infrastructure not otherwise attainable. RBSP water systems are built with an average community participation of 20 percent of the capital investment value. Up to 40 percent of the loans made during construction are paid back by the communities. Payments replenish a revolving fund set up by RBSP to help continue their operations. Local juntas maintain and operate water

systems, set and collect their own tariffs, and except for the most complicated technical matters, maintain and repair their own equipment. Extensions and upgrading of services operate in the same fashion.

A state water company (COPASA) in Belo Horizonte functions with more passive community participation. COPASA replaced water meters with flow restriction devices in low-income areas in order to cut losses from defective meters and clandestine use. Participation is required on the part of the communities only in the organization of local juntas for supervision and vigilance of the systems. But this program involved 100,000 residents in Belo Horizonte and operated successfully to cut losses of both water and administrative costs in the system.

Still another instance of community participation is being organized in the low-income settlement of Aguablanca in Cali, Colombia a community of 250,000 low-income persons, 90 percent of whom have settled within the past six years. Clandestine connections, the laying of pipe, improvised standpipes and local water distribution lines are blatantly illegal but widely visible in the community. EMCALI (the city water authority) is attempting to bring these clandestine hookups into the commercial system and to upgrade service by providing low-cost credit, technical assistance, and materials for further installations of individual and public connections.

### C. Cases of Partial, and Self-Sponsorship

Finally we have two cases of self-help that fall on either side of local or national sponsorship. First is the case of the quasi-legal housing settlements known as pirate colonies (in Colombia) or suburbios

(in Brazil). In one study of pirate subdivisions in Bogota, Allen Carroll (1980) found a strict quantitative relationship between property value and water and sewage infrastructure (including standpipes) financed by the developer. Where city intervention has been attempted, water service in the form of standpipes increases the value of the lot by a factor of two or three (Carroll, 1980). Carroll also found that private subdividers uninfluenced by the policy interventions by the city enjoyed fantastic returns on investment. City control over such developments has proven that, in hundreds of cases, water and sewerage can be financed through a private market and meet the demands for a certain strata of the urban population. Data in the Carroll study suggest that up to three-quarters of the illicit buyers would be able to afford minimum standards imposed in city-regulated developments.

In several squatter settlements studied by the author in 1977, investments in housing, water, and sewerage were made entirely in the absence of any official local or national support. The sponsorship in these cases was on the part of the communities themselves having found various ways and means to reduce uncertainty or offset the risks of their investments. In one community (in the South zone of Rio) investments in water and sewerage were widespread. Even when taken clandestinely, water connections cost money to hire skilled pipeline tappers. Conduction mechanisms through pipes, cement works, and accessories also represented substantial monetary value. No such investments were visible in a parallel community in the North zone consisting of populations of equivalent size, background, and income. The conditions of the surrounding environment, both in the labor market as well as competition for land from a private bus company, were sufficient to forestall such

investments.

Such institutionally unsponsored or self-help activities are by far the most widespread form of "participation" in low-income settlements in Latin America. These case illustrations suggest a variety of routes and mechanisms by which local or national sponsorship can accelerate and magnify community participation and self-help efforts to improve the sanitary environment in low-income communities.

The cases also expose a divergence of priorities between households and institutional sponsors in connection with infrastructure improvements. On the one hand, the households in making their decisions for investments look primarily to legal tenure, or some form of authorized or official approval, such as partial tenure, official infrastructure investments, engagements or ongoing dialogue with officials, or merely in the age of community. On the other hand, sponsors wishing to select target communities propitious for public sector investments would look first to local expressions of interest and organization. Evidence of investments already made, the degree of finishing buildings, the amount of second stories and rental housing from primary owners, clandestine hookups, and finally, local businesses, cooperatives, or improvement associations are also important. Ironically, each side in a sense looks for similar conditions and assurances. But the uncertainties represented by the absence of these conditions are most easily removed by official act. In turn, official action is mainly dependent upon a dialogue and mutual willingness of local associations to participate with official institutions and vice versa, as well as to a secondary degree, upon the presence of technical, procedural, and technological devices to enable extensions of water and waste systems at a reasonable cost.

V. STANDARDS, TECHNICAL APPROACH, AND TECHNOLOGIES

Community participation is appropriate to coordinate service expansions as and when they are convenient for the community, but participation must go hand in hand with technological changes and revisions in standards.

A. Revised Standards

Standards of service and of hardware have been adopted largely from European and First World applications with modifications to suit cost and material constraints in Latin America. Although there is probably room for modifications in technical standards concerning design lifetime, capacities, and volume of water delivered, most of the standards in operation which require modification are unwritten. For instance, complete services and universal house connections form an unwritten and expensive standard of service in water and wastes. Similarly, water-borne sewerage, metered service for water, and even the delivery of water itself from captation to individual water tap by an authorized public agency implies high overhead and administrative costs. Increased conservation and reduced losses are two additional areas where, given the high cost of water (on the order of 2-3 U.S. cents/cubic meter) and high volume of losses (40-50 percent), water retained or conserved has a high value. Conservation and loss reduction in the city of Cali alone, for instance, could in a few short years yield a return of .75 to 1.0 million dollars (see Table 6). Much higher values would be available in such arid cities as Mexico City, Monterrey, Lima, and the like.



B. New Approaches and Technologies

No new technological breakthrough is required to achieve water and waste goals by 1990. Many national and international institutions have combined their efforts to develop and perfect new or alternative low-cost technologies suitable for application in low-income urban areas. PAHO and the U.N.D.P. Technical Assistance Group are presently working to diffuse technologies. But perhaps with the exception of a vandal-proof spigot for public standpipes, no new technology is needed. Rather, more elaborate, refined, and practical configurations of present technologies are required. For instance, ablution blocks with facilities for drinking water, laundry, and personal hygiene can serve to focus facilities around community needs in a configuration which local communities can control, expand, and administer. Such a configuration, employing a "fontanero" to charge for water and maintain the facility, has been used successfully.

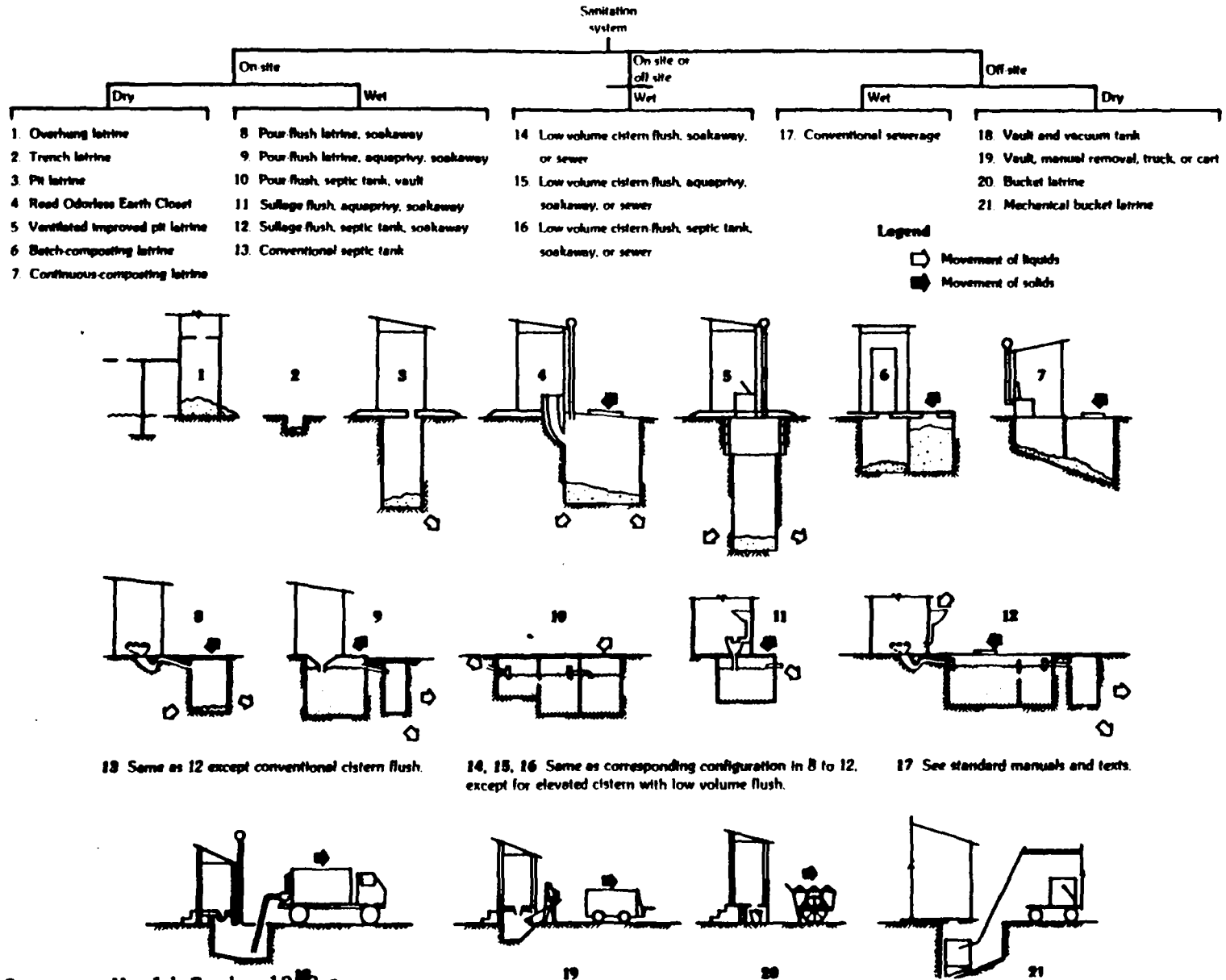
Along with these configurations, further work is required on low-flow facilities, particularly flush toilets, as well as flow restriction devices and biological waste disposal systems designed again for clustered use. The SIRDO is one such system which has been proven in several locations in Mexico (Schmink, 1984). The SIRDO system can serve the waste disposal requirements of between 50 and 150 persons in clusters of households for a cost 40 percent below standard, water-borne sewage systems. In addition, the SIRDO has the advantage of integrating organic wastes, thereby reducing solid waste collection and at the same time producing a high quality humus fertilizer for sale on local markets. Relatively intense organizational and

educational efforts are required to launch this system, although these efforts may be expected to diminish as experience and knowledge are acquired.

Finally, up-graded approaches to water and waste disposal have demonstrated cost effectiveness. McJunkin (1982) reports operating cost differentials on the order of 1 to 6 for simple water and waste systems. The World Bank has amply diffused the schematic arrangements and economic financial arguments in support of this approach (see Figure 4). Community participation fits hand in glove with this approach to the extent that control over the decision of initial investment, extension, expansions, density of hookups, placement of facilities, setting of tariffs, operation and maintenance, can be left in the hands of the community.

Figure 4

UPGRADING APPROACH TO WASTE DISPOSAL



Source: World Bank, 1983 a

VI. TOWARDS ALTERNATIVE STRATEGIES FOR WATER SUPPLY AND WASTE DISPOSAL

Financial resources are not available to meet the water supply and waste disposal goals agreed by member countries for the year 1990, and probably neither for the year 2000. This paper has argued that revisions in standards, approaches, and technologies will help not only to cut the costs of water delivery and waste disposal systems. Hypothetical revisions for Cali are illustrated in Table 6, suggesting a 40 percent savings in cost, and potential for more extensive availability of services for water and waste. But technological, institutional, and administrative reforms and innovations may not be the most important priorities, as PAHO suggests (1983). Nor can cost-cutting measures alone be sufficient to reach the health objectives of the member countries. These strategies must also incorporate various forms of community participation. This is necessary to mobilize community resources, but also more importantly, to elicit community attention and resolve to handle the wide variety of decisions and staged investments that will be required to effect minimum basic service in the first place, and later, progressively more elaborate services as the communities are ready to take them.

In effect, this argument proposes that an important fraction of the administrative, operation, and maintenance aspects of local water supply and delivery tasks be shifted from the central authority to local communities, as has been done in the Rural Basic Sanitation Program in Colombia. Local revenue collection and maintenance and repair have been and can be carried out at the local level. But to successfully

Table 6

## CALI: ALTERNATIVE STRATEGIES FOR 1990 GOALS

Strategy Component	Water				Sewerage				
	Pop. in 000's	Unit Cost	Total Cost	Net Change	Pop. in 000's	Unit Cost	Total Cost	Net Change	Total
Standard Technology	338.9	115	3.897		240	130	3.170		7.067
Conservation @.02 U.S.\$/m <sup>3</sup> 36.2 x 10 <sup>6</sup> m <sup>3</sup>	372.9		.724	-.724					-.724
Revised Standards									
1. 100 lcd	268.5	85	2.282	-.805					-.805
2. Ablution blocks					80	80	.640	-.400	-.400
3. Biological waste & pit latrines					80	50	.400	-.640	-.640
<b>TOTALS</b>									
Amount Saved				1.529				1.040	2.569
City Goals with Reductions			2.368				2.130		4.498

a. Unit costs in U.S. dollars, totals in millions.

Source: author

implement these notions a great deal more experimentation must be tried and the development of routine management and community organizational techniques refined for application to water and waste services. The groundwork for this socio-technical strategy has already be laid in self-help housing and to a lesser extent rural water and basic sanitation facilities.

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