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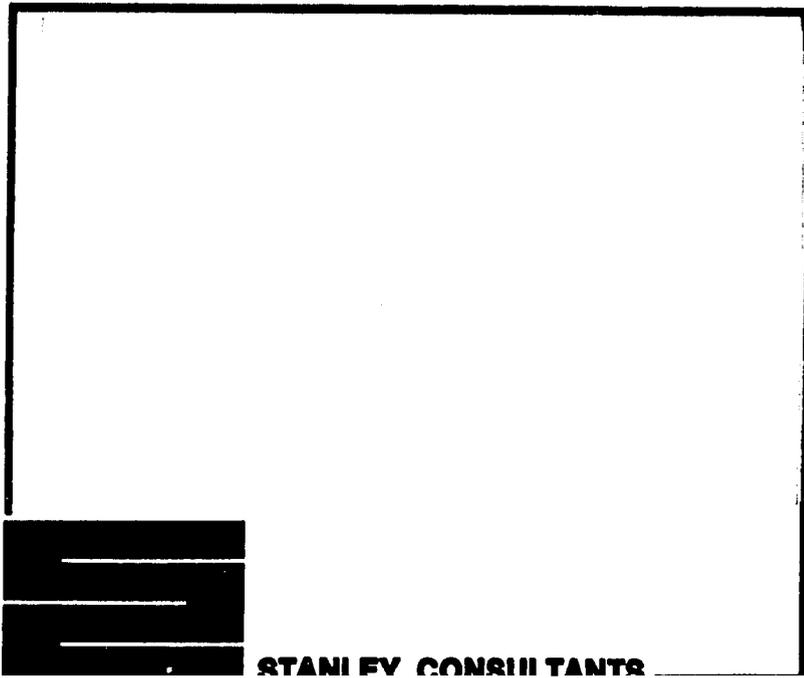
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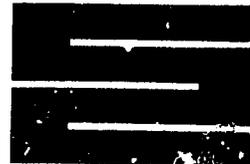
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PREFEASIBILITY STUDY
NEGOMBO METROPOLITAN AREA
WATER SUPPLY, SEWAGE
AND
DRAINAGE SYSTEMS

Prepared For
The Reimbursable Development Program
of
The Agency for International Development



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June 25, 1980

Office of Reimbursable Development Program
Bureau for Private & Development Corporation
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Agency for International Development
Washington, D. C. 20523

Attention: Mr. Richard Kranker
Project Manager

re: AID/otc-c-1628 Work Order No. 5

Gentlemen:

We are pleased to submit our prefeasibility report "Negombo Metropolitan Area Water Supply, Sewage and Drainage Systems". This has been prepared in accordance with the referenced contract and work order.

We have appreciated the opportunity to provide these services and are available at your convenience to discuss our findings; prepare terms of reference for a feasibility study for the Negombo Metropolitan Area Water Supply, Sewage and Drainage Systems or to provide a proposal to your office or to the Greater Columbo Economic Commission for the necessary consulting services for a comprehensive feasibility study.

We are submitting all 7 copies as requested to the Office of Project Development for necessary distribution to Ambassador Toussaint, GCEC, the AID Mission in Sri Lanka and within your agency.

Sincerely,

STANLEY CONSULTANTS, INC.

Richard L. Lord
Vice President

RLL:rd:7859

Enclosures

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Scope of Services

As part of a U.S. AID Requirements Contract for Sanitary Engineering Services, Stanley Consultants, Inc., was requested and later authorized to perform a prefeasibility study as follows:

1. Obtain information, based upon consultation with appropriate Embassy, U.S. AID, and the Greater Colombo Economic Commission (GCEC) for the Government of Sri Lanka, adequate to determine the General scope and magnitude of the proposed project to expand and improve the Negombo Metropolitan Area water supply, sewerage and drainage systems.
2. Analyze and provide a written report, together with substantiatory reasons, regarding whether:
 - A. The project offers a reasonable expectation for substantial (in relation to the estimated cost of a feasibility study) exports of U.S. goods and/or services.
 - B. The extent of possible non-U.S. competition for the implementation project and the U.S. competitive position.
3. If the report determines that the project offers a reasonable expectation for substantial exports of U.S. goods and services and a favorable U.S. competitive position for the implementation of the project, prepare terms of reference for a feasibility study of the project.
4. Terms of reference and substantiating report or negative report to be provided in plain typewritten form - original and six copies, within ten working days following completion of assignment in Sri Lanka.

Purpose of this Prefeasibility Study

There are five major purposes of this prefeasibility study. They are as follows:

1. Discuss scope of the entire program with GCEC to determine the extent of improvements to the infrastructure which they would like to implement.

2. Determine an approximate cost of the program which GCEC intends to implement.
3. Determine the cost of a feasibility study of adequate magnitude to satisfy lending agencies that the borrower has the ability to repay a loan through revenues and has established adequate cost benefit ratios in justifying the project.
4. Estimate for U.S. AID a probable amount of U.S. goods and services which might be incorporated into the final project and submit the ratio of feasibility study dollars to U.S. dollars goods and services to U.S. AID in Washington for their approval or rejection.
5. If the ratio submitted is satisfactory, the Ambassador can request that the study monies be made available in the form of a grant and that the terms of reference are prepared.

Study Funding

The proposed grant to conduct a feasibility study for providing water, sewage and storm drainage for Great Metropolitan Negombo as planned by GCEC has certain established rules for evaluation. This prefeasibility study was undertaken to provide the necessary cost information to make the evaluation. The grant is part of an R.D.P. program to promote development in host countries and to obtain for the United States an acceptable return in use of U.S. goods and services for providing the grant. This evaluation is the ratio between the cost of the feasibility study and the probable amount to be expended on U.S. goods and services in a world-wide competitive situation of finance, such as a loan by IDBA, The Asian Development Bank, or one of the Arab Funds. The ratio sought is generally a minimum of 50 or 100 to 1.

Meetings and Itinerary

An outline of the meetings and itinerary during this prefeasibility study are shown on Table 1 on the following pages:

TABLE 1
MEETINGS AND ITINERARY

<u>Date</u>	<u>Subject</u>
Monday, June 16, 1980 (a.m.)	Visited with Mr. Erikson at his office in the U.S. AID Mission office and obtained tentative schedule of meetings for the next two days.
Monday, June 16, 1980 (p.m.)	Held a meeting with U.S. AID personnel to determine general scope and magnitude of project as viewed by U.S. AID Mission. Present at meeting were John Erikson, Assistant Director, U.S. AID; Ralph Singleton, Chief Project Development and Support Office, U.S. AID; Vitus Fernando, Capital Development Assistant, U.S. AID; and R. L. Lord, SCI. R. L. Lord presented a rundown on his past experience in developing countries and that of SCI. Provided a copy of the Scope of Services as received from Dick Kranker, U.S. AID, Washington to Mr. Erikson. Received a copy of "Sri Lanka's Investment Zones". The prime effort is to determine overall project cost for a program of the magnitude envisioned by GCEC and the cost of a feasibility study for this program. The ratio of return for feasibility study dollars was discussed with a target of 100:1. This information will be telexed to Washington when established. This project would be considered to be financed by a fund like World Bank or one of the Arab Fund. R. L. Lord should discuss with GCEC the division of labor between their staff and the National Water Supply and Drainage Board in establishing standards and in review of submittals.
Tuesday, June 17, 1980 (a.m.)	Meeting with GCEC in Air Lanka Building. Present at meeting were Mr. K. Godage, Secretary General, GCEC; Mr. G. K. Amaratunga, Senior Manager, Regional Development and Local Administrator, GCEC; Mr. G.

TABLE 1 (continued)

Date

Subject

Dattari, U.N. Consultant for GCEC; Mr. L. D. Dickman, Planning Manager, Regional Planning GCEC; Mr. D. Samaraweera, Administration Office of GCEC; Mr. M. Silva, Civil Engineer, GCEC; Mr. P. V. Gunasinghe, National Water Supply and Drainage Board; Mr. Ferando, National Water Supply and Drainage Board; Mr. Vitus Fernando, U.S. AID; Mr. John Binskey, Second Secretary (Economic-Labor), U.S. Embassy, and R. L. Lord, SCI. Mr. Godage, who chaired the meeting, outlined the importance of this project in implementation of the required infrastrucure for the investment zone. Mr. John Binskey clarified the U.S. AID position that this effort was a prefeasibility study to determine whether it was appropriate for the U.S. Embassy to request funding for a grant to finance a feasibility study to evaluate the program. Received a map of the four residential areas envisioned for the project; a draft report dated 6-15-80 outlining history, demographics, and socio-economics of the area; GCEC report 6-16-80 regarding the Negombo Water Supply and Sanitation; a draft Negombo Area planning report dated 6-15-80; a finally reviewed proposed design of storm drainage project for storm drainage in Negombo for which the service area is shown in pink on Figure 1. This storm drainge portion should be limited to Negombo and Kochchikade with the remaining areas surface drainage being covered in land development costs. It was clarified that the National Water Supply and Drainage Board would be heavily involved in review and approval of submittals. At this meeting arranged times for subsequent meetings with the National Water Supply and Drainage Board and the Irrigation Department.

TABLE 1 (continued)

<u>Date</u>	<u>Subject</u>
Tuesday, June 17, 1980 (p.m.)	<p>Meeting at National Water supply and Drainage Board. Present at meeting were Mr. Gunasinghe, Mr. Stevens and Mr. Whitehead, all of the National Water Supply and Drainage Board; Mr. Dattari of GCEC and R. L. Lord of SCI. Mr. Gunasinghe outlined the unit processes of existing 2.7 mgd plant, which is only capable of being operated at 2.2 mgd. This is a rapid sand filtration plant taking water for the Maha Oya River. They are currently completing design plans for expansion of this plant to 5.5 mgd. Expansion would be by addition of new low dam, additional influent pumping, aeration, two new rapid sand filters, additional ground storage, a new booster pump station and some additional transmission main piping. Mr. Stevens and Mr. Whitehead discussed plans for further expansion of the plant transmission and distribution system to 16 mgd. Planned water consumption by users was agreed upon at this meeting and are presented in Tables 2 and 3 of this report. Was provided a report dated June 12, 1980 regarding the Negombo Water Supply.</p>
<p>Tuesday, June 17, 1980 (4:00 p.m.)</p>	<p>Meeting at the U.S. Embassy. Present were U.S. Ambassador Donald R. Toussaint, John Erikson, U.S. AID, Mr. John Binskey, Second Secretary (Economic-Labor), U.S. Embassy Vitus Fernando, U.S. AID, and R. L. Lord of SCI. Outlined to the Ambassador the scope of this prefeasibility study. The plans of GCEC toward the total project and the clarification which had been made to GCEC by Mr. Binskey regarding the extent of this possible grant and the necessity for obtaining further funding. Discussed the target rates between feasibility grant dollars and potential U.S. goods and services to be incorporated into the project.</p>

TABLE 1 (continued)

<u>Date</u>	<u>Subject</u>
Wednesday, June 18, 1980 (a.m.)	<p>Meeting at Irrigation Department. Present at meeting were Mr. Justin Gunasekera of the Irrigation Department, Mr. Dattari of GCEC and R. L. Lord of SCI. Discussed reliability and extent of existing stream flow records and anticipated stream flow based on gaugings from Badalgama Station 8 miles upstream with records since 1953. Reviewed a February 1980 report, "Dual-Purpose Utilization of the Maha Oya Water Resources for Supplemental Irrigation and Public Water Supply" and "Water Supply Master Plan" dated 1972. It would appear that about every 20 years, flows might drop to as low as 7 mgd for up to a 20-day duration, thus not being reliable at all time for the entire regional area potable water demands. Also to have this reduced amount of water available calendar planting of rice in the Katugampola Electorate would be necessary to prevent irrigation demands from occurring coincidental to normal low flow domestic water withdrawn. Discussed and verified the location of the proposed Holombuwa Reservoir Site on a map of the Kelani Ganga River Basin.</p>
Wednesday, June 18, 1980 (p.m.)	<p>Meeting at National Water Supply and Drainage Board. Present at meeting were Mr. Fernando of the National Water Supply and Drainage Board; Mr. Dattari of GCEC; and R. L. Lord of SCI. Mr. Fernando explained that at the present time there is no underground water-</p>

TABLE 1 (continued)

Date

Subject

borne sewage system in any of the service areas. He provided for review at his office a final design report by Engineering Science, Inc., entitled, "Sri Lanka Sewage Project 1980" which was World Bank funded. This report recommended providing a sewage system for the Negombo City as part of the study. This system was limited to Area 1 as shown on our Figure 1. The systems proposed in this study included an extensive underground sewer collection system, pumping stations, and disposal at sea with screening. Also available for review was an oceanographic study by Engineering Science. These two studies combined indicated less than positive indications that disposal at sea would have no adverse affects on the beaches at Negombo. It is this writer's conclusions that further study should be undertaken before this form of disposal is undertaken due to the lasting detrimental affects it could have on tourist trade should the system not work. The soils information indicated that the subsurface is fine sand with a water table 4 to 7 feet below the ground. These conditions make the system quite expensive to construct. Mr. Fernando also gave us the final design plans already completed for two areas of Negombo which have been completed by Engineering Science and the tender documents and cost estimates are near completion, these areas are designated in blue on Figure 1. SCI was provided a two-page report dated May 6, 1980 regarding the Negombo Sewage Project.

Thursday, June 19, 1980

R. L. Lord spent the day at U.S. AID office analyzing data collected regarding proposed systems and cost information available.

TABLE 1 (continued)

Date

Friday, June 20, 1980

Subject

Travelled to Negombo with Mr. Dattari and Mr. Stevens of National Water Supply and Drainage Board. In Negombo, met with Mr. Rajapakse, Special Commissioner, and Commissioner Abeyatala. They provided us with drawings of the distribution system which we could review. The indication was that three of the four elevated storage tanks were ineffective in holding their total volume in that they had been built at different elevations and thus only one tank was basically effective for its full volume. The other tanks were only partially effective. It was felt by all that the basic distribution piping system for the present City of Negombo was quite adequate. We were provided with the following distribution system operational costs for Negombo on an annual basis last year. They were: 82,158 rupies for administration; 44,570 rupies for labor and materials; and 360,000 rupies for water purchased. They suggested that a system be adopted in which the first 1,000 gallons per month per customer would be free and that the water consumed would be metered with a increasing rate as water consumption went up to pay the costs. They suggest that the better-off families could afford a figure approaching 50 rupies per month in this region. After this meeting, Mr. Rajapakse accompanied Mr. Dattari, Mr. Stevens, and Mr. R. L. Lord of SCI to the water treatment plant. We were provided a tour of the plant where present deficiencies were indicated and we were also allowed to look at the monthly operating records which showed how total operating costs for producing water were recorded. In the month of May, the cost was 125 rupies per 1,000

TABLE 1 (continued)

Date

Subject

gallons produced; the month of April 1.17 rupies per 1,000 gallons produce
 The information and tour was provided by Mr. K. N. P. Silva, Officer in
 Charge at the Bambukulia Water Treatment Plant. After obtaining the
 information at the water treatment plant, we went to the potential ground
 storage site where a large reservoir could be built atop the only major
 hill in the region. This would provide adequate head for the entire
 region. After leaving the reservoir site, we toured the entire service
 area via roads throughout the four residential regions indicated on
 Figure 1.

6 Saturday, June 21, 1980

R. L. Lord met with Mr. John Erikson of U.S. AID at 9:00 a.m. Provided
 him with an initial estimate of study cost versus probable U.S. purchase
 information which could be forwarded by telex to U.S. AID in Washington
 for their evaluation and comment. The remainder of the day was spent in
 attempting to establish industrial, commercial, governmental, and resi-
 dential consumers share of the capital and operating costs anticipated
 for the appropriate systems.

Sunday, June 22, 1980

R. L. Lord of SCI made a reconnaissance tour to region and along the
 route between the approximate site of the proposed Holombwa Reservoir
 Site in the Kelani Ganga River Basin and Greater Negombo.

TABLE 1 (continued)

<u>Date</u>	<u>Subject</u>
Monday, June 23, 1980	Spent in completing the cost estimates for serving the entire region and estimating the cost of the feasibility studies. In the afternoon, met with Mr. Amaratunga and Mr. Dattari of GCEC and indicated to him the apparent extent of the burden seen for residential areas and discussed the possibility of limiting the program to just potable water as it seemed to be the most immediate need. He agreed this could be part of our recommendation. In addition, we discussed the status of GCEC dialogue on obtaining funding for this project. He indicated no concerted effort has been made at this point in time to obtain funding for the project.
Tuesday, June 24, 1980	Spent in preparation of a presentation to the Ambassador and to GCEC, as well as preparation of the text for this report.
Wednesday, June 25, 1980 (a.m.)	Spent in preparation of this report, as well as some final modifications to the cost estimate and the presentation charts. The presentation was made to GCEC at approximately 11:00 a.m. The GCEC was chaired by Mr. E. P. Paul Perera, Deputy Director General of Administration of GCEC and was attended by numerous GCEC members and Mr. John Erikson of U.S. AID, as well as R. L. Lord of SCI who made the presentation. The meeting ended with a discussion of possible sources of program funding including U.S. AID.

TABLE 1 (continued)

<u>Date</u>	<u>Subject</u>
Wednesday, June 25, 1980 (p.m.)	Made a final presentation of the pre-feasibility findings to the Ambassador. The meeting was attended by U.S. Ambassador Toussaint, Mr. John Binskey of the Ambassador's staff, Mr. John Erikson, U.S. AID Mission, and Mr. Vitus Fernando of the U.S. AID Mission, and Mr. Ralph Singleton of the U.S. AID Mission. After the presentation, SCI was instructed to withhold preparation of terms of reference for a feasibility study until further request by Mr. John Erikson of the U.S. AID Mission.

Greater Colombo Economic Commission

The authority is a special autonomous statutory body for the Sri Lankan Investment Promotor's 160-Square Mile Zone. The five-member board, headed by a Director-General, functions directly under the President of Sri Lanka. The GCEC's objectives are to promote export-oriented foreign investments, create employment opportunities, and increase export earnings.

To plan and implement this growth, GCEC obtained the services of a consultant and has completed the planning for the Northern Region, Phase I; a 500-acre site at Katunayake adjacent to the international airport, and planning was also performed for Phase II which was for 130 acres.

The plan identified appropriate industries for the zones to best use the country's labor forces and raw materials. The overall plan included infrastructure planning for the region. Once fully developed, the industrial zones are expected to have a significant impact on Colombo and its economic development, as well as the well being of its citizens.

The Northern Region (Region I) of Greater Colombo Economic Commission has an important role to play in the orderly development of the GCEC area. Negombo Town is the focus of this region and naturally the Negombo Metropolitan Area will have to respond quickly to the growth taking place in and around it. With the rapid growth of employment in KIPZ which is expected to reach 46,000, the pressure on the Negombo area to provide housing for workers and related facilities assumes immediate importance. Tourism, fisheries and growth in airport traffic will further add to the economic activity in the area and call for a systematic development of the Negombo area.

Preliminary assessments indicate that the population in this region will grow from its present 179,000 to about 300,000. The population will consist of 40 percent or 18,400 workers of KIPZ who will like to relocate close to KIPZ and other migrants attracted by the growth of ancillary industries and services in the area.

The new housing demand for the population anticipated is assessed to be of the order 18,400 dwelling units and 14,720 dormitory places of which 11,040 dwelling units and 7,360 dormitory places would be for KIPZ workers.

Dwelling units and dormitories are only part of the development. People require other amenities and services for healthful and convenient living - shopping, health, education, community and recreation facilities space for other economic activity such as industries, whole-sale storage and utilities and services, such as water supply, sewerage, storm drainage, power, etc. It is, therefore, necessary to plan for the residential areas in a comprehensive manner providing for all the requirements of the population.

The target income group for most Sri Lankan employees will be 500-1,200 Rs. per month.

Service Area

The service area covered by this prefeasibility study basically is the northern region of the industrial Free Trade Zone which is outlined in yellow on Figure 1. Within this region there have been four zones designated to serve the residential population anticipated for this northern region which are outlined in green on Figure 1. These four zones are listed in Table 2. In addition, Table 2 designates the anticipated year 2000 population for each of the four residential zones as well as the anticipated daily water consumption in imperial gallons per capita per day for the four residential regions.

FIGURE 1
SERVICE AREA

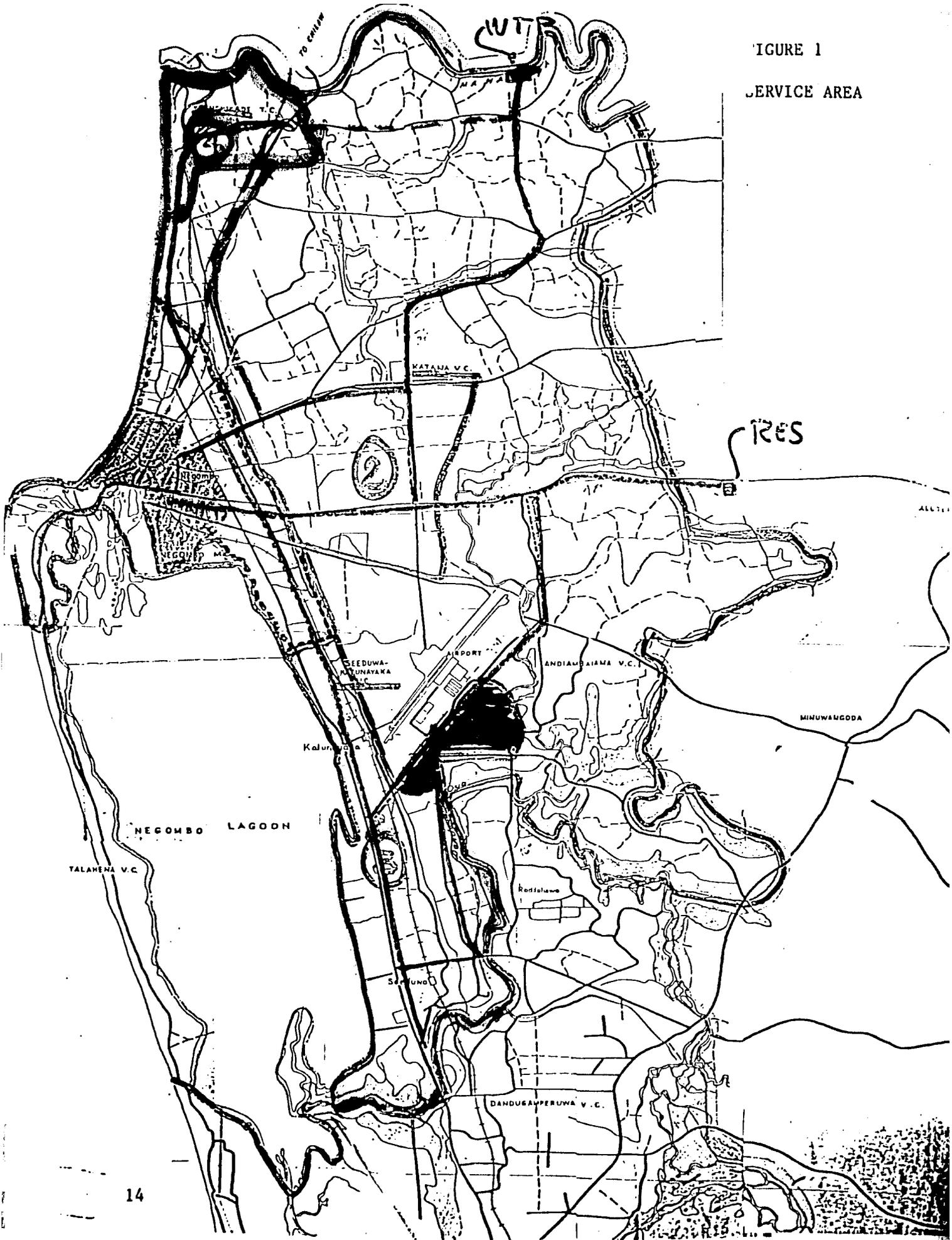


TABLE 2
POPULATION AND WATER CONSUMPTION ESTIMATES
FOR RESIDENTIAL AREAS

<u>Area</u>	<u>Name</u>	<u>Estimated Population</u>	<u>Per capita Consumption Water</u>
1	Negombo	200,000	40 gpcd.
2	Katana		
3	Seeduwa-Katanaayaka	80,000	45 gpcd.
4	Kochchikade	20,000	30 gpcd.

On Figure 1 also designated in orange, is the K.I.P.Z. which is the actual industrial area for the region.

The figures presented in Table 1 coincide with the current planning work being done by GCEC in developing land use and infrastructure planning for the region.

The extent of area to be served will be as follows:

	<u>Extent To Be Serviced (sq. mi.)</u>	<u>Remarks</u>
Negombo	4.00	Excludes lagoon area.
Kochchikade	1.50	Includes K.I.P.Z. industrial area of 410 acres with an employment of 46,000
New Urban areas in Katana	5.00	The new Katana Town will extend over 3.0 sq. miles and have a population of 80,000.

Water System

Existing Water Supply - Negombo residential Area 1, shown on Figure 1, has a protected water supply system established in 1965. The water is drawn from Maha Oya River at the Bambukuliya Plant at a distance of about 5 km upstream from the confluence of the river with the sea.

At present, Negombo gets about 2.2 million imperial gallons/day and the estimated population within the area served is of the order of 80,000 although the population within Negombo M.C. is estimated at 58,654 (1979). The plant is a rapid sand filtration type preceded by aeration, flocculation, and sedimentation with chlorination at a clearwell.

In 1971, Negombo town had 8,725 housing units and 356 living quarters (other than housing units [hostels, etc.]) of these 5,079 were permanent, 2,316 semipermanent and 1,330 temporary. The average number of occupants/unit is 6.3. The number of houses which were served with water supply is indicated below:

Taps outside house	5,005
Well (exclusive use)	2,412
Well (shared)	4,137
Other	533

Thus, 50 percent of the housing units do not get protected water and out of the remaining 36 percent of the units have taps outside the premises.

Negombo area has nine star hotels with a total of 550 rooms. Of these, only a few hotels are supplied adequately with protected water from the Maha Oya.

All remaining areas have no existing protected water systems.

Current Planning - The present supply is inadequate as the present supply is less than 35 gallons/capita. The ultimate requirement for a population of about 300,000 in the year 2000 is of the order of 16.0 million gallons.

The motors for the low lift and high lift pumps installed have worn out and their replacement to ensure supply has become imminent.

Due to restrictions of power available from the electricity grid, a standby generator is required to ensure adequate supply of water.

A large number of houses are not served by individual taps. The slums and shanty dwellings are served by street taps and it will be necessary to provide adequate supply for these people. A number of star

hotels need also to be served with protected water supply. The distribution network requires extension and strengthening with storage reservoirs at suitable places. The present supply can be augmented up to 5.5 million gallons by improvements to Bambukuliya plant.

The National Water Supply Board has identified the action required for augmentation of water supply to Negombo and are preceeding with design. The more important of these items are:

1. Repairing existing intake.
2. Install new intake pipes at low level.
3. Install new desilting pumps.
4. Install new low lift pumps.
5. Install new main low lift pumps to aerator.
6. Install extra weir length.
7. Install two new rapid sand filters.
8. Clean existing rapid sand filter.
9. Amend backwater arrangements.
10. Improvements to instrumentation.
11. Build new high level pump house.
12. Install new high level pumps.
13. New 18-inch delivery main from high level pump house to Negombo.

In addition, it would be necessary to build additional capacity to provide 16 million gallons per day adjacent to the existing expanded plant. Figure 1 indicates in red the location of the water treatment plant, and a scheme consisting of a ground storage reservoir and major transmission and distribution mains to serve the Greater Negombo Metropolitan area's year 2000 needs.

Sewerage System

Existing Sewage System - At present neither Negombo proper or any of Greater Metropolitan Negombo has any waterborne sewerage system. In Negombo, out of 8,461 occupied housing units 1,595 have flushout latrines, 1,387 have water-seal latrines; 2,306 have bucket latrines; 964 have pit latrines, and 2,132 have no latrines at all. Since the area of Negombo is flat, and in large areas, the water table is very

high, the septic tank drainage systems do not work satisfactorily in many areas. Stagnate septic water ponds in many areas create a serious health hazard and a source of waterborne disease when employed in conjunction with the many shallow wells employed in the area.

Current Planning - An underground drainage scheme has now been prepared by the National Water Supply Board. This proposal is the sewer the area within Negombo Municipal limits and dispose of the sewage into the ocean through an ocean outfall.

Detailed designs, drawings, and contract documents have been prepared on a collection, pumping, and ocean disposal system for the blue area shown on Figure 1.

A similar system is currently envisioned for Seeduwa-Katunayaka which would probably use the same outfall as Negombo. Another system combining Katana and Kochchikade into one additional common outfall near the mouth of the Maha Oya River is currently envisioned for these two residential areas.

Storm Water Drainage

Existing System - Negombo shown as Area 1 on Figure 1, may be divided broadly into three zones for surface drainage purposes. The area to the west of the Dutch Canal; the area between the Dutch Canal and Mosque Road; and the area between Mosque Road and municipal limits. The terrain of Kochchikade is also quite flat and not much above sea level. None of these areas are well drained with any maintained type of existing system.

As far as Katana, new developments and Seeduwa-Katanyaka new town are concerned, the surface drainage scheme will be considered part of land development and are excluded from the prefeasibility study.

Current Planning - The most severely affected area is the area between the Dutch Canal and Mosque Road which is generally flat and not very much above sea level. The Water Supply & Drainage Board has prepared designs for this area shown in pink on Figure 1 consisting of open ditches, culvert and storm water pumping facilities. Similar type facilities would be anticipated for the remainder of Negombo and Kochchikade.

Cost of Infrastructure

Based on current infrastructure planning and partial designs completed for the greater Negombo metropolitan area, estimated capital costs for these improvements are presented in Table 3. These costs are estimated as of July 1, 1980. These capital costs include in addition to estimated construction costs, approximately 15 percent for taxes, duties, and dockage, 15 percent for contingencies, and an additional 7 percent for engineering design and construction supervision. Thus a total overall project cost for the infrastructure for the entire region up to the year 2000 is presented in Table 3.

TABLE 3
ESTIMATED CAPITAL COSTS

<u>System</u>	<u>Cost</u> (million \$/U.S.)	<u>Cost</u> (million Rs.)
Water	34.0	544.0
Supply & Treatment	10.3	164.8
Distribution	18.9	302.4
Storage	4.8	76.8
Sewage	67.0	1,072.0
Collection	63.0	1,008.0
Disposal	4.0	64.0
Storm Drainage	<u>10.0</u>	<u>160.0</u>
TOTAL	111.0	1,776.0

Cost Allocation

The purpose of this section is to indicate the magnitude of costs relative to the three infrastructure systems included in this prefeasibility study to various entities. The four entities considered were the hotels, industry, government, and the residential areas of Negombo-Katana, Seeduwa-Katanayaka, and Kochchikade, as well as an overall total. These units are shown along the top of Table 4 on the next page.

TABLE 4
COST ALLOCATION

	Unit for Payment						Total
	Hotels	Industry	Government	Negombo & Katana	Seeduwa- Katanayaka	Kochchikade	
WATER SYSTEM							
Million imperial gallons per day (mgd)	1.2	1.5	1.0	8.0	3.6	0.7	16.0
Percent of total (X)	7.5	9.4	6.2	50.0	22.5	4.4	100.0
Share of capital cost (million Rs.)	41	51	33	272	123	24	544
Annual share of capital cost (million Rs.)	1.9 (5.1)	2.4 (6.4)	1.6 (4.1)	12.7 (33.8)	5.7 (15.2)	1.2 (3.0)	25.5 (67.6)
Annual share of operation cost (million Rs.) (1.25 Rs./1,000 gal.)	0.5 (0.5)	0.7 (0.7)	0.5 (0.5)	3.6 (3.6)	1.6 (1.6)	0.3 (0.3)	7.3 (7.3)
Res. share of capital cost (Rs./month)	--	--	--	33 (88)	37 (99)	31 (81)	--
Res. share of operation cost (Rs./month)	--	--	--	9 (9)	10 (10)	8 (8)	--
Deficit per res. (Rs./month)	--	--	--	15 (75)	7 (65)	19 (69)	--
Deficit (million Rs./year)	--	--	--	5.7 (28.6)	1.1 (9.9)	0.7 (2.6)	7.5 (41.1)
SEWER SYSTEM							
Share of capital cost (million Rs.)	80	101	67	536	241	47	1,072
Annual share of capital cost (million Rs.)	3.7 (9.8)	4.7 (12.5)	3.1 (8.2)	25.1 (66.5)	11.3 (29.9)	2.2 (5.8)	50.1 (132.7)
Annual share of operation cost (million Rs.) (0.25 Rs./1,000 gal.)	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	0.7 (0.7)	0.3 (0.3)	0.1 (0.1)	1.4 (1.4)
Res. share of capital cost (Rs./month)	--	--	--	66 (175)	74 (196)	58 (154)	--
Res. share of operation cost (Rs./month)	--	--	--	2 (2)	2 (2)	2 (2)	--
Deficit per res. (Rs./month)	--	--	--	61 (170)	46 (168)	52 (148)	--
Deficit (million Rs./year)	--	--	--	23.2 (64.8)	7.0 (25.6)	2.0 (5.6)	32.2 (96.0)
DRAINAGE SYSTEM							
Percent of total (X)	5	--	10	70	--	15	100
Share of capital cost	8	--	16	112	--	24	160
Annual share of capital cost (million Rs.)	0.4 (1.0)	--	0.7 (2.0)	5.2 (13.9)	--	1.1 (3.0)	7.4 (19.9)
Deficit (million Rs./year)	--	--	--	5.2 (13.9)	--	1.1 (3.0)	6.3 (16.9)
TOTAL PAYMENT RES. (Rs./month)							
High Income	--	--	--	75	85	69	--
Middle Income	--	--	--	20	20	20	--
Low Income	--	--	--	--	--	--	--
TOTAL ANNUAL DEFICIT (million Rs./year)	--	--	--	34.1 (107.3)	8.4 (35.5)	3.8 (11.2)	46.3 (134.0)
TOTAL ANNUAL COST (million Rs./year)	7.0 (17.5)	6.8 (21.0)	6.3 (15.8)	43.0 (114.2)	17.0 (45.1)	4.5 (11.8)	84.6 (225.4)

In subsequent computations for the three systems, the capital costs have been converted to an annual basis using two types of financing. The first type which is recommended would be that of a soft loan which might have terms of 3-1/2 percent interest over a 40-year period. An annualizing factor of .04683 was used for this sort of a loan. The other type of loan considered would be a more commercial type loan of say for a 30-year period at 12 percent interest with an annualizing factor of 0.124144. Any numbers using this commercial type of a loan have been shown in parenthesis on the following tables so that in any annualized figure you will see one number without parentheses which is the soft loan and one number with parentheses which would be a commercial loan. Sources of the soft loans would be such as the World Bank, Asian Development Bank, one of the Arab Funds. The reason for showing these two types of funding is to point out the importance of obtaining a soft loan when compared to our estimate of the residential components capability to bear portion of the tariffs.

Under the water system, the first line indicates the millions of gallons per day allocated to each of the users. The second line indicates the percent of the total gallons that each of the users would consume. The third line indicates the share of the capital cost based on the consumption that each user should bear. The fourth line has annualized these capital cost to each of the users. The fifth line has allocated total operating costs to each of the users. The sixth line has shown each residence share of the capital cost in rupies per month. This was arrived at assuming 6.3 persons per connection. The upper number is with a soft loan; the number in parentheses would be the impact of a commercial loan. The next line indicates each residential residences share of the operating cost in rupies per month. The next line indicates our estimate of the deficit per residence that would be accrued for each of the three residential areas based on certain member's ability or inability to pay. Certain portions of the population are not able to pay; some are capable of paying up to maybe 20 rupies per month and other individuals being able to pay their full share of the bill. The ninth and last line under the water system would be our estimate as

to the deficit for the three residential areas and the total deficit which you can see is about 7.5 million rupies per year with a soft loan for the water system.

Under the sewer system, the first line indicates the share of the capital cost we anticipate for each of the same regions. They have been annualized on the same basis as the water system and residence shares of each of the costs have been spread in the same means. Deficits were calculated in a different manner in that it was felt only the upper income individuals would be able to pay at say half the rate that a sewage system would cost. The other residents would be incapable of paying any towards a sewer system. This would result in a much larger deficit indicated in the seventh line under the sewage system of 32.2 million rupies per year with a soft loan.

The storm drainage system was only distributed among two residential areas. The percent of the total amount was shown on the first line; the share of the capital cost in rupies was shown on the second line. It was annualized on the same two types of loan basis and the third line and it was assumed that all residential areas would end up being a deficit and that this would normally be carried as part of the road system so it would probably would be borne by the Sri Lankan government. With a soft loan, this would result in a deficit of 6.3 million rupies per year as shown on the fourth line under the drainage system.

The next line on Table 4 is our estimate of the total payments by the residents in three categories: high income, middle income, and low income in the three residential areas in rupies per month. This sort of payment in the above costs would result in a total annual deficit on the next to the last line in Table 4 with a total annual deficit of 46.3 million rupies per year and the last line is the total annual cost of the entire system in rupies per year with a soft loan would result in 84.6 million rupies per year.

It is felt that on reviewing these cost allocations that it might be wise for the GCEC to set a priority system as to which of these infrastructure facilities are the most important. It is our opinion that the water system should receive the highest priority from a health standpoint and also for a development standpoint of the area and that the feasibility study might be limited to just this system.

Feasibility Study

Any feasibility study undertaken for providing water, sewage, and storm drainage infrastructure necessary for the residential areas included in the Greater Negombo Metropolitan Region, must be of a comprehensive nature satisfying the requirements of international lending agencies such as the World Bank.

This study would have to include a review of existing demographic data, existing reports, and it would be necessary for this study to substantiate that data in the field and provide supplemental data where required.

A similar review and supplementation of existing information, reports and data would also be necessary regarding land use planning and the socio-economics of both the residential population; and the commercial and industrial enterprises in the entire region. The socio-economics is extremely important in that it would evaluate the capability of the area to support the tariffs necessary for financing and operation of the infrastructure systems proposed.

Alternatives which should be investigated to determine the optimum water supply for the Greater Negombo Metropolitan Region are the currently used Moya Oya River. This investigation would include evaluation of existing rainfall and stream flow hydrologic information; investigation of other sites such as potential reservoir in the Kelani Ganga River Basin with subsequent transmission lines to the Negombo area as this might be a more dependable supply for the ultimate quantities of water required for the greater Negombo area; investigation as to possible sources of groundwater in the region; and possibility of expansion of the Colombo water system to serve the Greater Negombo Metropolitan Region.

Various distribution and transmission layouts and loop configurations should be considered in arriving at optimum distribution main sizes for the Greater Negombo area. This study would include Hardy-Cross Analysis of the numerous configurations. Also a thorough evaluation as to the feasibility of building the one large ground storage tank near the airport versus that of building numerous elevated storage tanks and booster pumping stations throughout the system should be

evaluated to determine the optimum in benefit ratio for the entire Greater Negombo Metropolitan Region.

Probably the area requiring the most extensive investigation as to alternative would be that of the type of sewage system which should be undertaken for the Greater Negombo Metropolitan Region in the light that currently nothing exists on a community-wide basis and that the residential population is not accustomed to paying tariffs for this type of service. It is felt that two major type systems should be investigated. One would be a waterborne sewer system as currently envisioned. This type of system could incorporate ocean disposal as currently planned for Negombo; land disposal in which the sewage would be used for irrigation purposes and production of some type of agricultural product; lagooning of the sewage with subsequent discharge to a receiving stream; or some sort of conventional type of sewage treatment system consisting of aeration and anaerobic digestion in which methane gas could be produced and used as a source of energy. The other major type of system to be investigated would be one in which it is not basically a waterborne system. This would probably consider two basic systems. One might be the more conventional septic tank type system which is currently used in some of the homes with the entire cost being borne on an individual consumer basis or an even more unique approach might be that of "night soil" type of disposal system currently used in Japan where the human wastes are collected in vacuum type tank trucks and the concentrated waste is subsequently treated through aeration basins and anaerobic digestions. This later type of system also generates methane gas for energy consumption and the digested sludge has the potential for use as fertilizer in agricultural production. This "night soil" type of system does away with large required capital cost for the sewers and pump stations required by a waterborne system and also eliminates the problems of groundwater contamination which can come from a more conventional septic tank system.

Evaluation of the storm drainage as directed would be simply be confined to Area 1, Negombo, and Area 4, Kochchikade as directed by GCEC. This evaluation would consider whether open channels or closed

conduit type storm drainage collection systems should be used in the area. The closed systems have the advantage of safety in regard to drowning and also limit places for collection and breeding of mosquitoes and such which can occur with open type ditches which might be rather stagnant. Both systems would probably require some sort of pumping in these low lying areas.

The feasibility studies would then assign costs to each of the alternatives and a cost-benefit ratio would be prepared for the various alternatives. In addition, these costs would be analyzed on a basis so that tariffs could be established for recovery capital costs from the users. These tariffs would also have to include the operating costs for each of the systems. These total costs would then be evaluated against the socio-economic evaluation of the areas' capabilities to pay and certain deficits for some consumers would be indicated. The feasibility study would then indicate possible means of meeting these deficits such as higher rates for certain commercial and industrial users or government subsidies to underwrite the deficits in order to satisfy the lending agency that all or a part of the project was feasible for Greater Negombo Metropolitan Region.

The estimated cost for a comprehensive feasibility study on all three systems, water, sewage and storm drainage, is \$625,000. If a comprehensive feasibility study was undertaken for only the water system, which should have the highest priority from both the standpoint of public health and ability to collect tariff, the estimated cost would be \$375,000.

U.S. Goods and Services

Based on the capital cost estimates for the three infrastructure systems and a review of current construction contractors working in the Sri Lanka area, as well as personal contacts with both local and U.S. suppliers, it was judged that the U.S. would be in the best competitive situation if separate contracts were let for furnishing major equipment and piping for the various projects and separate contracts be issued for installation of this material and equipment with the contractor providing

locally procureable materials. Since there are many international and local contracting firms working in Sri Lanka and none of which are apparently U.S. firms of any size, it was felt that combining any project into one contract would put U.S. goods and materials in a non-competitive position in that the contractors would likely select their materials from sources within their own nations or that with which they are familiar from other projects. Thus we are making these estimates based on separate contracts. In discussions with U.S. pipe suppliers, it appears that we are talking about large enough quantities of transmission and distribution piping that they would be in a competitive in a ship load situation with other world suppliers and the same would hold for major pumping and treatment equipment. Our company's recent bidding experience on several water projects would indicate that the U.S. is competitive in pumps and equipment, as well as piping. It is also felt that the U.S. would be in a good position to provide engineering services for design, construction supervision of the project, especially if U.S. AID would finance the feasibility study and providing that the U.S. consultant did an adequate job, they should be in an advantageous position to be selected as the consulting engineer on the project.

TABLE 5
ESTIMATE OF U.S. GOODS AND SERVICES

<u>System</u>	<u>Maximum Million \$ U.S. Goods & Services</u>	<u>Probable Million \$ U.S. Goods & Services</u>
Water System	14.2	6.5
Sewage System	20.0	7.0
Storm Drainage System	<u>0.5</u>	<u>0.2</u>
TOTAL	34.7	13.7

A total feasibility study as envisioned for the three systems was undertaken and the project was felt the maximum possible U.S. goods and services in comparison to the cost of the feasibility study would be a

ratio of 55:1. If the feasibility study was undertaken for the water system only, the maximum ratio of U.S. goods and services to the cost of the water feasibility study would be 42:1.

A further analysis was done on the probability that all these goods and services would not go to U.S. consultants or suppliers and that the following is an estimate of the probable amount of monies which would be spent in U.S. goods and services. The entire system as undertaken would result in a ratio of 22:1 if only the water portion of the feasibility was undertaken, the probable U.S. goods and services which would be used on that portion of the project would be 17:1.

Recommendations

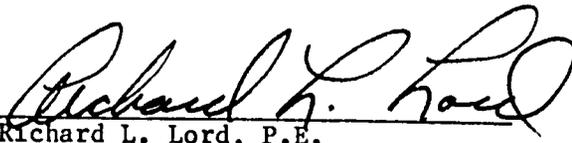
Due to the rapid and ambitious expansion plans for the Greater Negombo Metropolitan Region, it is imperative that a feasibility study be undertaken to provide adequate infrastructure to protect the health of the large population influx causing this area to become a major urban section of Sri Lanka. This high concentration of population in conjunction with the topographic and geological properties of the area, make it imperative that some changes are made from the current practice of shallow wells for potable water supply and septic tanks or pit latrines for human waste disposal. As the population density increases in this area, the health hazardous will compound.

As a bare minimum, the feasibility study could be reduced to that of potable water supply. As these improvements would at least separate the source of contamination from human waste from travelling into the potable water supply system.

Thus it is recommended that the Greater Columbo Economic Commission undertake a feasibility study of some proportion to be able to obtain the necessary soft loan funding for the infrastructure required. This study should be undertaken irregardless of obtaining a U.S. AID grant for the feasibility study.

It is also imperative that the Greater Colombo Economic Council make a concerted effort in discussions with various lending agencies about obtaining funding for all or a portion of the infrastructure discussed in this prefeasibility study. It is hoped that the information in this study can be of assistance to GCEC in discussions with potential lending agencies.

Respectfully submitted,
STANLEY CONSULTANTS, INC.


Richard L. Lord, P.E.
Vice President