

APPENDIX IX

ANNEX B

ECONOMIC DATA ON WATER SECTOR

Prepared by: Dr. Alfred Francis Ph.D. Econ.



THE UNIVERSITY OF THE WEST INDIES

DEPARTMENT OF ECONOMICS
MONA CAMPUS

Cable: Univers Telex: 2123

Mona
Kingston 7, Jamaica

15th March 1993

Mr. Horace Beckford
Sentar Consultants Ltd.
13 West Kings House Road
Kingston 10

Dear Mr. Beckford,

Re: Data Requirements on the
Water Sector: Final Submission

I hereby submit final data requirements on the Water Sector.

Item 1. Most Recent Input/Output Table for Jamaica

Input-Output Table 1980 and Classification of Industries are attached. (I have also attached an Input-Output Table for 1977).

Item 3. Estimate of Income Multiplier of Water Sector

This item is covered by the 1980 Input-Output table and was discussed with Dr. Addison.

Item 6. Marginal Propensity to Consume in Jamaica

As discussed with Dr. Addison, data are submitted on GDP, Consumption Expenditure and Mean Population to enable computation of marginal propensity to consume. (See attached data sheet).

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THE UNIVERSITY OF THE WEST INDIES

DEPARTMENT OF ECONOMICS
MONA CAMPUS

Cable: Univers Telex: 2123

Mona
Kingston 7, Jamaica

10th March 1993

Mr. Horace L. Beckford
Sentar Consultants Ltd.
13 West Kings House Road
Kingston 10

Dear Mr. Beckford,

Re: Data Requirements on the
Water Sector: Interim Submission

Figures on the Water Sector are reflected by the 'Water and Sanitation Sector' in the National Accounts of the Jamaican Economy prepared by the Statistical Institute of Jamaica (STATIN). The primary source of the raw data for Water and Sanitation in the National Accounts is the National Water Commission (NWC).

Item 2. Estimate of Value Added by Water Sector

187,961 (J\$ '000) 1991

Source: STATIN

Item 4. Employment of Water Sector

Average No. of Persons Employed

1990	3542
1991 Q1	3276
1991 QII	3147
1991 QIII	3390

Source: STATIN

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Mr. Horace L. Beckford
Sentar Consultants Ltd.

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10th March 1993

Item 5. Employment Multiplier or labour/output ratio in Water Sector

1990 Gross Output/Employment = $\frac{418912}{3542}$

1991 Gross Output/Employment* = $\frac{506031}{3271}$

* Based on 1991 Q1, QII & QIII data above.

Source: STATIN

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ITEM 6. MARGINAL PROPENSITY TO CONSUME IN JAMAICA

<u>Year</u>	GDP at constant (1974) Prices J\$ million	Private Final Consumption Expenditure Constant (1974)prices J\$ million	Mean Population ('000)
1974	2159.2	1606.1	1979.9
1975	2152.5	1596.9	2012.8
1976	2013.5	1562.5	2040.5
1977	1965.5	1543.4	2063.1
1978	1976.0	1468.7	2087.8
1979	1940.0	1347.4	2112.1
1980	1828.8	1280.2	2133.2
1981	1875.5	1317.5	2162.3
1982	1898.7	1362.6	2200.1
1983	1942.2	1505.8	2240.8
1984	1925.6	1629.9	2279.8
1985	1836.1	1637.5	2311.1
1986	1867.2	1642.2	2335.8
1987	1983.4	1793.1	2350.6
1988	2012.6	1842.7	2356.4

Sources: National Income and Product Preliminary Report 1990,
National Income and Product 1989, 1988; Statistical
Yearbook 1989. STATIN.

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Item 7. Breakdown of Government Expenditure and Revenue
by Sector

TABLE 6.6
FUNCTIONAL CLASSIFICATION OF RECURRENT AND CAPITAL EXPENDITURE (\$Millions)

1989/90-1991/92 SERVICES	Recurrent			1989/90 ^e	Capital		Total Recurrent & Capital		
	1989/90 ^a	1990/91 ^f	1991/92 ^e		1990/91 ^f	1991/92 ^e	1989/90 ^a	1990/91 ^f	1991/92 ^e
A. GENERAL SERVICES									
1. General Administration									
1. State Services	77.6	89.0	100.2	17.9	2.3	3.2	95.6	91.4	103.4
2. Public Debt And Fiscal Services	2,274.4	2,766.3	3,451.3	2,056.0	1,981.3	2,975.2	4,230.4	4,747.6	6,426.5
3. Foreign Services	63.7	104.1	133.5	-	-	-	63.7	104.1	133.5
4. Personnel Administration	29.0	28.7	30.7	-	-	-	29.0	28.7	30.7
5. General Economic Regulation	31.2	46.2	46.6	-	-	-	31.2	46.2	46.6
6. Other General Services	364.6	483.3	1,015.3	77.6	115.1	390.0	442.3	598.6	1,405.5
Total General Administration	2,840.5	3,317.8	4,777.8	2,151.6	2,098.7	3,368.4	4,992.0	5,616.3	8,146.2
2. Security Services									
1. Defence	193.7	240.7	306.0	11.7	5.0	22.0	205.5	285.7	328.0
2. Justice	44.1	68.0	69.1	14.0	12.6	4.0	58.1	80.6	73.1
3. Police	304.9	489.2	575.9	24.3	48.1	104.0	419.2	597.2	743.9
4. Prisons	51.1	85.1	84.4	2.4	2.8	7.9	53.6	87.9	97.3
Total Security Services	683.8	922.9	1035.5	52.4	68.5	201.9	736.4	991.4	1,237.4
Total (A) General Services	3,524.3	4,440.7	5,813.3	2,204.1	2,167.2	4,714.6	5,728.4	6,607.9	9,383.5
B. Social And Community Services									
1. Education, Training And Cultural Development	1092.2	1333.9	1552.2	2204.1	2167.2	3570.3	1,316.9	1,577.1	1,774.8
2. Health	572.8	719.3	811.7	71.3	138.5	169.8	644.0	837.8	981.4
3. Social Security And General Welfare	269.5	236.0	238.7	1.0	14.7	17.0	270.5	250.7	255.7
4. Housing	24.9	29.2	29.7	17.1	34.0	52.5	42.0	63.2	82.2
5. Water Supplies	3.1	3.5	15.7	106.1	242.3	249.2	109.2	245.8	264.9
6. Other Social And Community Services	123.9	185.1	196.4	230.9	200.3	173.1	354.8	385.5	369.5
Total (B) Social & Community Services	2,086.4	2,507.1	2,847.4	651.1	672.9	881.2	2,737.5	3,280.1	3,728.6
C. Economic Services									
1. Agriculture	90.5	105.9	119.2	177.5	172.3	243.0	268.0	278.2	362.2
2. Industry And Commerce	12.0	26.9	42.9	4.2	34.4	106.1	16.2	61.3	149.0
3. Transport And Communications	84.0	108.8	107.3	45.0	46.8	67.7	129.0	155.6	174.9
4. Roads	14.3	13.0	10.7	142.7	269.0	257.5	157.1	282.1	268.2
5. Fuel And Power	3.0	4.8	5.0	4.7	12.1	20.0	7.6	16.9	25.0
6. Development And Preservation Of Natural Resources	37.4	50.8	48.9	13.1	31.3	29.7	50.5	82.1	78.6
7. Other Economic Services	119.3	179.1	189.4	402.9	499.1	468.4	522.2	678.3	657.8
Total (C) Economic Services	360.6	489.4	523.4	790.1	1,065.2	1,192.3	1,150.7	1,554.5	1,715.7
D. Miscellaneous Services									
1. Misc. grants To Local Authorities	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0
2. Other Unallocable Expenditure	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0
Total (d) Miscellaneous Services	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0
Gross Total	5,972.3	7,438.3	9,185.1	3,645.3	4,105.2	5,643.8	9,617.6	11,543.5	14,822.9
Less Appropriations-in-aid	71.6	81.5	105.2	-	0.8	0.8	71.6	82.2	106.0
Net Total	5,900.7	7,356.8	9,079.9	3,645.3	4,104.4	5,643.0	9,546.0	11,461.2	14,722.9

A-actual Expenditure (provisional)
e-estimates
p-preliminary
f-revised estimates

Source: Ministry of Finance and Planning

(b) Item 7. Breakdown of Government Expenditure and Revenue by SectorTABLE 6.1
TAX REVENUE 1987/88 - 1991/92

Tax Category	1987/88 ^a	1988/89 ^a	1989/90 ^a	1990/91 ^r	1991/92 ^p
1. Customs Duty	332.4	531.0	761.3	781.2	1529.7
2. Excise Duty	33.8	55.7	43.4	45.7	40.7
3. Consumption Duty	1,077.8	1,175.3	1,355.7	1,406.1	1294.6
4. Income Tax	1,753.7	2,046.4	2,663.4	3,638.9	4746.3
5. Land and Property Tax	65.5	58.2	70.3	67.1	69.2
6. Stamp Duty	702.3	619.4	771.1	898.3	1023.3
7. Motor Vehicle Licences	38.7	39.0	40.6	47.3	45.9
8. Other Licences	4.0	8.9	10.3	16.7	21.8
9. Entertainment Tax	8.1	7.3	7.7	10.4	5.5
10. Travel Tax	40.3	46.0	75.9	86.2	166.3
11. Betting, gambling, and lotteries	38.8	32.1	39.4	49.6	66.4
12. Tax De Sejour	65.5	51.5	70.5	86.6	80.4
13. Retail Sales Tax	43.9	79.2	152.8	207.8	169.3
14. Education Tax	61.3	65.6	217.9	305.9	428.1
15. Telephone Service Tax	33.8	40.0	59.9	78.3	76.3
16. Contractor's Levy	8.0	16.0	19.9	16.6	24.6
17. University Cess	-	-	4.0	1.2	6.5
18. Special Consumption Tax	-	-	-	-	43.7
19. General Consumption Tax	-	-	-	-	1149.8
20. Bank Cess	-	-	-	-	97.6
Total Tax Revenue	4,306.9	4,901.6	6,364.1	7,744.1	11,499.0

a - actual
r - revised
p - preliminary

Source: Accountant General's Department Ministry of Finance & Planning

Source:

(a) Table 6.6 Economic and Social Survey Jamaica 1991, Planning Institute of Jamaica (PIOJ)

(b) Table G.1 Economic and Social Survey Jamaica 1991 Planning Institute of Jamaica (PIOJ)

Item 11. Balance of Payments Data

	US\$mn	January-December 1991
MERCHANDISE	-654.3	
Exports (f.o.b.)	1145.2	
Imports (c.i.f.)	1799.5	
SERVICES (NET)	250.0	
Foreign Travel	710.4	
Investment Income	-489.5	
Other	29.1	
GOODS & SERVICES	-404.3	
TRANSFERS (NET)	272.7	
Private	167.7	
Official	105.0	
CURRENT ACCOUNT	-131.6	
NET CAPITAL MOVEMENT	77.6	
Change in Reserves (BOJ)	54.0	
Increase = Minus		

Source: Table 38.1, Statistical Digest, Bank of Jamaica, October 1992

Item 12. Interest Rates

Interest on Foreign Loans by Water Sector

Range of 6% to 10% with average around 8%.

Yours sincerely



A.A. Francis.

SIMPLIFIED INPUT/OUTPUT
TABLE OF THE JAMAICAN ECONOMY

INDUSTRIAL SECTORS	EXPORT AGRICULTURE		DOMESTIC AGRICULTURE		INVESTOR AND FISHING		RAINFOR AND MATERIALS		OTHER MINING AND QUARRYING		MANUFACTURING		PETROLEUM REFINING		ELECTRICITY AND WATER		CONSTRUCTION AND INSTALLATION		DISTRIBUTION		TRANSPORT AND STORAGE		HOTELS, RESTAURANTS AND CLUBS		OTHER SERVICES		TOTAL				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
EXPORT AGRICULTURE	59.6			0.3			9.3																								
DOMESTIC AGRICULTURE		26.1		0.2	3.7																										
LIVESTOCK AND FISHING			5.2																												
RAINFOR AND MATERIALS																															
OTHER MINING & QUARRYING																															
MANUFACTURE	7.7	5.9	34.4	14.9	6.7	0.6	185.9	0.3	3	21.4	17.4	30.7	17.3	56.1	402	58.1	104.1	169.8	44.8	476.8	878.8										
PETROLEUM REFINING	3.7		2.7	57.2	0.9					6.4	23.4	20.1																			
ELECTRICITY AND WATER	0.3		3.1	3.1	4.4	0.4				16.8	1.1	1.0	0.1	4.5	1.1	2.9	19.4														
CONSTRUCTION AND INSTALLATION	2.9		1.1	2.9	1.0					5.2	0.9																				
DISTRIBUTION	15.7	2.5	4.6	4.5	7.4	0.4				72.7	2.7	2.2	11.4	30.5	2.8	38.6	11.1	206.5	16	500.1	70.8	47.8	643.7	82.6							
TRANSPORT AND STORAGE	15.8	7.7	1.5	34.6	2.3	2.3				15.2	0.2	1.0	9.2	74	5.0	11.6	17.5	197.9	22.3	101.4											
HOTELS, RESTAURANTS AND CLUBS	0.2	0.2		1.1	0.1	0.3				5.3	0.8	0.3	0.2	8.3	7.2	0.6	9.3	33.9	3.3	146.6	0.3										
OTHER SERVICES	1.7	1.0	0.5	2.7	2.9	1.9				42.2	4	3.9	3.3	30.6	34.1	6.7	78.2	273.6	31.9	500.7	5.4	31.6	569.6	1843.2							
NET TOTAL	107.7	43.4	53.6	122.0	46.5	5.0	678.1	33.4	32.7	85.2	689	705.9	104.0	223.9																	
NETS	21.8	18.4	5.7	53.2	22.8	0.9	240.1	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9	118.1	7.9
TOTAL INTEREST TAXES	3	1.1	1.2	4.7	4.6	0.3	24.9	1.5	12.8	4.4	288.6	37.6	11.4	78.4	20.1	109.7	0.2														
COMPENSATION OF EMPLOYEES	58.9	29.6	34.2	65.6	30.8	4.8	146.8	1.2	25.7	24.4	64.3	100	49.2	288.9	436																
SECTOR SUBSIDIES	-0.9	-4.1	-0.5	-0.3		-2.1																									
OPERATING SURPLUSES	-0.1	106.8	54.6	935.0	6.6	1.7	93.3	62.5	38.3	26.4	238.5	48.2	5.6	100.6																	
FINAL CONSUMPTION	0.6																														
TOTAL EXPORTS	190.4	195.2	148.8	481.4	117	13.6	881.1	1216.7	16.9	288.6	784.2	537.5	248.5	4843.2	6667	2172.9	359	3801.7	4000.6												
TOTAL IMPORTS	191	195.2	148.8	481.4	117	13.6	878.8	1216.7	16.9	288.6	784.2	537.5	248.5	4843.2	6667	2172.9	359	3801.7	4000.6												

WHEN A SECTOR IS READ HORIZONTALLY THE NUMBERS INDICATE WHAT IT SHIPS TO OTHER SECTORS. WHEN A SECTOR IS READ VERTICALLY, THE NUMBERS SHOW WHAT IT CONSUMES FROM OTHER SECTORS. (\$000,000)

APPENDIX IX

ANNEX A

BENEFIT ANALYSIS

INTRODUCTION

This Annex presents some of the possible benefits that may accrue from different levels of capital investment. Such an exercise allows the benefits to be compared to the costs and assists in the decision-making process.

While the rationale is good, estimating the benefits of projects or investments is not that straightforward, and the techniques available are quite controversial, as the specific numbers attached to these, tend to be superficial. In this Appendix, some of the benefits that may occur are discussed, stressing the difficulties in attaching specific numbers to some type of benefits. Costs are nonetheless estimated using a macroeconomic approach that emphasizes the effect of the investment on employment, government budgets, and the balance of payments. In the final section, a distinction is made between maximization of benefits and economic efficiency, arguing that the highest level of investment, need not be the most efficient for Jamaica.

Traditionally, economists have measured benefits from a good or service by the price that individuals would be prepared to pay for that good or service. When the good is not directly marketable, but involves the provision of public services, then the value to society as a whole acts as a proxy for the size of the benefits that accrue. Total benefits are then obtained as an aggregation of benefits to all classes of society.

The main benefits from a wastewater treatment project stems from improved health of the population, the improvement in water quality that follows and the ecosystem as a whole. Freeman(1990), discusses ways in which attempts have been made to measure these empirically, by extrapolating from the improvements in water quality, to the effect on changes in uses that are made of that water and the monetary values that the benefitters would be prepared to put on obtaining that water quality. The three main sources of benefits are improved health of the population, improvement to crop yields if treated wastewater is used for irrigation, and aesthetic benefits. Health benefits can be measured by establishing a relationship between wastewater treatment and mortality, whereas effects on vegetation may be captured by improvements in agricultural production due to the wastewater treatment project. The benefits from aesthetic improvement may be high in Jamaica because of the importance of the tourist industry, but such benefits cannot be measured unless the demand for recreational opportunity in the Kingston area was known.

IX.6 SUMMARY, CONCLUSIONS, POLICY RECOMMENDATIONS

This report has been concerned with analysing the options for the National Water Commission, in its assessment of privatisation options. Various options for ownership and control have been discussed, with the three main categories being:

- (a) Private Ownership
- (b) Public Ownership
- (c) Some combination of Public/Private

We suggested the need for Jamaican authorities to consider the option of Private ownership over a period of time, under which the private owner builds, owns and operates the facility, which may be transferred back to the Public after the end of the concessionary period. Such an option seems to meet the needs of the National Water Commission and Jamaica best.

Secondly, we assessed the nature of the effect of privatisation on the Jamaican economy, in terms of the value added to the water sector after privatisation, what employment effects may be and the effect on the Government's budget. We also indicated in a qualitative fashion what the possible balance of payments effects may be given the absence of appropriate data that would give accurate results. It was shown that privatisation would be worthwhile as the value of output of the sector increases, with strong positive effects on employment and the Government's budget, as well as improving services.

The final section of this report, discusses, the role of government in the enforcement and regulation of environmental standards, and control of pricing. Various measures are suggested to lessen the impact of rate increases on the people of Jamaica, through a system of discriminatory pricing, and an environmental tax on tourists.

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This formula expresses the rate of growth of the economy as the change in value added divided by the change in net domestic product. This gives the rate of growth in the economy, solely attributable to privatisation.

IX.5.2 Employment

The effects on employment in the economy can also be assessed from the effect of privatisation on privatised employment, non privatised employment, and the increase in employment in public sector after release of public funds from the water sector. The direct effects are the impact effect given as the difference in employment under privatisation and government operation, and any effects on public sector employment, as shown below.

$$\sigma E = E_p - E_g + E_c$$

where, E = Total employment

E_p = Employment under private operation

E_g = Employment under Gov't operation

E_c = Public sector employment.

These measure the direct employment effects of privatisation. The indirect effect on employment is captured by the effect of the direct effects on employment in other sectors of the economy, captured through using the employment multiplier, i.e.:

$$\sigma E_i = m (E_p - E_g)$$

where, m = the employment multiplier of the privatised sector.

Total employment is then given as the sum of direct, indirect and public sector employment effects. Due to the paucity of data, however, it was necessary to use "best guess" estimates on this aspect. Given that the effect on employment would be felt through the increase in value added, as well as through budgetary effects, we argued that both the impact effect and direct effects would be low. If employment increased by approximately 50 people it would lead to about 500 new jobs indirectly⁴. Hence total resultant employment effects would be about 550 new jobs. Alternatively, employment effects could be estimated using the output labour ratios given for Jamaica⁵. The output labour ratio given for 1991 was 0.1546, and given total change in net value added, suggests employment effects of approximately 750 new jobs, a little higher than the "best guess" estimate. It is assumed that public sector employment effects would be zero.

⁴ See discussion on benefits of privatisation for discussions on multipliers and further explanations on this.

⁵ See item 5 in annex B.

IX.5.3 Budgetary Effects

The effect on the government's budget is captured by the difference between debt service and subsidy payments and tax collections and reductions in loan expenditures.

$$G_p = (S_g + D_g) - (S_p + D_p) + T_p$$

where, G_p	= Net gain with privatisation
S_g	= subsidies paid before
D_g	= Debt service prior to Privatisation
T_p	= Changes in taxes after privatisation
S_p	= subsidies paid after privatisation

Data for this was obtained from the Ministry of Finance and Planning's publication on the functional classification of recurrent and capital expenditures by government⁶. These functional classifications did not meet the sectoral definition for the water sector, but the best available estimates were used to provide a qualitative picture of the effects on government accounts without overemphasising the quantitative result.

It was assumed that the value of social and community services provided by the government in the water sector constituted the size of government subsidy in this area. The greatest difficulty was in assigning a part of public debt and fiscal services to this sector. Government subsidies in the sector were derived as \$J106.1M in 1991 in recurrent expenditures and \$J249.2m in capital expenditures. Total expenditure on subsidies here was therefore estimated to be \$J355.3m. Assuming a 5% share in public debt, debt service incurred before privatisation by the government due to water is estimated as \$J172.59m.

Based on the rationalisation that under privatisation government subsidy would be eliminated and assuming that debt service is unchanged (i.e. if government guarantees the debt) and using telephone tax revenue as a measure of tax revenue after privatisation, then the net effect on the government's budget is positive to the value of \$J783.4m. Since the water sector does not at present pay any taxes, this would represent a reversal in government finances. Assuming no tax

⁶ See item 7 in annex B.

revenue after privatisation, then the effect would be approximately \$J527.89m. The strongest case for privatisation then lies in the effect on Government's finances.

IX.4.4 Balance Of Payments (B.O.P.)

The effect on the balance of payments are determined by the reduction in imports and increase in output that is exported, both of which have positive effects on the balance of payments, and the increase in private foreign debt service which has negative effects on B.O.P and the reduction in public foreign debt service. Increases in imports due to output expansion by privatised sector and the economy as a whole have negative effects on the balance of payments.

Given the nature of the output of the water sector, increases in output should have major effects on the domestic economy, with little spill over into exports. It is, however, expected that improved water (and sewerage) services would serve to boost tourism and hence improve the balance of payments. The main negative impact would be due to foreign debt servicing as a result of the project. The longer term should, nonetheless, show an overall positive effect.

IX.4.5 Conclusion

This section has attempted to measure the macro economic effects of privatising the water sector in Jamaica. Despite the paucity of data, our estimates show strong employment and budgetary effects. Output effects are also encouraging, and it is expected that these would have a positive effect on Jamaica's balance of payments. The prospects for privatisation in Jamaica are good. It is the main way in which the Government would introduce efficiency into the delivery of water services in Jamaica. If there is a case against privatisation, it lies in its distributional effects, as has been discussed in the section on international examples. The next section concerns, the role of the Government and suggests ways in which these distributional effects may be mitigated.

XI.5 PRIVATISATION AND THE ROLE OF THE GOVERNMENT

This section presents some issues which should be of concern to any government in its aim to maximise the welfare of society as a whole. Central to the privatisation debate and the financing of projects in the water sector are the importance of tariffs and pricing. What should be the role of the government to ensure that pricing does not lead to unacceptable hardships for the people of Jamaica? Should the pricing considerations be left with a regulatory agency that not only monitors performance but also the tariffs that are charged in the industry? Would the role of government in

this regulatory aspect come into sharp conflict with its role as a guarantor of debt and hence interest in its financial viability? These are some of the issues which are discussed in this section.

IX.5.1 Environmental Concerns

This section deals with the need for an effective enforcement mechanism in regulating wastewater disposal under privatisation. The government needs to set an environmental and safety standard, that covers all aspects of the operation and ensures that environmental considerations remain foremost, rather than commercial considerations in day to day operations.

There must also be an effective legislative framework, in order to ensure effective enforcement of standards. These objectives are a primary reason for government maintaining part ownership in such operations.

IX.5.2 Economic And Pricing Considerations

The analysis of various privatisation proposals shows that not only would an increase in tariffs be necessary but an improvement in collection rates will be critical to the viability of such a project. Also there are important distributional effects of privatisation creating the need for policies that shift the incidence of rate increases on industrial and wealthier clients. The following recommendations are made:

- (a) It is recommended that the government put in place a price controlling regulatory agency that does not create a disincentive to efficiency.
- (b) The government must restructure tariffs to users of water and wastewater treatment facilities, to shift the incidence of rate increases on industrial and wealthier clients, rather than on domestic poorer clients.
- (c) Provisions must be made to allow tariffs to be responsive to changes to the value of the Jamaican dollar to provide a safety valve for potential foreign investors.
- (d) Given the importance of wastewater treatment to the tourist industry, it is suggested that the government consider the possibility of an environmental tax on hotel rooms to be used towards financing the project.

APPENDIX X

Portmore Sewer System

X PORTMORE SEWER SYSTEM

X.1 GENERAL

Information on the respective elements and general status of the existing sewage facilities for South-east St. Catherine has been addressed in the project Inception Report (Appendix C) and in Phase I Working Document No. 2 (Appendix I Section 3).

This section of the report addresses the following:

- a) Population projection and associated sewage generation based on actual development planning.
- b) Determination of the desirable areas to be served respectively by the proposed Soapberry and existing Greater Portmore treatment facilities.
- c) Development of the necessary modifications to the existing system to achieve diversion of sewage to the respective treatment locations.

The development of sewerage proposals for the area has been carried out with the assistance of Maurice Jones of Fluid Systems Engineering Ltd., who is also responsible for the coordination of engineering on the existing Greater Portmore sewerage facilities.

Ultimate development of the proposed system will result in the abandonment of the following existing treatment facilities:

- a) Independence City Package treatment plant, estimated capacity 3 - 5 imgd.
- b) Bridgeport Package treatment plant, estimated capacity 2.0 imgd.
- c) Caymanas Gardens lagoon treatment plant, estimated capacity 0.162 imgd.
- d) Hamilton Gardens oxidation ditch treatment facility, estimated capacity 0.077 imgd.

The Braeton treatment plant has already been abandoned and sewage from the Braeton and Reid's Pen housing schemes now flows to the Greater Portmore Pond System.

A review and comparison of Fluid Systems Engineering Ltd. flow assessments (set out in Section 2 of this Appendix) relative to infiltration and peak flow criteria used for the remainder of the study area has resulted in upgrading of their sizing, which has been used for costing. These comparisons are set out in Section 3.0 of this Appendix.

X.2 PROPOSED SEWERAGE DEVELOPMENT (BY FLUID SYSTEMS ENGINEERING LTD)

X.2.1 CURRENT AND FUTURE SEWAGE FLOWS

The current and projected sewage flows for S.E. St. Catherine have been determined based on the known and projected number of housing units and design assumptions with respect to occupancy and per capita sewage generation.

Projected population has been based on the known ability of the area to assimilate growth beyond the existing development. This allows for the 18,000 Greater Portmore houses and an additional 25,000 persons which may be physically housed in the area. Based on these projections the ultimate population is estimated to be 229,825. The population growth projected by the Statistical Institute and reflected in the general population forecast, Appendix II of Phase I Working Document No. 2 is 290,404. This would result in a population shift of approximately 60,570 persons from the area.

Because of the type of planned development in this area, per capita sewage generation is less than that for the remainder of the Kingston Metropolitan Area (K.M.A.). The allowance used for this area is 55 imperial gallons per capita, including infiltration. Table 1 sets out the estimated population and projected sewage flows.

X.2.2 FLOW ALLOCATION TO TREATMENT FACILITIES

Flows have been allocated to the proposed Soapberry Treatment facility and an expanded Greater Portmore Treatment facility based on limitations at the Greater Portmore site for treating not more than 8.5 imgd and the logistics of delivering the

flows to the respective sites. Table 2 sets out the proposed allocation which indicates a flow of 4,800,675 igpd to the Soapberry ponds, and 7,917,450 igpd to the Greater Portmore ponds. A provisional allowed capacity of 5,053,029 Igpd has been provided in the planning of the Soapberry pond site for Portmore Sewage.

X.2.3 THE PROPOSED COLLECTION AND TRANSMISSION SYSTEM

Figure 1 shows the proposed modified collection and transmission system as it relates to the Soapberry and Greater Portmore treatment facilities.

X.2.3.1 System to be Served by Soapberry Treatment Facility

The existing collection sewers and secondary pump stations would be retained and the pump stations modified or rehabilitated as indicated on Figure 1. Both the Bridgeport and Independence City systems would discharge to new pump stations at the existing respective treatment plant locations. Sewage collected at the new Bridgeport pump station would be pumped to the new Independence City pump station via a new 16" diameter main. The total inflow of sewage to the new Independence City pump station would be pumped directly to the Soapberry treatment facility via a 28" diameter main.

The Hamilton Gardens, Christian Pen and Caymanas Gardens systems would be combined to discharge directly to the Soapberry treatment site. Both Christian Pen and Hamilton Gardens pump stations would discharge to the Caymanas Gardens No. 2 pump station via individual new 4" diameter pumping mains. Caymanas Gardens No. 1 pump station presently discharges to the No. 2 Caymanas Gardens Station. A new 6" diameter pumping main would convey the collected sewage from Caymanas Gardens No. 2 station directly to the proposed Soapberry treatment facility.

X.2.3.2 System to be Served by the Greater Portmore Treatment Facility

Modifications to this section of the sewage system involves the diversion of the Marine Park sewage to the Greater Portmore system. This would involve modifications to the Marine Park and Braeton No. 1 pump stations and the discharge of the Marine Park Pump Station to the Braeton No. 1 pump station which is presently a part of the Greater Portmore system.

KINGSTON HARBOUR ENVIRONMENTAL PROJECT

TABLE X.1

S.E. St. Catherine Current and Projected Sewage Flows

WWTP	Areas	# of houses	# of b/r	Estimated Population	per capita contribution	Est. sewage flows - igpd	
Independence City	Independence 2br	600	2	3,000	55	165,000	
	Independence 3br	500	3	3,750	55	206,250	
	Portsmouth	1000	2	5,000	55	275,000	
	Passage Fort	1200	2	6,000	55	330,000	
	Westchester	1140	2	5,700	55	313,500	
	Meadowvale	1100	2	5,500	55	302,500	
	Waterford	3725	2	18,625	55	1,024,375	
	Town Centre	100	2	500	55	27,500	
	Cumberland H+J	1143	2	5,715	55	314,325	
	Cumberland - lots	590	2	2,950	55	162,250	
	SUB TOTAL		11,098		56,740		3,120,700
	Bridgeport	Bridgeport Ph-1	260	3	1,950	55	107,250
		Bridgeport Ph-2	700	2	3,500	55	192,500
		Bridgeport Ph-3	380	3	2,850	55	156,750
Edgewater		700	3	5,250	55	288,750	
West Bay Ph-1		100	3	750	55	41,250	
West Bay Ph-2		99	3	743	55	40,838	
West Bay Ph-3		23	3	173	55	9,488	
Garveymeade		660	2	3,300	55	181,500	
Westmeade		368	2	1,840	55	101,200	
Westport		360	2	1,800	55	99,000	
Southboro Q+R		900	2	4,500	55	247,500	
Marine Park		400	2	2,000	55	110,000	
Bridgeview		408	2	2,040	55	112,200	
Naggo Head Indus.		48	lots			75,000	
Bayside/Forum		200	2	1,000	55	55,000	
SUB TOTAL			5,606		31,695		1,818,225
Caymanas Gds.		Caymanas Gds1	250	2	1,250	55	68,750
	Caymanas Gds2	250	2	1,250	55	68,750	
	Christian Pen	90	2	450	55	24,750	
	SUB TOTAL	590		2,950		162,250	
Hamilton Gds.	Hamilton Gds	280	2	1,400	55	77,000	
Greater Portmore	Quads/ 2W - 5W	5740	1.6	22,960	55	1,262,800	
	Row/ 6W - 3N	3408	2	17,040	55	937,200	
	Row/ 6W - 3N	852	3	6,390	55	351,450	
	New Braeton P.1	330	2	1,650	55	90,750	
	Braeton Ph.1	380	2	1,900	55	104,500	
	Braeton Ph.2	380	2	1,900	55	104,500	
	Braeton Ph.3	380	2	1,900	55	104,500	
	Reid's Pen SIA	200	2	1,000	55	55,000	
	GPP Phase2 - 2	5200	2	26,000	55	1,430,000	
	GPP Phase2 - 3	1300	3	9,750	55	536,250	
	New Braeton P.2	330	2	1,650	55	90,750	
	New Braeton P.3	330	2	1,650	55	90,750	
	SUB TOTAL	18,830		93,790		5,158,450	
	Future Communities				25,000	55	1,375,000
Old Communities	Gregory Pk	400		2,000	55		
	Naggo Head	300		1,500	55		
	Old Braeton	2000		10,000	55		
	Newlands	520		2,600	55		
	Portmore Lane	440		2,200	55		
	SUB TOTAL	3,660		18,300		1,006,500	
TOTAL		40,064		229,875		12,718,125	

KINGSTON HARBOUR ENVIRONMENTAL PROJECT

TABLE X.2

S.E. St. Catherine Proposed Distribution of Sewage Flows to Future Treatment Facilities

WWTP	Areas	# of houses	# of b/r	Estimated Population	per capita contribution	Est. sewage flows - lgpd	
Independence City	Independence 2br	600	2	3,000	55	165,000	
	Independence 3br	500	3	3,750	55	206,250	
	Portsmouth	1000	2	5,000	55	275,000	
	Passage Fort	1200	2	6,000	55	330,000	
	Westchester	1140	2	5,700	55	313,500	
	Waterford	3725	2	18,625	55	1,024,375	
	Town Centre	100	2	500	55	27,500	
	Cumberland I+J	1143	2	5,715	55	314,325	
	Cumberland - lots	590	2	2,950	55	162,250	
		Sub-Total	9998		51,240		2,818,200
Bridgeport	Bridgeport Ph-1	260	3	1,950	55	107,250	
	Bridgeport Ph-2	700	2	3,500	55	192,500	
	Bridgeport Ph-3	380	3	2,850	55	156,750	
	Garveymeade	660	2	3,300	55	181,500	
	Westmeade	368	2	1,840	55	101,200	
	Westport	360	2	1,800	55	99,000	
	Southboro Q+R	900	2	4,500	55	247,500	
	Bayside/Forum	200	2	1,000	55	55,000	
	Edgewater	700	3	5,250	55	288,750	
	West Bay Ph-1	100	3	750	55	41,250	
	West Bay Ph-2	99	3	743	55	40,838	
	West Bay Ph-3	23	3	173	55	9,488	
	Bridgeview	408	2	2,040	55	112,200	
	492,525						
		Sub-Total	5158		29,695		1,633,225
Caymanas Gds.	Caymanas Gds1	250	2	1,250	55	68,750	
	Caymanas Gds2	250	2	1,250	55	68,750	
	Christian Pen	90	2	450	55	24,750	
	Sub-Total	590		2,950		162,250	
Hamilton Gds.	Hamilton Gds	280	2	1,400	55	77,000	
Soapberry Stabilization Ponds						4,800,675	
Greater Portmore	Quads/ 2W - 5W	5740	1.6	22,960	55	1,262,800	
	Row/ 6W - 3N	3408	2	17,040	55	937,200	
	Row/ 6W - 3N	852	3	6,390	55	351,450	
	New Braeton P.1	330	2	1,650	55	90,750	
	Braeton Ph.1	380	2	1,900	55	104,500	
	Braeton Ph.2	380	2	1,900	55	104,500	
	Braeton Ph.3	380	2	1,900	55	104,500	
	Reid's Pen SIA	200	2	1,000	55	55,000	
	GPP Phase2 - 2	5200	2	26,000	55	1,430,000	
	GPP Phase2 - 3	1300	3	9,750	55	536,250	
	New Braeton P.2	330	2	1,650	55	90,750	
	New Braeton P.3	330	2	1,650	55	90,750	
	Sub-Total	18830		93,790		5,158,450	
	Naggo Head Indus.	48	lots				75,000
	Meadowvale	1100	2	5,500	55	302,500	
Marine Park	400	2	2,000	55	110,000		
Future Communities			25,000	55	1,375,000		
	Sub-Total			25,000		1,375,000	
Old Communities	Gregory Pk	400		2,000	55		
	Naggo Head	300		1,500	55		
	Old Braeton	2000		10,000	55		
	Newlands	520		2,600	55		
	Portmore Lane	440		2,200	55		
	Sub-Total	3660		18,300		1,006,500	
Greater Portmore Stabilization Ponds						7,917,450	

HYDRAULICS OF SEWAGE PUMP TRUNK MAINS

TABLE X.3

Bridgeport to Soapberry
Hamilton Gds., Christian Pen to Caymanas Gds.
Caymanas Gds. to Soapberry

LOCATION	1stNode Elev	2ndNode Elev	PIPE No.	FLOW MIGD	Node2 Demnd	CHAIN AGE	PIPE LENG	PIPE Dia1	PIPE Dia2	PIPE Equi Diam	HW-C VALU	EQUI VEL fps	Hloss ft.	SUM Hloss ft.	PUMP head ft	SUM PUMP head	-HGL-	Press. psi	hp	TOTAL Kw
Flows based on 55 igpd/p																				
Bridgeport->	-12.5	7.5				13600														
Independence City->	-5	15	1	3.27	0.00	0	13600	16	0	16	130	4.3	54.4	54.4	65	65	73	28	64	47
							13600													
Independence City->	-5	15				9980														
Soapberry->	0	15	1	8.90	0.00	0	9980	28	0	28	130	3.9	16.8	16.8	18	18	33	8	48	36
							9980													
Hamilton Gds.->	5	25				2300														
Caymanas Gds.->	0	20	1	0.15	0.00	0	2300	4	0	4	130	3.3	27.5	27.5	25	25	50	11	1	1
							2300													
Caymanas Gds.->	0	20				4100														
Soapberry->	0	15	1	0.48	0.00	0	4100	6	0	6	130	4.5	55.4	55.4	52	52	72	23	7	6
							4100													

KINGSTON HARBOUR ENVIRONMENTAL PROJECT

TABLE X.4

Quantities for Pump Stations (New works, Modifications, Rehab) and Pumping Mains

Item	Description	Quantity	Unit
1	Pump Station Works - Modifications		
	Marine Park		
	Station pipework	1	item
	Pipelaying 4" - 1800 ft.	1800	ft.
	Braeton Ph.1.		
	Pumps - Gorman Rupp 4"	2	ea.
	Starters - Size 3.	2	ea.
	Hamilton Gardens		
	Pumps - Gorman Rupp 3"	2	ea.
	Starters - Size 2.	2	ea.
	Christian Pen		
	Caymanas Gardens		
	Pumps - Gorman Rupp 4"	2	ea.
	Starters - Size 3.	2	ea.
2	Pump Station Works - New		
	Bridgeport		
	Pumps - 3.27 Migd @ 65 ft. TDH	1	item
	Starters, Controls, electric ancillaries	1	item
	Standby power plant - 100 KVa	1	item
	Station pipework, valves, flow meter	1	item
	Station building, dry well	1	item
	Independence City		
	Pumps - 8.90 Migd @ 20 ft. TDH	1	item
	Starters, Controls, electric ancillaries	1	item
	Standby power plant - 100 KVa	1	item
	Station pipework, valves, flow meter	1	item
	Station building, dry well	1	item
3	Pump Station Works - Rehabilitation		
	West Bay - 1	1	item
	West Bay - 2	1	item
	Bridgeport	1	item
	Edgewater - 1	1	item
	Edgewater - 2	1	item
	Garvey Meade	1	item
	Passage Fort - 1	1	item
	Passage Fort - 2	1	item
	Passage Fort - 3	1	item
	Caymanas Gds. - 1	1	item
4	Pumping Mains - New		
	Bridge Port to Independence - 16"	13600	ft.
	Bridge Port to Independence - road repair	7556	s.y.
	Independence - Inlet wks	1	item
	Independence to Soapberry - 28"	9980	ft.
	Independence to Soapberry - road repair	5544	s.y.
	Soapberry - Inlet wks	1	item
	Hamilton Gds. to Caymanas Gds.m - 4"	2300	ft.
	Hamilton Gds. to Caymanas Gds. - road repair	1278	s.y.
	Caymanas Gds. - Inlet wks	1	item
	Christian Pen to Caymanas Gds. - 4"	1200	ft.
	Christian Pen to Caymanas Gds. - road repair	667	s.y.
	Caymanas Gds. to Soapberry - 6"	4100	ft.
5	Contingency @ 25%	1	item
6	Engineering and Surveys @ 12.5%	1	item
	TOTAL - US\$		

X.2.3.3 Pump Station Modifications

Table 3 gives details of flow, head, and Hp requirements for the proposed new and modified pumping requirements.

X.2.3.4 Quantities

Details of quantities for estimating purposes are shown in Table 4.

X.3 REVIEW AND UPGRADING OF FLUID SYSTEMS SIZING

Sewage flows from part of the Portmore area are planned to be transmitted to Soapberry for treatment at the Soapberry Lagoons. The proposal is to transmit sewage flows to Soapberry by a system of pump stations and forcemains, as shown on Figure X.1 "Recommended Sewage Transmission System", prepared by Fluid Systems Engineering Ltd. The per capita sewage contribution used is 55 gallons per capita per day. The following information was summarized from the Fluid Systems Tables:

	<u>Population</u>	<u>Average Daily Sewage Flow</u>
Hamilton Gardens	1,400	77,000
Caymanas Gardens	2,950	162,250
Bridgeport	29,695	1,633,225
Independence City	<u>51,240</u>	<u>2,818,200</u>
Total	85,285	4,690,675 Gallons

Two transmission systems will conduct the portion of the Portmore flows to Soapberry.

X.3.1 THE CAYMANAS GARDENS SYSTEM

Hamilton Gardens pump station (existing) pumps the sewage from Hamilton Gardens to the Caymanas Gardens pump station (existing) and the Caymanas Gardens pump station pumps the total flow from both areas to Soapberry. Both of these existing stations need to be modified.

X.3.2 THE INDEPENDENCE CITY SYSTEM

Sewage from the Bridgeport area would be pumped via a new pump station in Bridgeport, to the Independence City Pump Station, which would pump sewage collected in the Independence area via a forcemain to Soapberry. Both the Bridgeport and Independence City stations are proposed as new pump stations.

X.3.3 MODIFICATIONS TO EXISTING SYSTEMS

Modifications are necessary at the Marine Park Station and the Braeton Station. These modifications are necessary because of the changes in 3.1 and 3.2 above and these modification costs are included in the Portmore System.

The Fluid System tabulation of "Hydraulics of Sewage Pump Trunk Mains", shows the peak flows, the head losses, pipe sizes, etc., for the 4 pump stations/forcemain combinations; with pump horsepower and kilowatt requirements for each pump station.

This table is not consistent with the sewage flow calculations in Kingston.

X.3.3.1 The peak factor used by Fluid Systems was 2.0 throughout, and the Harmon Formula, as used in Kingston, gives higher peak factors.

X.3.3.2 The 10% infiltration factor was not applied.

The following tables were prepared to compare the flows:

SEWAGE FLOWS AS PRESENTED BY FLUID SYSTEMS

Pump Station	Average Daily Flow gal	Peak Flow mgd	Peak Flow gpm	Peak Factor	Force Main
Hamilton Gardens Pump Station	77,000	0.1500	104	2.0	4"
Caymanas Gardens Pump Station	77,000 <u>162,250</u> 239,250	0.4800	333	2.0	6"
Bridgeport Pump Station	1,633,225	3.270	2,270	2.0	16"
Independence City	1,633,255 <u>2,818,200</u> 4,451,425	8.900	6,180	2.0	28"

Note: 28" dia. may be not available

SEWAGE FLOWS MODIFIED TO MATCH KINGSTON ASSESSMENT

Pump Station	Average Daily Flow Gallons	Average + Infiltration Gallons/Day	Peak Factor	Peak Flow mgd	Peak Flow gpm	Force Main dia.
Hamilton Gardens	77,000	84,700	3.50	0.2965	250	6"
Caymanas Gardens	77,000 <u>162,250</u> 239,250	263,200	3.25	0.8554	600	8"
Bridgeport	1,633,225	1,796,500	2.50	4.4914	3,120	18"
Independence City	1,633,225 <u>2,818,200</u> 4,451,425	4,896,600	2.05	10.038	6,970	30"

The peak sewage flows are significantly higher

X.4 COST ESTIMATES (US \$)

Using the modified sewage flows, the larger force main pipes and the elevations from the Fluid Systems Tables, the following pump station requirements and costs were estimated and include 20% contingency on capital costs.

X.4.1 HAMILTON GARDENS

This is an existing pump station assumed to be a wet well type with Gorman Rupp self priming pumps, similar to Caymanas pump station, for which there is some information.

For Hamilton Gardens, it is assumed that the existing equipment is too small for the intended scheme and that only the wet well can be used. The estimate is based upon:

1. Removal of all existing equipment.
2. Supply and installation of two new 3hp - 4" diameter Gorman Rupp pumps and piping.
3. Construction of building to house pumps/electrical/generator.
4. Standby generator system - new.
5. Yard piping/site work.
6. Level controls.
7. wiring, lighting, electrical.

Capital Cost	\$65,000
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Annual Operating and Maintenance Cost:

Labor and Material	\$ 300
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Power Demand	100
--------------	-----

Power Consumption	<u>600</u>
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Total	\$1,000
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X.4.2 CAYMANAS GARDENS

This also is an existing pump station which presently contains 2 - 4" Gorman Rupp pumps, with one pump not working. The pump station will be modified to pump 600 gpm by the following modifications:

1. Reuse the existing wet well and whatever building is usable.
2. Remove all pumps, piping and electrical equipment.
3. Modify building to house new pumps, new electrical and new generator.
4. Provide all new piping and controls.

Capital Cost	\$85,000
--------------	----------

Annual Operating and Maintenance Cost:

Labor and Material	\$ 600
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Power Demand	300
--------------	-----

Power Consumption	<u>2,000</u>
-------------------	--------------

Total	\$2,900
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X.4.3 BRIDGEPORT

The Bridgeport pump station will be a new wet well/dry well type station with capacity of 3,120 gpm, using vertical centrifugal type sewage pumps and a standby generator system.

1. Cast in place concrete wet well/dry well.
2. Wet well/dry well ventilation system.
3. Access by stairs with hoist for equipment.
4. 3 pumps, 50 hp each, one of these is a standby pump.
5. Emergency generator - 150 KW min.
6. Motor control centre, wiring, lighting, level controls.
7. Concrete block building.

Capital Cost	\$1,100,000
Annual Operating and Maintenance Cost:	
Labor and Material	\$2,800
Power Demand	2,300
Power Consumption	<u>15,700</u>
Total	\$20,800

X.4.4 INDEPENDENCE CITY

The Independence City pump station will be a new wet well/dry well type station with a rated capacity of 6,970 gpm using three vertical centrifugal non-clog type sewage pumps and a standby generator system.

1. Cast in place concrete wet well/dry well.
2. Concrete block building to house pump motors, motor control centre, panels, emergency generator.
3. Access by stairs, with complete wet well/dry well ventilation systems.
4. Hoists for pumps.
5. 3 pumps, 30 hp each, plus 1 - 30 hp standby unit.
6. Emergency generator - 130 KW min.
7. Level control system.

Capital Cost	\$2,350,000
Annual Operating and Maintenance Cost:	
Labor and Material	\$6,300
Power Demand	2,100
Power Consumption	<u>17,700</u>
Total	\$26,100

X.4.5 MODIFICATIONS TO EXISTING STATIONS

Marine Park

Piping modifications 12,000

Braeton

Replace pumps and piping modifications 30,000

X.4.6 SUMMARY OF PORTMORE LIFT STATION COSTS

LIFT STATION	CAPITAL COST		ANNUAL O&M COST	
	Stage 1	Stage 2	Stage 1	Stage 2
1. Hamilton Gardens	75,000	-	1,000	1,000
2. Caymanas Gardens	98,000	-	2,900	2,900
3. Bridgeport	1,265,000	-	20,800	20,800
4. Independence City	2,703,000	-	26,100	16,100
5. Marine Park	14,000	-	-	-
6. Braeton	35,000	-	-	-
Totals	4,190,000	-	50,800	50,800

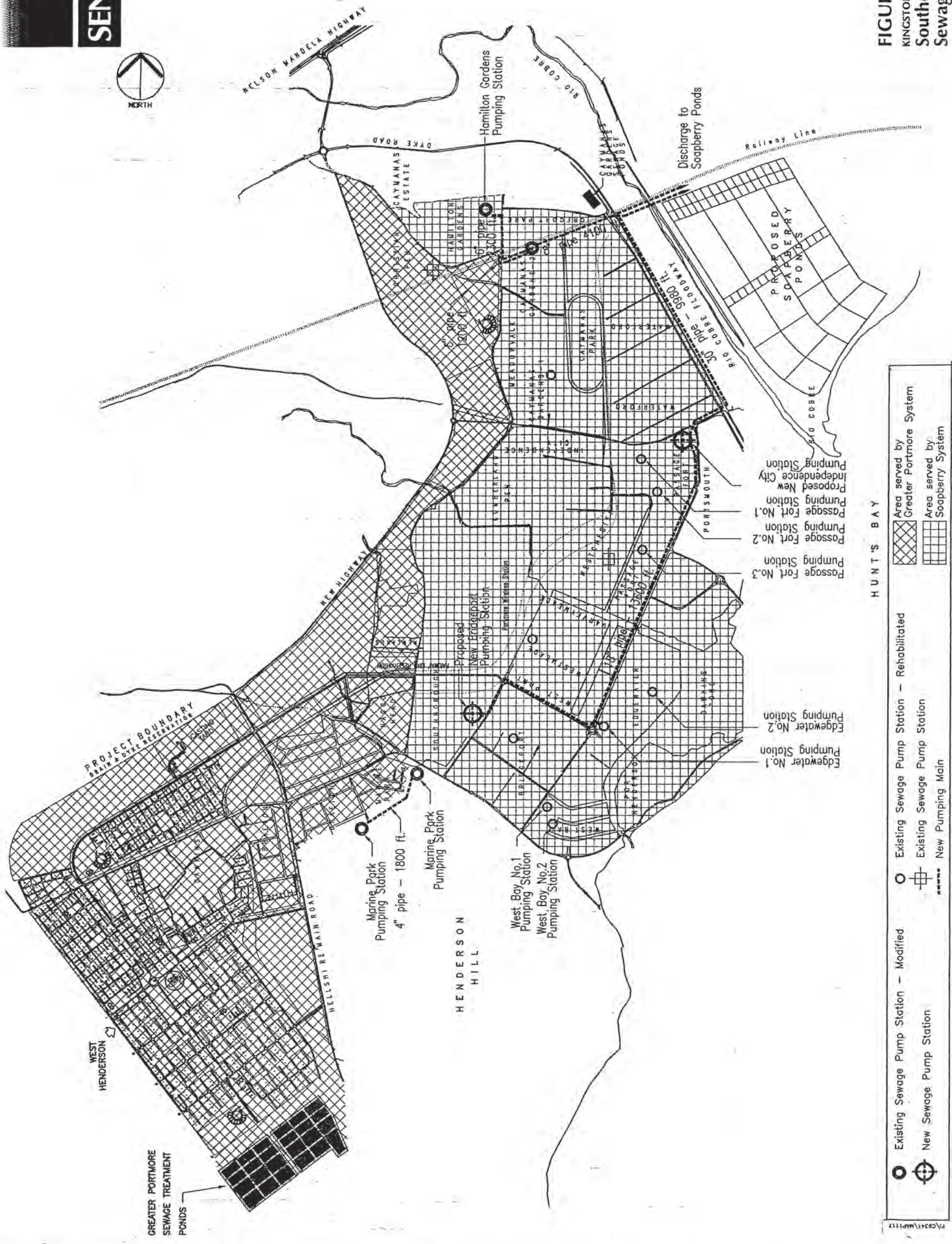
Note: Capital Costs in this summary include 20% Contingency, and 15% Engineering.

Operation and maintenance costs of Marine Park and Braeton are not included in the costs of pumping to Soapberry because flow is directed to Greater Portmore system.

X.4.7 PUMPING MAIN COSTS (US \$)

Pumping main costs have included the following factors:

- Installation and restoration prices taken from Fisher Pryce and Associates reported costs for gravity sewers constructed with closed sheeting 6.7 ft. - 9.8 ft. depth of bury.
 - A cost factor of 2.0 on installation cost due to high groundwater table.
- | | | |
|----|---|----------------------------|
| 1) | 2300 ft. 6", Hamilton Gardens to Caymanas Gardens | 107,641.00 |
| 2) | 4100 ft. 8", Caymanas Gardens to Soapbery | 192,216.00 |
| 3) | 13,600 ft. 18", Bridgeport to Independence City | 1,450,048.00 |
| 4) | 9,980 ft. 30", Independence City to Soapbery | <u>1,847,353.00</u> |
| | | 3,597,258.00 |
| | 35% Contingencies & Engineering | <u>1,259,040.00</u> |
| | Total US \$ | <u>4,856,298.00</u> |



LEGEND

- Existing Sewage Pump Station - Modified
- New Sewage Pump Station
- Existing Sewage Pump Station - Rehabilitated
- Existing Sewage Pump Station
- New Pumping Main
- Area served by Greater Portmore System
- Area served by Soapberry System

FIGURE X.1
 KINGSTON HARBOUR ENVIRONMENTAL PROJECT
Southeast St. Catherine Recommended Sewage Transmission System