ST. JOHN'S

REGIONAL WATER SYSTEM STUDY

Volume IV

CANADA
DEPARTMENT OF REGIONAL
ECONOMIC EXPANSION

GOVERNMENT OF NEWFOUNDLAND
AND LABRADOR
DEPARTMENT OF MUNICIPAL
AFFAIRS & HOUSING

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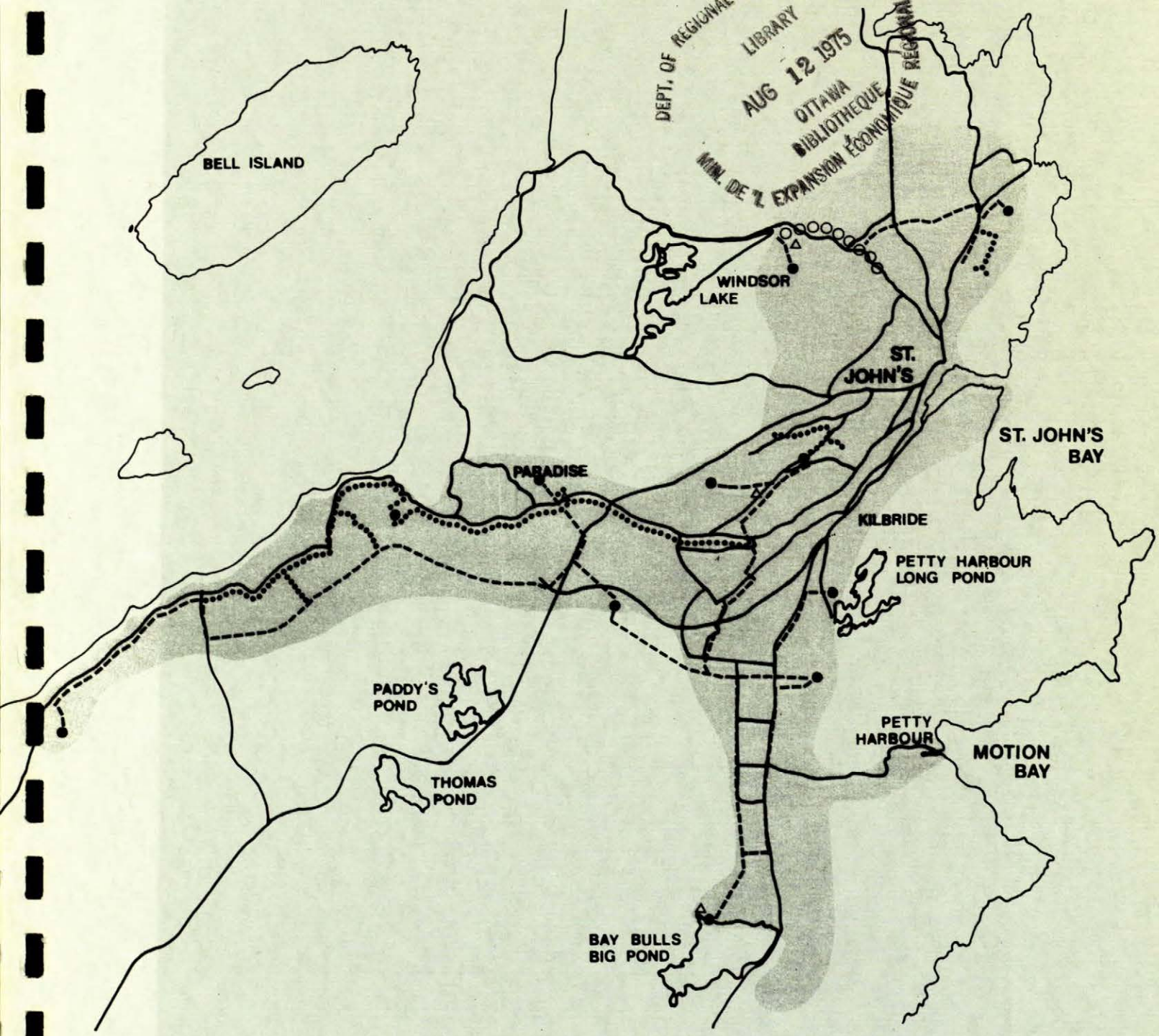
Foundation of Canada Engineering Corporation Limited

ST. JOHN'S REGIONAL WATER SYSTEM STUDY

St. John's Special Area Project 3.1

Volume IV

Chapters 10, 11



December 1974

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Abbreviations

acre-foot ..... acre-ft
average ..... avg

biochemical oxygen demand ..... BOD
brake horsepower ..... bhp

capita ..... cap
cubic ..... cu
cubic centimeter (s) ..... cu cm = ml
cubic feet per day ..... cfd
cubic feet per hour ..... cfh
cubic feet per minute .... cfm
cubic feet per second .... cfs
cubic foot (feet) ..... cu ft.
cubic inch(es) ..... cu in.
cubic yard(s) ..... cu yd

degree(s) ..... deg
degree(s) Centigrade (Celsius) ..... ^{o}C
degree(s) Fahrenheit ..... ^{o}F
diameter ..... dia
dissolved oxygen ..... DO
dissolved solids ..... DS

elevation ..... el
equation ..... eq
exponential ..... exp

feet ..... ft
figure(s) ..... Fig
foot ..... ft

gallon(s) US ..... US gal
gallon(s) (Imperial) (Imp.)..... gal or Igal
gallon(s) per capita per day (Imp.)..... gpcd or Igpcd
gallon(s) per day (Imp.) ..... gpd or Igpd
gallon per day per acre (Imp.) ..... gpd/acre
gallons per day per capita (Imp.) ..... gpd/cap
gallons per day per square foot(Imp.).. gpd/sq ft
gallon(s) per hour (Imp.) ..... gph
gallon(s) per minute (Imp.) ..... gpm
gallon(s) per second (Imp.) ..... gps
grams per liter ..... g/l

horsepower ..... hp
horsepower-hour(s) .... hp-hr
hour(s)..... hr
hydrogen ion concentration (-log [H+]) ..... pH

inch(es) ..... in.

Jackson turbidity units ..... Jtu

kilovolt(s)..... kv
kilowatt(s) ..... kw
kilowatt-hour(s) ..... kwh

linear foot ..... lin ft
liters l
logarithm (common-base 10) ..... log
logarithm (natural-base e) ..... ln

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man-hour(s) ..... man-hr
maximum ..... max
membrane filter ..... MF
meter(s) ..... m
mho(s) ..... mho
microgram(s) ..... µg
microgram(s) per liter... µg/l
microliter ..... µl
micron(s) ..... µ
mile(s) ..... mi
milligram(s) ..... mg
milligrams per liter .... mg/l
milliliter(s) ..... ml
million gallons (Imp.) ..... mil gal or MG
million gallons per day (Imp.) ..... mgd
million gallons per day per acre (Imp.)..... mgd/acre
minimum ..... min.
minute(s) ..... min
most probable number .... MPN

number(s) ..... No.

part(s) per billion ... ppb=µg/l
part(s) per million ... ppm = mg/l
percent ..... % or percent
pound(s) ..... lb
pound(s) per square inch ..... psi
pound(s) square inch absolute ..... psia
pound(s) per square inch gage ..... psig

revolution(s) per minute ..... rpm
revolution(s) per second ..... rps

second(s) ..... sec
second feet (cubic feet per second) ..... cfs

square ..... sq
square foot (feet) ..... sq ft
square inch(es) ..... sq in

volume ..... vol

weight ..... wt

yard(s) ..... yd
year(s) ..... yr

These symbols may be used in conjunction with numerical values or in mathematical expression.

greater than ..... > or G
less than ..... < or L
infinity ..... ∞

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CHAPTER 10

ECONOMIC ANALYSIS

SYNOPSIS

The economics of providing water on a regional basis compared to a local scheme of St. John's augmenting its own supply system have been examined in this Chapter. Economic factors such as annual costs, annual revenues, cash flows, and the effect of interest rates, escalation rates and subsidies are included in this presentation. A summary of the findings and recommendations is as follows:

- A staged construction program has been assumed for the economic analysis.

- The economic analysis has been prepared on the assumption that the consumer has paid for the services the project provides by the end of the (economic) life of the project.

- At an interest rate of 8 percent and 0 percent escalation, the charge per 1,000 gallons of water is $0.64 in the Regional System and $0.79 in the Local System.

- Effects of changes in interest rates and escalation rates, as well as subsidies on the ultimate charge per 1,000 gallons have been evaluated.

- The cost per 1,000 gallons in the Regional System increases to $1.22 under the assumption that capital was obtained at 10 percent interest rate and costs escalated at a rate of 5.5 percent per annum.

- The effect of subsidy on the cost per 1,000 gallons of water to the consumer could be as great as $0.46 under the condition of 8 percent interest rate and no escalation, or as great as $0.73 under the condition of 10 percent interest and a 5.5 percent escalation rate.

I. INTRODUCTION

Based on an econometric analysis (Chapter 6, Volume II), a regional water conveyance and production system has been developed and recommended upon in Chapters 7 and 8 of Volume III. As noted in the above cited chapters, the City of St. John's, as the central city of the region, essentially forms the core of the proposed regional water system. However, the City of St. John's has had a study carried out for a water supply scheme to supplement the future needs of its own system. This system, referred to in this Chapter as the "local system", supplies water to St. John's, Mount Pearl, Kilbride, Wedgewood Park, Shea Heights. The scheme for the local system has been developed by Canadian-British Engineering Consultants in their reports of 1957 [1] and 1966[2].

This Chapter examines the economics of providing water on a regional basis compared to the local scheme of St. John's augmenting its own supply system. Economic factors such as annual costs, annual revenues, cash flows, and the effect of interest rates, escalation rates and subsidies are included in this presentation.

II. METHODOLOGY

1. General

For the purpose of this economic analysis it has been assumed that:

(i) the consumer pays fully for the service the project provides.

(ii) the project costs are subject to a 0 percent, 4.5 percent or 5.5 percent escalation rate and project funds are available at interest rates of 8 percent, 9 percent and 10 percent per annum. For the local system only an escalation rate of 0 percent and an interest rate of 8 percent have been used.

(iii) the consumer has paid for the services by the end of the (economic) life time of the project, as stipulated in the ensuing sections of this Chapter.

The cost to the consumer, therefore, consists of the following:

(a) Land Acquisition Cost
(b) Design and Construction Costs.
(c) Equipment Costs.
(d) Maintenance and Operation Costs.

2. The St. John's Regional Water System

In Chapter 9 of Volume III we have divided the works recommended for the St. John's Regional Water System into 13 packages to be considered in the programming of a staged construction. However, except for initial construction of packages 1, 2 and 3, no scheduling has been recommended for the staged construction of the other packages, as the final decision in this regard

would likely be based on local political and subjective factors. Nonetheless, for the economic analysis presented here, we have assumed a program of staged construction based on engineering considerations. We feel that this program (even though hypothetical), as given in Table 10.1, is of a benefit since it does provide insight as to the economic aspects of the regional supply system.

TABLE 10.1

ST. JOHN'S REGIONAL WATER SYSTEM

HYPOTHETICAL PROGRAM OF STAGED CONSTRUCTION

Package No.	Package Description	Estimated Cost ($M)	Year of Construction
1	Treatment Works - Bay Bulls Big Pond, first phase construction 16MGD.	8.90	1974-75
2	42"-30" diameter conveyance main from Bay Bulls Big Pond to New Town - Mount Pearl, including booster station at Ruby Line.	4.32	1974-75 1975-76
2A	Service reservoir at New Town - Mount Pearl.	0.75	1989-90
3	30"-24" diameter conveyance main from bifurcation at Ruby Line to St. John's Intermediate Pressure Zone.	2.24	1974-75 1975-76

TABLE 10.1

ST. JOHN'S REGIONAL WATER SYSTEM

HYPOTHETICAL PROGRAM OF STAGED CONSTRUCTION

Package No.	Package Description	Estimated Cost ($M)	Year of Construction
4	18"-10" diameter conveyance main from New Town - Mount Pearl to Conception Bay South Area, including service reservoirs.	3.30	1977-78 1978-79
5	20"-18" diameter conveyance main from existing Venturi House to North Expansion Zone.	0.83	1977-78
5A	Service reservoir at North Expansion Zone.	1.10	1984-85
6	Service reservoir for St. John's Intermediate Pressure Zone and expansion of system to high pressure zone (South Expansion Zone) including booster station and local service.	2.25	1982-83 1983-84
7	Strengthening of existing mains in St. John's Low Pressure Zone including service reservoir.	1.50	1988-89
8	Conveyance main to Goulds and Kilbride including service reservoirs.	1.74	1980-81 1981-82
9	Conveyance main to Paradise including booster station and service reservoir.	0.47	1979-80

TABLE 10.1

ST. JOHN'S REGIONAL WATER SYSTEM

HYPOTHETICAL PROGRAM OF STAGED CONSTRUCTION

Package No.		Estimated Cost ($M)	Year of Construction
10	Conveyance main to Torbay Road and Torbay including booster station and service reservoir.	1.30	1990-91 1991-92
11	Expansion of Treatment Facilities at Bay Bulls Big Pond to a capacity of 24 MGD.	2.15	1985-86 1986-87
12	Treatment Facilities at Windsor Lake.	7.00	1986-87 1987-88 1988-89
13	Conveyance main to Penetanguishene including booster station and service reservoir.	0.31	1992-93

Based on the foregoing, and the contents of Chapters 6, 7, 8 and 9, a projected expenditure program (capital and annual) relative to the assumed construction stages of the different packages and the water quantities that will accordingly be used was prepared for the period 1973-74 through 1994-95. This material is contained in Appendix I, and it can be seen from it that the regional water system stipulates the following requirements as related to land, design and construction, and equipment:

(a) Lands to be purchased are estimated at some 150 acres

for the full project term. This total requirement is comprised of periodic purchases made necessary throughout the life of the project for the purpose of installation of treatment facilities, conveyance mains, pumping stations, reservoirs and the like. Land purchase prices range from $1,000 per acre to $2,000 per acre.

For the implementation of packages one and two the purchase price of $1,000 per acre is assumed. For packages three through eleven the purchase price is $1,500 per acre, and for the implementation of package twelve it is $2,000 per acre. The total purchase price of this land over the full project term is estimated at .280 million dollars, based on 1974 dollar value. This figure is arrived at under the assumption that Crown Lands or land currently owned by the Provincial Government and required for this project will be transferred to the project without charge.

Since the land costs are recoverable at the end/or during the life time of the project by re-selling these lands at their original price, for other purposes such as, right of ways, storage areas, park areas, and the like, it is assumed that the cost of land is the cost of money or interest payments calculated on the basis of the initial purchase price (See Appendix III).

The annual cost of land is, therefore, the annual interest payment, calculated on basis of the purchase price of land in use.

The design and construction costs are estimated at 34.635 million dollars based on 1974 dollar value.

Assuming that the construction components have an (economic) service life of 40 years, the annual cost of design and construction is the annual principal and interest payment for this investment amortized over 40 years (See Appendix III). Therefore, the annual payment for design and construction is increased by the annual cost of design and construction investment as the project is implemented.

(c) Equipment costs which are calculated as a percentage of the total construction costs total 5.475 million dollars based on 1974 dollar value.

It is assumed for the purpose of this analysis that equipment will have a 20 year (economic) service life and a nil salvage value. Thus, the annual cost of equipment is the initial equipment costs amortized over 20 years (See Appendix III).

The above costs are incurred as each new package is introduced into the system. Therefore, the annual payment for equipment is increased by the annual cost of investment in equipment installed as the project progresses.

The annual operating and maintenance costs shown in Appendix III (and discussed in Chapter 6) include power calculated at $100 per horsepower per year, treatment, administration which includes both operating and maintenance personnel, heating and other similar costs.

3. The St. John's Local Water System

The scheme for the St. John's Local Water System is based on the supply of the entire future water need from Windsor Lake augmented by a new reservoir to be developed on Broad Cove River, and Petty Harbour Long Pond. The originally conceived local system, as developed by Canadian-British Engineering Consultants[1] [2], has been updated by us to reflect the following:

(i) Cost escalation. Components of work and cost included in Canadian-British reports were evaluated for present cost using the Construction Cost Index reported in Engineering News Record.

(ii) Quantities, quality and pressure of water, and area served by the local scheme - to correspond to that of the Regional System. Accordingly, the total maximum daily water use will be 24.5 MGD. Of this, about 4.5 MGD will be supplied from Petty Harbour Long Pond and 20 MGD from the Windsor Lake - Broad Cove Reservoir System.

(iii) Costs of components of work not included in Canadian-British reports but required to correspond to the Regional System were taken from the latter estimates.

(iv) Annual costs. Relevant annual costs were taken from the Regional System estimates.

As in the case of the Regional System, we have assumed a program to implement the local scheme in stages, as shown in Table 10.2.

TABLE 10.2

ST. JOHN'S LOCAL WATER SYSTEM

HYPOTHETICAL PROGRAM OF STAGED CONSTRUCTION

Package No.	Package Description	Estimated Cost ($M)	Year of Construction
1	Broad Cove Project Stage 1 Development for 2.75 MGD (should have been developed by 1968, consequently, 1968 prices were used for this stage).	0.90	1974-75
2	Broad Cove Project Stage 2 Development to a yield of 6.75 MGD (in lieu of 8.75 MGD as originally recommended, to correspond with the Regional System)	7.00	1974-75 1975-76
3	Pump Station for Kenmount Road - Mundy Pond area.	0.90	1975-76
4	Main Ring at South Expansion Zone (to correspond with the Regional System).	0.85	1976-77
5	Main Ring at North Expansion Zone (to correspond with the Regional System)	0.80	1977-78

TABLE 10.2

ST. JOHN'S LOCAL WATER SYSTEM

HYPOTHETICAL PROGRAM OF STAGED CONSTRUCTION

Package No.		Estimated Cost (M$)	Year of Construction
6	Service Reservoir at North Expansion Zone (to correspond with the Regional System).	1.00	1987-88
7	Service Reservoir for St. John's Intermediate Pressure Zone plus Facilities for High Pressure Zone (to correspond with the Regional System).	2.20	1982-83 1983-84
8	Service Reservoir for St. John's Low Pressure Zone (to correspond with the Regional System).	1.50	1988-89
9	Windsor Lake Treatment Plant, including improvements to intake (to correspond with the Regional System)	9.00	1985-86 1986-87 1987-88
10	Petty Harbour Long Pond Treatment Plant (to correspond with water quality of Regional System).	4.00	1979-80 1980-81 1981-82
11	24" Diameter Parallel Line to Windsor Lake Main Conduit	0.50	1986-87 1987-88

Based on the foregoing, an expenditure program (capital) and annual) relative to the assumed construction stages of the different packages, was prepared for the period 1973-74 through 1994-95. This program is contained in Appendix II, and it can be seen from it that the Local Water System stipulates the following requirements as related to land, design and construction, and equipment.

(a) Lands to be purchased in addition to the impounding reservoir are estimated at some 75 acres for the full project term. This total requirement is comprised of periodic purchases made necessary throughout the life of the project for the purpose of installation of treatment facilities, conveyance mains, pumping stations, reservoirs and the like. An average land purchase price of $1,500 per acre has been used.

For the development of Broad Cove reservoir a lump sum of $500,000 has been considered. The total purchase price of land over the full project term is thus estimated at .610 million dollars, based on 1974 dollar value. This figure is arrived at under the assumption that Crown Lands or land currently owned by the Provincial Government and required for this project will be transferred to the project without charge.

(b) The design and construction costs are estimated at 24.540 million dollars based on 1974 dollar value over the full project term.

It has been assumed that the construction components have an (economic) service life of 50 years.

Accordingly, the annual cost of design and construction is the annual principal and interest payment for this investment amortized over 50 years (See Appendix IV). Therefore, the annual payment for design and construction is increased by the annual cost of design and construction investment as the project is implemented.

(c) Equipment costs which are calculated as a percentage of the total construction costs total 5.350 million dollars based on 1974 dollar value.

It is assumed for the purpose of this analysis that equipment will have a 20 year (economic) service life and a nil salvage value. Thus, the annual cost of equipment is the initial equipment costs amortized over 20 years (See Appendix IV).

The above costs are incurred as each new package is introduced into the system. Therefore, the annual payment for equipment is increased by the annual cost of investment in equipment installed as the project progresses.

The annual operating and maintenance costs shown in Appendix IV include power calculated at $100 per horsepower per year, treatment, administration which includes both operating and maintenance personnel, heating and other similar costs.

III. ANNUAL COSTS AND REVENUES

1. St. John's Regional Water System

The results of the economic analysis showing annual costs and annual revenues for the different escalating rates and fund interest rates as outlined previously in Section II.1 of this Chapter, are contained in Appendix III through Appendix III (H).

Using the data in Appendix III, it can be seen that:

(i) Annual capital payments account for about 70 percent of the total annual costs. Since these payments are basically fixed, there is relatively little latitude available to reduce annual costs through improvements of efficiency in operation and maintenance. This, however, is not to infer that such improvement efforts should not be practised.

(ii) Operational losses are incurred in the initial 13 years of the project due to the time elapsed between the original investment and revenue produced. In the later years when consumption has increased, the revenue exceeds the annual cost and surplus is generated.

Under the premise that the system should operate on a self-sustaining basis at all times at a constant rate per 1,000 gallons without generating a surplus, it is necessary to defer the initial losses to a period when a surplus revenue is generated.

The effect of changes in interest rates and escalation rates on the ultimate charge per 1,000 gallons is shown in Table 10.3. It can be seen that on the basis of 8 percent interest rate and 0 percent escalation the water charge is $0.64 per 1,000 gallons.

TABLE 10.3

WATER CHARGE PER 1,000 GALLONS
AT DIFFERENT INTEREST AND ESCALATION RATES

Interest Rates	Escalation Rates		
	0%	4.5%	5.5%
8%	$0.64	$0.97	$1.07
9%	$0.69	$1.04	$1.15
10%	$0.74	$1.10	$1.22

Note: Table illustrates uniform charge to the consumer per 1,000 gallons necessary to absorb total costs under above escalation and interest rates.

2. St. Jonn's Local Water System

The results of the economic analysis showing annual costs and annual revenues for an 8 percent interest rate and 0 percent escalation, are contained in Appendix IV (A).

Since operational losses are incurred in the initial years, these losses were deferred by borrowing monies and repayment of same in periods of operating surplus.

On tnis basis the rate per 1,000 gallons is $0.79 and the working capital requirements are $466,500 over the first 20 years of operation.

3. Comparison of Regional vs. Local System

The economics of a Regional Water System versus a Local St. John's System have been examined. The results of this economic analysis, as presented above and contained in Appendices III - III (H) and IV - IV (A), clearly indicate the benefits that can be experienced in a regional system.

The charge per 1000 gallons in a Regional System (at 8 percent interest rate and 0 percent escalation) would be $0.64. Under the same conditions water in a Local System would cost $0.79 per 1000 gallons. These figures compare to $0.17 per 1000 gallons in the existing City of St. John's system.

The charge of $0.64 per 1000 gallons is not unusually high when related to other urban centres where modern water supply facilities are in service. In Oakville, for example, the rate per 1,000 gallons is $0.58 for consumption between 6,000 and 20,000 gallons and $0.69 for consumption in excess of 20,000 gallons on a bi-monthly basis. In cities with older systems, such as the City of Toronto, the rate is $0.41 per 1,000 gallons. The rate per 1,000 gallons in Etobicoke is $0.52, and in North York a rate of $0.50 per 1,000 gallons is levied.

On the basis of the above presentation, a cash flow program and the effect of subsidies on water rates in the St. John's Regional Water System have been prepared. This analysis is presented in the following sections.

IV CASH FLOW PROGRAM

Cash flow programs have been prepared for conditions of 8 percent interest rate and 0 percent escalation, and 10 percent interest rate and 5.5 percent escalation rate. These cash flow programs, contined in Appendices V (A) and V (B), are shown to account for the following major groups of cash in flow and disposition on a year by year basis:

(i) an opening balance.

(ii) investments representing the annual investment in land, design and construction, and equipment.

(iii) revenue resulting from the sale of water generated by the project.

(iv) loans incurred to defer initial losses to a period when surplus revenue is generated.

(v) working capital necessary to balance the annual fluctuations in revenue and disbursements.

(vi) installations representing the annual capital expenditures for the project. (See item (ii) above).

(vii) annual capital repayments representing the annual payments of principal and interest for capital investment implemented by the project to date.

(viii) operating and maintenance costs.

(ix) loan repayments representing the annual payments of principal and interest for loans incurred to off set initial operating losses. (See item (iv) above).

It will be noted in Appendix V that the minimum working capital required for conditions of 10 percent interest rate and 5.5 percent escalation rate is $909,333. The resulting water charge is $1.22 per 1,000 gallons. For conditions of 8 percent interest rate and 0 percent escalation the working capital required is $1,204,779, resulting in a water charge of $0.64 per 1,000 gallons.

V. EFFECT OF SUBSIDIES

In the following, the effect of subsidies on the ultimate charge per 1,000 gallons is described.

For the St. John's Regional Water System the charge per 1,000 gallons may be reduced if assistance were made available to the program through subsidies or grants. For example, compared to the water rates computed in Table 10.3, a grant of 10 million dollars applied to investment will result in a reduction of the cost per 1,000 gallons from $0.64 to $0.49 under the assumption of 8 percent interest and 0 percent escalation. A reduction from $1.04 to $0.87 would result under the assumption of 9 percent interest and 4.5 percent escalation A reduction from $1.22 to $1.03 would result under the assumption of 10 percent interest and 4.5 percent escalation. The effects of subsidy to capital cost in increments of 5 million dollars on the ultimate rate per 1,000 gallons are illustrated graphically for payments of 8 percent, 9 percent, and 10 percent interest and 0 percent, 4.5 percent and 5.5 percent escalation, in Appendix VI.

It will be noted that the X axis represents the project life expressed in years and the Y axis represents the rate per 1,000 gallons of water. The rate per 1,000 gallons of water would be $0.64 if no subsidies were applied. Assuming that subsidies or grants are being made available progressing in increments of 5 million dollars as the project is being implemented, that is in accordance with the need for investment funds, the uniform rate for 1,000 gallons of water that is necessary to put the system on a self-sustaining basis would decrease as shown by the curves. Each of the curves accounts for the effects of the assumed interest rate and escalation rate.

VI. CONCLUSION

The costs considered in this Economic Analysis were stated in a 1974 dollar value. These costs were analyzed considering different escalation rates and availability of capital subject to different interest rates.

Costs were defrayed over periods of 1 year, 20 years and 40 years in accordance with the service life anticipated from the expenditure.

It was determined that the cost per 1,000 gallons was $0.64 under the assumption that capital is made available subject to an 8 percent interest rate and that there was no escalation in costs. The cost per 1,000 gallons increases to $1.22 under the assumption that capital was obtained at a 10 percent interest rate and costs escalated at a rate of 5.5 percent per annum.

The effects of possible grants or subsidies for investment on the consumer price per 1,000 gallons have also been considered. It was determined that the effect of a subsidy on the cost per 1,000 gallons of water to the consumer could be as great as $0.46 per 1,000 gallons under the condition of 8 percent interest and no escalation rate or as great as $0.73 per 1,000 gallons under the condition of 10 percent interest and a 5.5 percent escalation rate.

An in-depth analysis of grants, subsidies or other forms of assistance including the possible sources of the same is outside the terms of reference. Thus the economic analysis confined itself to the theoretical effect of assistance in varying degrees on the price per 1,000 gallons of water to the consumer.

It will be of interest to compare the annual cost of water to a residential customer in the St. John's Regional and Local Water Systems with that in other existing and new systems. Table 10.4 gives this cost comparison.

TABLE 10.4

ANNUAL COST OF WATER

SAMPLE OF ONTARIO MUNICIPAL RATES[1]

AND HALIFAX PROPOSED POCKWOCK WATER SUPPLY SYSTEM[2]

COMPARED WITH STUDY AREA RATES[3]

MUNICIPALITY	Approximate Population Served	Cost For Family of 4, Using 35 gpd/Person $/Year
ONTARIO		
Toronto	700,000	26
Ottawa-Carleton	445,872	20
Windsor	210,900	21
Mississauga	145,000	38
Borough of York	142,296	28
Kitchener	113,831	21
St. Catherines	106,000	21
Sudbury	84,100	37
Kingston	74,121	29
Belleville	33,814	37
POCKWOCK SYSTEM		
Halifax	110,000	44
Dartmouth	50,000	68
Bedford-Sackville	6,000	70
STUDY AREA		
Regional Scheme	195,000	33
Local Scheme	160,000	40

1. Water Works Digest, "1972 10th Annual Survey of Municipal Water Rates of Ontario" May 1972, Vol. 14, No. 1; published by Stanton.
2. Feasibility Study Proposed Pockwock Water Supply System, Stevenson & Kellog Ltd., Management Consultants, 1973.
3. Based on 8 percent interest rate and 0 percent escalation.

REFERENCES

(1) St. John's Metropolitan Area - A Report on the Planning, Utility Services and Metropolitan Administration of an Area embracing the City of St. John's, the Town of Mount Pearl Park - Glendale and the surrounding areas. Canadian - British Engineering Consultants, November 1957.

(2) City of St. John's Report on Water Supply System, April 1966, Canadian - British Engineering Consultants.

A P P E N D I X I

ST. JOHN'S REGIONAL WATER SYSTEM

ESTIMATES - COST, CONSUMPTION AND PACKAGE INTRODUCTION

$ = 1974 DOLLAR VALUE

Year	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	TOTAL
Land	-	100000	-	10000	30000	10000	35000	-	20000	-	-	-	5000	20000	-	10000	10000	10000	10000	-	-	-	280000
Pre-design	100000	-	-	30000	15000	10000	10000	-	15000	-	30000	30000	15000	25000	-	10000	15000	-	15000	-	-	-	320000
Design	80000	360000	140000	60000	120000	20000	20000	70000	50000	50000	40000	120000	20000	170000	120000	80000	50000	30000	25000	10000	-	-	1635000
Construction	-	4400000	6940000	1500000	1830000	2300000	450000	740000	1000000	1000000	1200000	1100000	1000000	1400000	3000000	2500000	750000	600000	685000	290000	-	-	32685000
Design and Construction	180000	4760000	7080000	1590000	1965000	2330000	480000	810000	1065000	1050000	1270000	1250000	1035000	1595000	3120000	2590000	815000	630000	725000	300000	-	-	34640000
Equipment	-	-	1370000	1250000	-	-	15000	-	-	-	50000	45000	-	710000	1000000	1000000	-	-	15000	20000	-	-	5475000
Power	-	-	60000	66000	72000	88000	97000	103000	114000	121000	130000	140000	147000	152000	178000	207000	213000	229000	233000	241000	248000	253000	3094000
Treatment	-	-	290000	290000	300000	335000	360000	360000	385000	395000	410000	420000	425000	430000	825000	885000	895000	925000	945000	960000	970000	975000	11780000
Administration	-	40000	60000	80000	120000	150000	150000	150000	150000	150000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000	3450000
Compensation	-	-	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	25000	500000
O. & M.	-	-	65000	65000	75000	105000	110000	110000	128000	128000	150000	160000	160000	160000	160000	175000	185000	185000	195000	200000	200000	200000	2916000
Operation and Maintenance	-	40000	500000	526000	592000	703000	742000	748000	802000	819000	915000	945000	957000	967000	1388000	1492000	1518000	1564000	1598000	1626000	1643000	1653000	21740000
Packages	-	-	1,2,3	1,2,3	1,2,3,5	1,2,3,5, 4	1,2,3,5, 4,9	1,2,3,5, 4,9	1,2,3,5, 4,9,8	1,2,3,5, 4,9,8	1,2,3,5, 4,9,8,6	1,2,3,5, 4,9,8,6 5A	1,2,3,5 4,9,8,6 5A	1,2,3,5, 4,9,8,6, 11,5A,	1,2,3,5, 4,9,8,6, 11,5A,7,	1,2,3,5, 4,9,8,6, 11,5A,7, 12,	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,10,	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,10, 13	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,10, 13	1,2,3,5, 4,9,8,6, 11,5A,7, 12,2A,10, 13	31010
Consumption in M.G.D.	-	-	5.05	5.45	6.75	8.30	9.10	9.65	10.60	11.10	11.60	12.10	12.50	12.90	20.60	23.00	23.90	24.40	25.10	25.60	26.00	26.50	

APPENDIX II

ST. JOHN'S LOCAL WATER SYSTEM

COST ESTIMATES - 1974 DOLLAR VALUE

	LAND COST	DESIGN AND CONSTRUCTION	EQUIPMENT	MAINTENANCE AND OPERATING
1974	$ 500,000	$ 4,300,000	$ -	$ 20,000
1975	-	2,780,000	2,300,000	140,000
1976	20,000	930,000	-	171,000
1977	-	830,000	-	193,000
1978	20,000	200,000	-	195,000
1979	-	1,050,000	-	197,000
1980	-	2,030,000	-	199,000
1981	20,000	550,000	1,000,000	438,000
1982	-	1,070,000	-	470,000
1983	-	1,280,000	50,000	490,000
1984	50,000	1,300,000	-	492,000
1985	-	3,100,000	1,000,000	493,000
1986	-	2,470,000	1,000,000	495,000
1987	-	1,070,000	-	1,001,000
1988	-	1,580,000	-	1,048,000
1989	-	-	-	1,061,000
1990	-	-	-	1,073,000
1991	-	-	-	1,080,000
1992	-	-	-	1,087,000
1993	-	-	-	1,095,000
1994	-	-	-	1,103,000
Total (30,500,000)	$ 610,000	$ 24,540,000	$ 5,350,000	

APPENDIX III

ST. JOHN'S REGIONAL WATER SYSTEM

8% INTEREST - 0% ESCALATION RATE

YEAR	LAND PURCHASED PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COSTS	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPR DEFICIT/ SURPLUS
P.I.	108000	5384800	0	8639	451569	0	460209	0	460209	0	-460209
1976	0	7080000	1370000	0	593728	139534	1193472	500000	1693472	1179678	-513794
1977	10000	1590000	1250000	799	133337	127312	1454921	526000	1980921	1273118	-707803
1978	30000	1965000	0	2399	164784	0	1622105	592000	2214105	1576797	-637308
1979	10000	2330000	0	799	195393	0	1818298	703000	2521298	1938877	-582421
1980	35000	480000	15000	2799	40252	1527	1862878	742000	2604878	2125757	-479121
1981	0	810000	0	0	67926	0	1930804	748000	2678804	2254237	-424567
1982	20000	1065000	0	1599	89310	0	2021714	802000	2823714	2476156	-347558
1983	0	1050000	0	0	88052	0	2109766	819000	2928766	2592956	-335810
1984	0	1270000	50000	0	106502	5092	2221360	915000	3136360	2709756	-426604
1985	0	1250000	45000	0	104824	4583	2330768	945000	3275768	2826556	-449212
1986	5000	1035000	0	399	86795	0	2417963	957000	3374963	2919995	-454968
1987	20000	1595000	710000	1599	133756	72313	2625633	967000	3592633	3013436	-579197
1988	0	3120000	1000000	0	261643	101849	2989126	1388000	4377126	4812154	+435028
1989	20000	2590000	1000000	1599	217197	101849	3309773	1312500	4622273	5372792	+750519
1990	10000	815000	0	799	68345	0	3378918	1518000	4896918	5583032	+686114
1991	10000	630000	0	799	52831	0	3432549	1564000	4996549	5699833	+703284
1992	10000	725000	15000	799	60798	1527	3495675	1598000	5093675	5863353	+769678
1993	0	295000	20000	0	24738	2036	3522450	1626000	5148450	5980154	+831704
1994	0	0	0	0	0	0	3522450	1643000	5165450	6073592	+908142
1995	0	0	0	0	0	0	3522450	1653000	5175450	6167033	+991583

APPENDIX III (A)

ST. JOHN'S REGIONAL WATER SYSTEM

8% INTEREST - 4.5% ESCALATION RATE

YEAR	LAND PURCHASE PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COSTS	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	112000	5644000	0	8959	473305	0	482265	0	482265	0	-482266
1976	0	8078280	1563170	0	677444	159208	1318918	570500	1889418	1787949	-101469
1977	11930	1896870	1491250	954	159071	151883	1630827	627518	2258345	1929569	-328776
1978	37380	2448390	0	2990	205321	0	1839139	737632	2576771	2389834	-186937
1979	13020	3033660	0	1041	254402	0	2094583	915306	3009889	2938611	- 71278
1980	47635	653280	20415	3810	54784	2079	2155257	1009862	3165119	3221850	+ 56731
1981	0	1151820	0	0	96591	0	2251848	1063656	3315504	3416578	+101074
1982	29720	1582590	0	2377	132715	0	2386941	1191772	3578713	3752925	+174212
1983	0	1630650	0	0	136746	0	2523687	1271907	3795594	3929950	+134356
1984	0	2061210	81150	0	172853	8265	2704805	1485045	4189850	4106975	- 82875
1985	0	2120000	76320	0	177783	7773	2890361	1602720	4493081	4283999	-209082
1986	8860	1834020	0	708	153800	0	3044870	1696690	4741560	4425617	-315943
1987	37040	2953940	1314920	2963	247717	133924	3429475	1790884	5220359	4567239	-653120
1988	0	6037200	1935000	0	506279	197079	4132834	2685780	6818614	7293421	+474807
1989	40440	5236980	2022000	3235	439173	205940	4781182	2653875	7435057	8143139	+708082
1990	21130	1722095	0	1690	144414	0	4927287	3207534	8134821	8461783	+326962
1991	22080	1391040	0	1766	116652	0	5045705	3453312	8499017	8638809	+139792
1992	23080	1673300	34620	1846	140322	3526	5191400	3688184	8879584	8886644	+ 7060
1993	0	711540	48240	0	59669	4913	5255982	3921912	9177894	9063671	-114223
1994	0	0	0	0	0	0	5255982	4140360	9396342	9205288	-191054
1995	0	0	0	0	0	0	5255982	4354002	9609984	9346910	-263074

APPENDIX III (B)

ST. JOHN'S REGIONAL WATER SYSTEM

8% INTEREST - 5.5% ESCALATION RATE

YEAR	LAND PURCHASED PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COST	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	113000	5467000	0	9039	458462	0	467502	0	467502	0	-467503
1976	0	8311920	1608380	0	697037	163813	1328353	587000	1915353	1972263	+ 56910
1977	12390	1970010	1548750	991	165204	157740	1652289	651714	2304003	2128482	-175521
1978	39210	2568255	0	3136	215373	0	1870799	773744	2644543	2636194	- 8349
1979	13790	3213070	0	1103	269447	0	2141350	969437	3110787	3241542	+130755
1980	50925	698400	21825	4073	58567	2222	2206214	1079610	3285824	3553980	+268156
1981	0	1243350	0	0	104267	0	2310481	1148180	3458661	3768781	+310120
1982	32380	1724235	0	2590	144594	0	2457665	1298438	3756103	4139801	+383698
1983	0	1793400	0	0	150394	0	2608059	1398852	4006911	4335075	+328164
1984	0	2288540	90100	0	191916	9176	2809152	1648830	4457982	4530349	+ 72367
1985	0	2376250	85545	0	199272	8712	3017137	1796445	4813582	4725623	- 87959
1986	10030	2076210	0	802	174110	0	3192050	1920745	5112795	4881839	-230956
1987	42320	3375020	1502360	3385	283029	153015	3631479	2046172	5677651	5038061	-639590
1988	0	6963840	2232000	0	583987	227329	442795	3098016	7540811	8045275	+504464
1989	47100	6099450	2355000	3767	511499	239856	5197919	3090937	8288856	8982588	+693732
1990	24850	2025275	0	1987	169839	0	5369746	3772230	9141976	9334079	+192103
1991	26210	1651230	0	2096	138472	0	5510314	4099244	9609558	9529355	- 80203
1992	27760	2005350	41490	2212	168168	4225	5684921	4420068	10104989	9802738	-302251
1993	0	860810	58360	0	72187	5943	5763052	4744668	10507720	9998014	-509706
1994	0	0	0	0	0	0	5763052	5057154	10820206	10154230	-665976
1995	0	0	0	0	0	0	5763052	5368944	11131996	10310451	-821545

APPENDIX III (C)

ST. JOHN'S REGIONAL WATER SYSTEM

9% INTEREST - 0% ESCALATION RATE

YEAR	LAND PURCHASED PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COST	ANNUAL DESIGN AND CONSTRUCTION COST	ANNUAL EQUIPMENT COST	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	109000	5401000	43000	9809	502071	4710	516591	0	516591	0	-516592
1976	0	7080000	1370000	0	658149	150077	1324819	500000	1824819	1271840	-552979
1977	10000	1590000	1250000	899	147804	136932	1610456	526000	2136456	1372580	-763876
1978	30000	1965000	0	2699	182664	0	1795820	592000	2387820	1699985	-687835
1979	10000	2330000	0	899	216594	0	2013314	703000	2716314	2090352	-625962
1980	35000	480000	15000	3149	44620	1643	2062727	742000	2804727	2291832	-512895
1981	0	810000	0	0	75296	0	2138023	748000	2886023	2430349	-455674
1982	20000	1065000	0	1799	99001	0	2238824	802000	3040824	2669606	-371218
1983	0	1050000	0	0	97606	0	2336430	819000	3155430	2795531	-359899
1984	0	1270000	50000	0	118057	5477	2459965	915000	3374965	2921456	-453509
1985	0	1250000	45000	0	116198	4929	2581093	945000	3526093	3047381	-478712
1986	5000	1035000	0	449	96212	0	2677755	957000	3634755	3148119	-486636
1987	20000	1595000	710000	1799	148269	77777	2905602	967000	3872602	3248861	-623741
1988	0	3120000	1000000	0	290032	109545	3305179	1388000	4693179	5188103	+494924
1989	20000	2590000	1000000	1799	240763	109545	3657288	1312500	4969788	5792542	+822754
1990	10000	815000	0	899	75761	0	3733949	1518000	5251949	6019206	+767257
1991	10000	630000	0	899	58564	0	3793413	1564000	5357413	6145132	+787719
1992	10000	725000	15000	899	67395	1643	3863351	1598000	5461351	6321427	+860076
1993	0	295000	20000	0	27422	2190	3892964	1626000	5518964	6447353	+928389
1994	0	0	0	0	0	0	3892964	1643000	5535964	6548091	+1012127
1995	0	0	0	0	0	0	3892964	1653000	5545964	6648832	+1102868

APPENDIX III (D)

ST. JOHN'S REGIONAL WATER SYSTEM

9% INTEREST - 4.5% ESCALATION RATE

YEAR	LAND PURCHASE PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COSTS	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	113000	5653000	46000	10169	525497	5039	540706	0	540706	0	-540706
1976	0	8078280	1563170	0	750948	171238	1462893	570500	2033393	1916970	-116423
1977	11930	1896870	1491250	1073	176331	163360	1803658	627518	2431176	2068809	-362367
1978	37380	2448390	0	3364	227599	0	2034622	737632	2772254	2562287	-209967
1979	13020	3033660	0	1171	282005	0	2317799	915306	3233105	3150664	- 82441
1980	47635	653280	20415	4287	60728	2236	2385050	1009862	3394912	3454342	+ 59430
1981	0	1151820	0	0	107072	0	2492122	1063656	3555778	3663122	+107344
1982	29720	1582590	0	2674	147115	0	2641912	1191772	3833684	4023740	+190056
1983	0	1630650	0	0	151583	0	2793495	1271907	4065402	4213539	+148137
1984	0	2061210	81150	0	191607	8889	2993992	1485045	4479037	4403338	- 75699
1985	0	2120000	76320	0	197073	8360	3199425	1602720	4802145	4593137	-209008
1986	8860	1834020	0	797	170488	0	3370711	1696690	5067401	4744974	-322427
1987	37040	2953940	1314920	3333	274595	144044	3792683	1790884	5583567	4896816	-686751
1988	0	6037200	1935000	0	561211	211971	4565866	2685780	7251645	7819721	+568075
1989	40440	5236980	2022000	3639	486824	221501	5277831	2653875	7931706	8730756	+799050
1990	21130	1722095	0	1901	160084	0	5439816	3207534	8647350	9072393	+425043
1991	22080	1391040	0	1987	129309	0	5571112	3453312	9024424	9262195	+237771
1992	23080	1673300	34620	2077	155548	3792	5732529	3688184	9420713	9527913	+107200
1993	0	711540	48240	0	66144	5284	5803957	3921912	9725869	9717715	- 8154
1994	0	0	0	0	0	0	5803957	4140360	9944317	9869551	- 74766
1995	0	0	0	0	0	0	5803957	4354002	10157959	10021392	-136567

APPENDIX III (E)

ST. JOHN'S REGIONAL WATER SYSTEM

9% INTEREST - 5.5% ESCALATION RATE

YEAR	LAND PURCHASED DATE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COST	ANNUAL DESIGN AND CONSTRUCTION COST	ANNUAL EQUIPMENT COST	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	114000	5709000	46000	10259	530702	5039	546001	0	546001	0	-546002
1976	0	8311920	1608380	0	772667	176191	1494860	587000	2081860	2119712	+ 37852
1977	12390	1970010	1548750	1115	183130	169659	1848764	651714	2500478	2287610	-212868
1978	39210	2568255	0	3528	238742	0	2091035	773744	2864779	2833279	- 31500
1979	13790	3213070	0	1241	298683	0	2390959	969437	3360396	3483885	+123489
1980	50925	698400	21825	4583	64922	2390	2462855	1079610	3542465	3819681	+277216
1981	0	1243350	0	0	115580	0	2578435	1148180	3726615	4050541	+323926
1982	32380	1724235	0	2914	160283	0	2741632	1298438	4040070	4449299	+409229
1983	0	1793400	0	0	166712	0	2908344	1398852	4307196	4659172	+351976
1984	0	2288540	90100	0	212740	9870	3130954	1648830	4779784	4869044	+ 89260
1985	0	2376250	85545	0	220893	9371	3361218	1796445	5157663	5078917	- 78746
1986	10030	2076210	0	902	193002	0	3555123	1920745	5475868	5246813	-229055
1987	42320	3375020	1502360	3808	313738	164577	4037247	2046172	6083419	5414713	-668706
1988	0	6963840	2232000	0	647351	244506	4929105	3098016	8027121	8646751	+619630
1989	47100	6099450	2355000	4238	566998	257980	5758323	3090937	8849260	9654139	+804879
1990	24850	2025275	0	2236	188267	0	5948826	3772230	9721056	10031908	+310852
1991	26210	1651230	0	2358	153496	0	6104681	4099244	10203925	10241783	+ 37858
1992	27660	2005350	41490	2489	186415	4545	6298130	4420068	10718198	10535605	-182593
1993	0	860810	58360	0	80020	6393	6384543	4744668	11129211	10745480	-383731
1994	0	0	0	0	0	0	6384543	5057154	11441697	10913375	-528322
1995	0	0	0	0	0	0	6384543	5368944	11753487	11081275	-672212

APPENDIX III (F)

ST. JOHN'S REGIONAL WATER SYSTEM

10% INTEREST - 0% ESCALATION RATE

YEAR	LAND PURCHASED PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COST	ANNUAL DESIGN AND CONSTRUCTION COST	ANNUAL EQUIPMENT COST	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER DEFICIT/ SURPLUS
P.I.	110000	5448000	43200	10999	557112	5074	573186	0	573186	0	-573187
1976	0	7080000	1370000	0	724000	160920	1458107	500000	1958107	1364002	-594105
1977	10000	1590000	1250000	999	162593	146824	1768525	526000	2294525	1472042	-822483
1978	30000	1965000	0	2999	200940	0	1972465	592000	2564465	1823172	-741293
1979	10000	2330000	0	999	238265	0	2211730	703000	2914730	2241827	-672903
1980	35000	480000	15000	3499	49084	1761	2266076	742000	3008076	2457906	-550170
1981	0	810000	0	0	82830	0	2348906	748000	3096906	2606461	-490445
1982	20000	1065000	0	1999	108906	0	2459812	802000	3261812	2863056	-398756
1983	0	1050000	0	0	107372	0	2567184	819000	3386184	2998106	-388078
1984	0	1270000	50000	0	129870	5872	2702927	915000	3617927	3133156	-484771
1985	0	1250000	45000	0	127824	5285	2836037	945000	3781037	3268206	-512831
1986	5000	1035000	0	499	105839	0	2942376	957000	3899376	3376244	-523132
1987	20000	1595000	710000	1999	163104	83396	3190877	967000	4157877	3484825	-673592
1988	0	3120000	1000000	0	319051	117459	3627388	1388000	5015388	5564053	+548665
1989	20000	2590000	1000000	1999	264853	117459	4011701	1312500	5324201	6212291	+888090
1990	10000	815000	0	999	83341	0	4096042	1518000	5614042	6455380	+841338
1991	10000	630000	0	999	64423	0	4161465	1564000	5725465	6590432	+864967
1992	10000	725000	15000	999	74138	1761	4238365	1598000	5836365	6779502	+943137
1993	0	295000	20000	0	30166	2349	4270880	1626000	5896880	6914553	+1017673
1994	0	0	0	0	0	0	4270880	1643000	5913880	7022591	+1108711
1995	0	0	0	0	0	0	4270880	1653000	5923880	7130632	+1206752

APPENDIX III (G)

ST. JOHN'S REGIONAL WATER SYSTEM

10% INTEREST - 4.5% ESCALATION RATE

YEAR	LAND PURCHASE PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COSTS	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTION	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	114000	5708000	46000	11399	583700	5403	600503	0	600503	0	-600503
1976	0	8078280	1563170	0	826084	183609	1610197	570500	2180697	2027557	-153140
1977	11930	1896870	1491250	1192	193973	175162	1980525	627518	2608043	2188155	-419888
1978	37380	2448390	0	3737	250372	0	2234635	737632	2972267	2710101	-262166
1979	13020	3033660	0	1301	310222	0	2546158	915306	3461464	3332421	-129043
1980	47635	653280	20415	4763	66804	2397	2620123	1009862	3629985	3653618	+ 23633
1981	0	1151820	0	0	117785	0	2737908	1063656	3801564	3874441	+ 72877
1982	29720	1582590	0	2971	161835	0	2902715	1191772	4094487	4255863	+161376
1983	0	1630650	0	0	166750	0	3069465	1271907	4341372	4456611	+115239
1984	0	2061210	81150	0	210779	9531	3289776	1485045	4774821	4657360	-117461
1985	0	2120000	76320	0	216791	8964	3515531	1602720	5118251	4858108	-260143
1986	8860	1834020	0	885	187546	0	3703963	1696690	5400653	5018704	-381949
1987	37040	2953940	1314920	3703	302069	154450	4164187	1790884	5955071	5179305	-775766
1988	0	6037200	1935000	0	617364	227285	5008836	2685780	7694616	8270828	+576212
1989	40440	5236980	2022000	4043	535533	237504	5785917	2653875	8439792	9234419	+794627
1990	21130	1722095	0	2112	176101	0	5964131	3207534	9171665	9595765	+424100
1991	22080	1391040	0	2207	142247	0	6108586	3453312	9561898	9796516	+234618
1992	23080	1673300	34620	2307	171111	4066	6286072	3688184	9974256	10077563	+103307
1993	0	711540	48240	0	72762	5666	6364500	3921912	10286412	10278314	- 8098
1994	0	0	0	0	0	0	6364500	4140360	10504860	10438909	- 65951
1995	0	0	0	0	0	0	6364500	4354002	10718502	10599510	-118992

APPENDIX III (H)

ST. JOHN'S REGIONAL WATER SYSTEM

10% INTEREST - 5.5% ESCALATION RATE

YEAR	LAND PURCHASED PRICE	DESIGN AND CONSTRUCTION INVESTMENT	EQUIPMENT INVESTMENT	ANNUAL LAND COST	ANNUAL DESIGN AND CONSTRUCTION COSTS	ANNUAL EQUIPMENT COSTS	ANNUAL CAPITAL PAYMENTS	OPERATIONS AND MAINTENANCE	TOTAL ANNUAL COSTS	ANNUAL REVENUE COLLECTED	ANNUAL OPER. DEFICIT/ SURPLUS
P.I.	115000	5765000	46000	11499	589528	5403	606431	0	606431	0	-606432
1976	0	8311920	1608380	0	849976	188920	1645328	587000	2232328	2248730	+ 16402
1977	12390	1970010	1548750	1238	201453	181916	2029936	651714	2681650	2426848	-254802
1978	39210	2568255	0	3920	262629	0	2296486	773744	3070230	3005729	- 64501
1979	13790	3213070	0	1378	328568	0	2626433	969437	359870	3695934	+100064
1980	50925	698400	21825	5092	71418	2563	2705507	1079610	3785117	4052169	+267052
1981	0	1243350	0	0	127144	0	2832651	1148180	3980831	4297080	+316249
1982	32380	1724235	0	3237	176320	0	3012209	1298438	4310647	4720109	+409462
1983	0	1793400	0	0	183393	0	3195602	1398852	4594454	4942756	+348302
1984	0	2288540	90100	0	234026	10583	3440211	1648830	5089041	5165403	+ 76362
1985	0	2376250	85545	0	242995	10048	3693254	1796445	5489699	5388049	-101650
1986	10030	2076210	0	1002	212313	0	3906570	1920745	5827315	5566164	-261151
1987	42320	3375020	1502360	4231	345129	176467	4432398	2046172	6478570	5744284	-734286
1988	0	6963840	2232000	0	712122	262170	5406690	3098016	8504706	9173043	+668337
1989	47100	6099450	2355000	4709	623729	276618	6311747	3090937	9402684	10241746	+839062
1990	24850	2025275	0	2484	207104	0	6521336	3772230	10293566	10642509	+348943
1991	26210	1651230	0	2620	168854	0	6692811	4099244	10792055	10865158	+ 73103
1992	27660	2005350	41490	2765	205067	4873	6905517	4420068	11325585	11176864	-148721
1993	0	860810	58360	0	88026	6854	7000398	4744668	11745066	11399513	-345553
1994	0	0	0	0	0	0	7000398	5057154	12057552	11577626	-479926
1995	0	0	0	0	0	0	7000398	5368944	12369342	11755746	-613596

APPENDIX IV

ST. JOHN'S LOCAL WATER SYSTEM

8% INTEREST - 0% ESCALATION RATE

	LAND COST 8%	ANNUAL TOTAL	DESIGN AND CONSTRUCTION 8%/50 YRS.	ANNUAL TOTAL	EQUIPMENT 8%/20 YRS.	ANNUAL TOTAL	ANNUAL TOTAL & M&O
1974	$ 40,000	$ 40,000	$ 351,482	$ 351,482	$ -	$ -	$ 411,482
1975	-	40,000	227,237	578,719	234,255	234,255	992,974
1976	1,600	41,600	76,018	654,737	-	234,255	1,101,592
1977	-	41,600	67,844	722,581	-	234,255	1,191,436
1978	1,600	43,200	16,348	738,929	-	234,255	1,221,384
1979	-	43,200	85,827	824,766	-	234,255	1,299,221
1980	-	43,200	165,932	990,698	-	234,255	1,467,153
1981	1,600	44,800	44,957	1,035,655	101,850	336,105	1,854,560
1982	-	44,800	87,462	1,123,177	-	336,105	1,974,022
1983	-	44,800	104,627	1,227,744	509,250	845,355	2,607,899
1984	4,000	48,800	106,262	1,334,006	-	845,355	2,720,161
1985	-	48,800	253,394	1,587,400	101,850	947,205	3,076,405
1986	-	48,800	201,898	1,789,298	101,850	1,049,055	3,382,153
1987	-	48,800	87,462	1,876,760	-	1,049,055	3,975,615
1988	-	48,800	129,149	2,005,909	-	1,049,055	4,151,764
1989	-	48,800	-	2,005,909	-	1,049,055	4,164,764
1990	-	48,800	-	2,005,909	-	1,049,055	4,176,764
1991	-	48,800	-	2,005,909	-	1,049,055	4,183,764
1992	-	48,800	-	2,005,909	-	1,049,055	4,190,764
1993	-	48,800	-	2,005,909	-	1,049,055	4,198,764
1994	-	48,800	-	2,005,909	-	1,049,055	4,206,764

APPENDIX IV (A)

ST. JOHN'S LOCAL WATER SYSTEM

8% INTEREST - 0% ESCALATION RATE

	BILLIONS OF GALLONS CONSUMED	COST OF PRODUCING GALLONS	REVENUE $0.79/UNIT	OPERATIONAL DEFICIT/ SURPLUS	REQUIRED ANNUAL LOAN REPAYMENTS
1974		$ 411,482	$ -	$ 411,482	$ 41,909
1975		992,974	-	992,974	101,134
1976	.91	1,101,592	723,450	378,142	38,513
1977	1.19	1,191,436	946,050	245,386	24,992
1978	1.50	1,211,384	1,192,500	18,884	1,923
1979	1.59	1,299,221	1,264,050	35,171	3,582
1980	1.68	1,467,153	1,335,600	131,553	13,398
1981	1.75	1,854,569	1,391,250	463,310	47,188
1982	3.28	1,974,922	2,607,600	+ 633,578	
1983	3.36	2,607,899	2,671,200	+ 63,301	
1984	3.43	2,720,161	2,726,850	+ 6,689	
1985	3.50	3,076,405	2,782,500	293,905	29,934
1986	3.58	3,382,153	2,846,100	536,053	54,596
1987	3.65	3,975,615	2,901,750	1,073,865	109,373
1988	6.02	4,151,764	4,785,900	+ 634,136	
1989	6.11	4,164,764	4,857,450	+ 692,686	
1990	6.21	4,176,764	4,936,950	+ 760,186	
1991	6.30	4,183,764	5,008,500	+ 824,736	
1992	6.39	4,190,764	5,080,050	+ 889,286	
1993	6.48	4,198,764	5,151,600	+ 952,836	
1994	6.57	4,206,764	5,223,150	+1,016,386	
1995	6.66		5,294,700		

Minimum working capital required . . . . .$ 466,542

APPENDIX V(A)

CASH FLOW

8% Interest - 0% Escalation Rate

	SOURCES			DISBURSEMENTS					
YEAR	OPENING BALANCE	INVESTMENT	REVENUE $0.67/unit	LOANS	INSTALLATIONS	CAPITAL REPAYMENTS	OPERATIONS MAINTENANCE	LOAN REPAYMENTS	CLOSING BALANCE
P.I.	1250000	5492800	0	460209	5492800	460209	0	46872	1203128
1976	1203128	8450000	1234978	505366	8450000	1193472	500000	51472	1151656
1977	1151656	2850000	1332798	746467	2850000	1454921	526000	76028	1075628
1978	1075628	1995000	1650713	737764	1995000	1622105	592000	75141	1000487
1979	1000487	2340000	2029765	741046	2340000	1818298	703000	75475	925012
1980	925012	530000	2225070	704796	530000	1862878	742000	71783	853229
1981	853229	810000	2359907	715668	810000	1930804	748000	72890	780339
1982	780339	1085000	2592230	701145	1085000	2021714	802000	71411	708928
1983	708928	1050000	2714505	755333	1050000	2109766	819000	76930	631998
1984	631998	1320000	2836780	917582	1320000	2221360	915000	93455	538543
1985	538543	1295000	2959055	1028170	1295000	2330768	945000	104719	433824
1986	433824	1040000	3056875	1134264	1040000	2417963	957000	115524	318300
1987	318300	2325000	3154695	1369638	2325000	2625633	967000	139497	178803
1988	178803	4120000	5037730	405593	4120000	2989126	1388000	41309	137494
1989	137494	3610000	5624650	289629	3610000	3309773	1492000	29498	107996
1990	107996	825000	5844745	194177	825000	3378918	1518000	19776	88220
1991	88220	640000	5967020	191304	640000	3432549	1564000	19484	68736
1992	68736	750000	6138205	136734	750000	3495675	1598000	13926	54810
1993	54810	315000	6260480	83160	315000	3522450	1626000	8469	46321
1994	46321		6358300	10809		3522450	1643000	1100	45221
1995	45221		6456120	0		3522450	1653000	1157887	16800

Minimum working capital required $1,204,779.

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A P P E N D I X V (B)

CASH FLOW

10% Interest - 5.5% Escalation Rate

	SOURCES			DISBURSEMENTS			
YEAR	OPENING BALANCE (WORKING CAPITAL)	INVESTMENT	REVENUE $1.22/unit	INSTALLATIONS	CAPITAL REPAYMENT	OPERATION MAINTENANCE	CLOSING BALANCE
P.I.	1000000	5926000	0	5926000	606431	0	393569
1976	393569	9920300	2248730	9920300	1645328	587000	409971
1977	409971	3531150	2426848	3531150	2029936	651714	155169
1978	155169	2607465	3005729	2607465	2296486	773744	90668
1979	90668	3226860	3695934	3226860	2626433	969437	190732
1980	190732	771150	4052169	771150	2705507	1047610	489784
1981	489784	1243350	4297080	1243350	2832651	1148180	806033
1982	806033	1756615	4720109	1756615	3012209	1298438	1215081
1983	1215081	1793400	4942756	1793400	3195602	1398852	1563383
1984	1563383	2378680	5165403	2378640	3440211	1648830	1639745
1985	1639745	2461795	5388049	2461795	3693254	1796445	1538095
1986	1538095	2086240	5566164	2086240	3906570	1920745	1276944
1987	1276944	4919700	5744284	4919700	4432398	2046172	542658
1988	542658	9195840	9173043	9195840	5406690	3098016	1210995
1989	1210995	8501550	10241746	8501550	6311747	3090937	2050057
1990	2050057	2050125	10642509	2050125	6521336	3772230	2399000
1991	2399000	1677440	10865158	1677440	6692811	4099244	2472103
1992	2472103	2074500	11176864	2074500	6905517	4420068	2323382
1993	2323382	919170	11399513	919170	7000398	4744668	1977829
1994	1977829	0	11577626	0	7000398	5057154	1497903
1995	1497903	0	11755746	0	7000398	5368944	884307

Minimum working capital required $909,333

Increase in rate from $1.22 to $1.28/1000 gal. required in 1996

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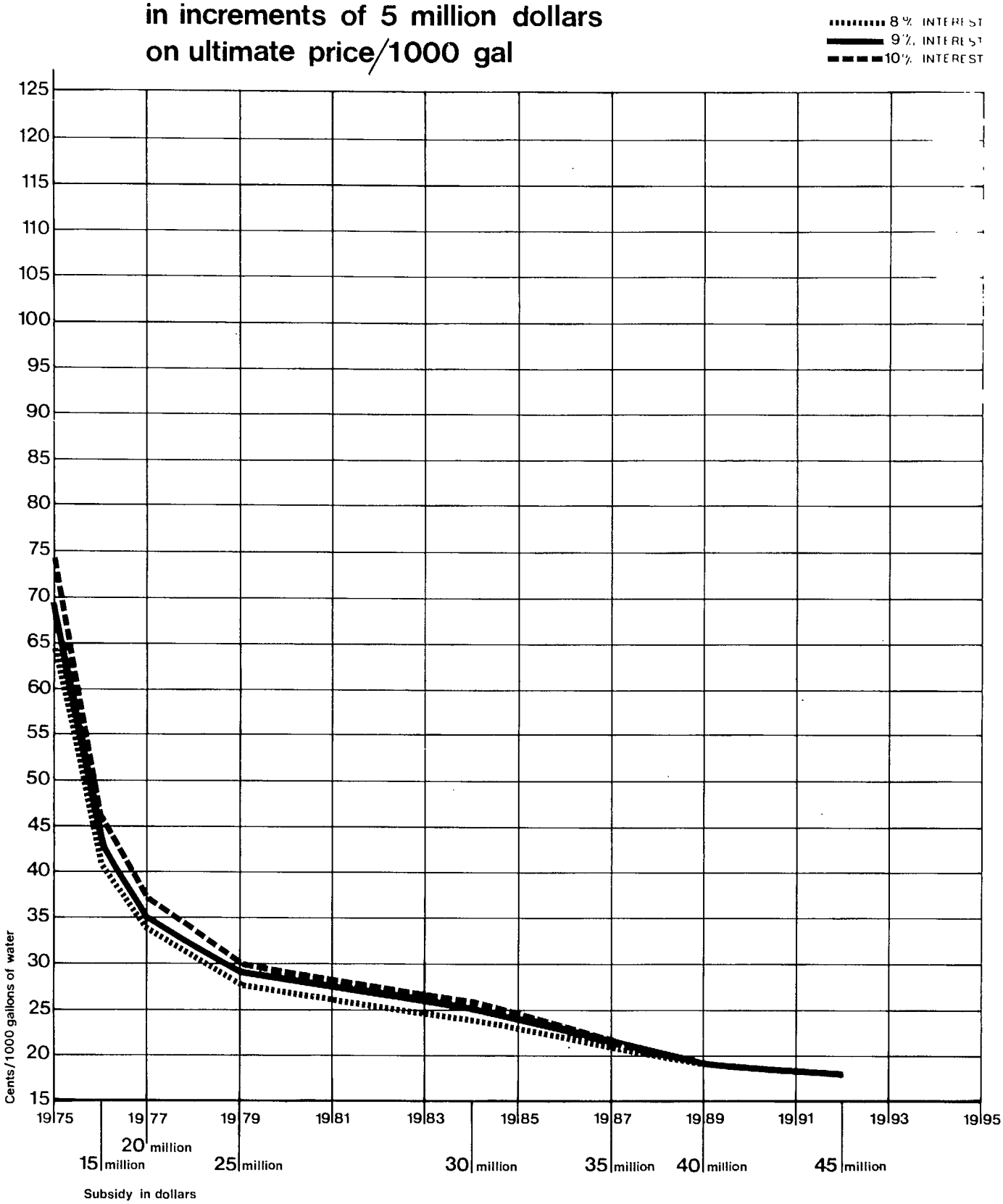
At 0 % escalation

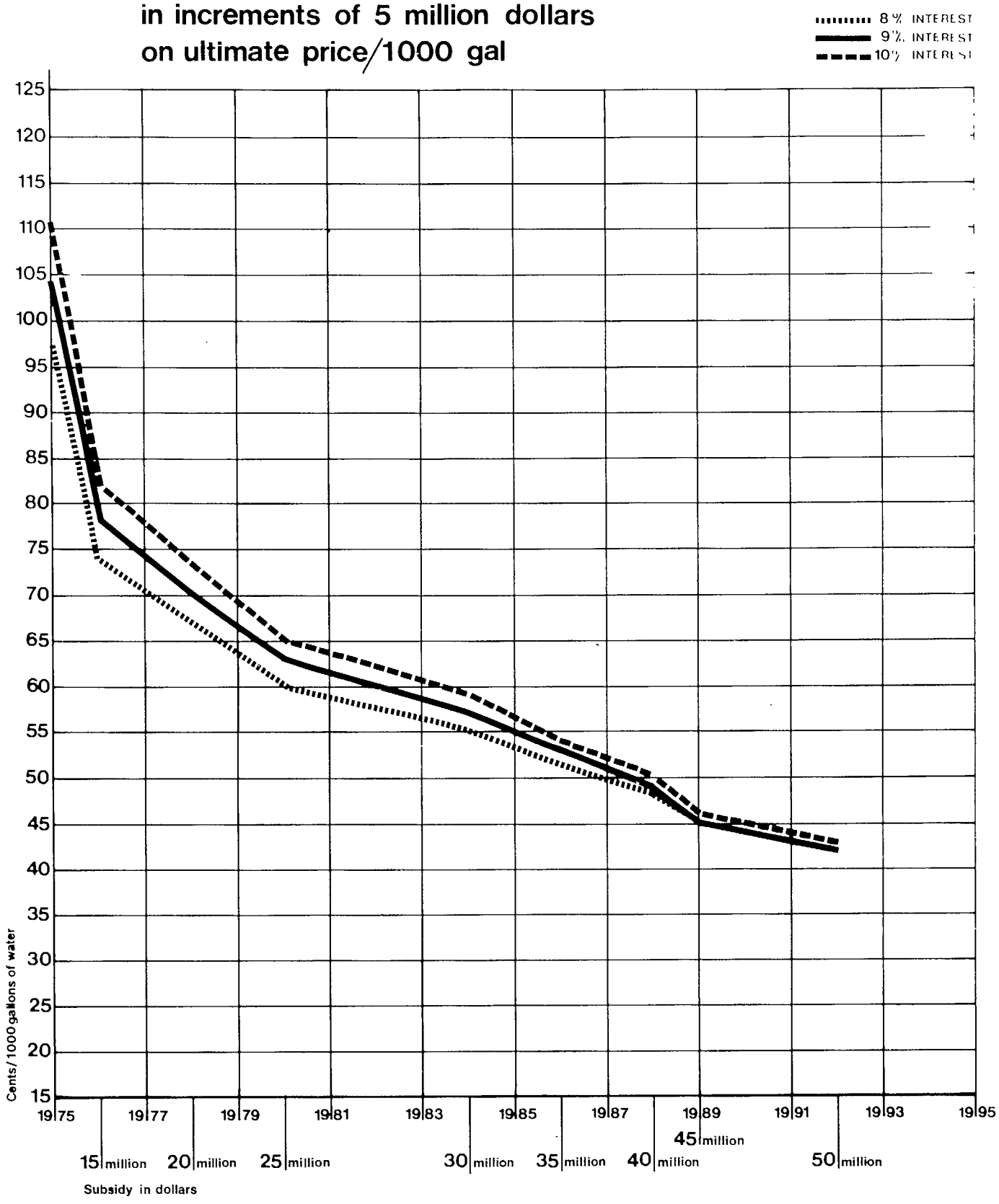
Effect of subsidy to capital costs in increments of 5 million dollars on ultimate price/1000 gal



FENCO

At 4.5% escalation

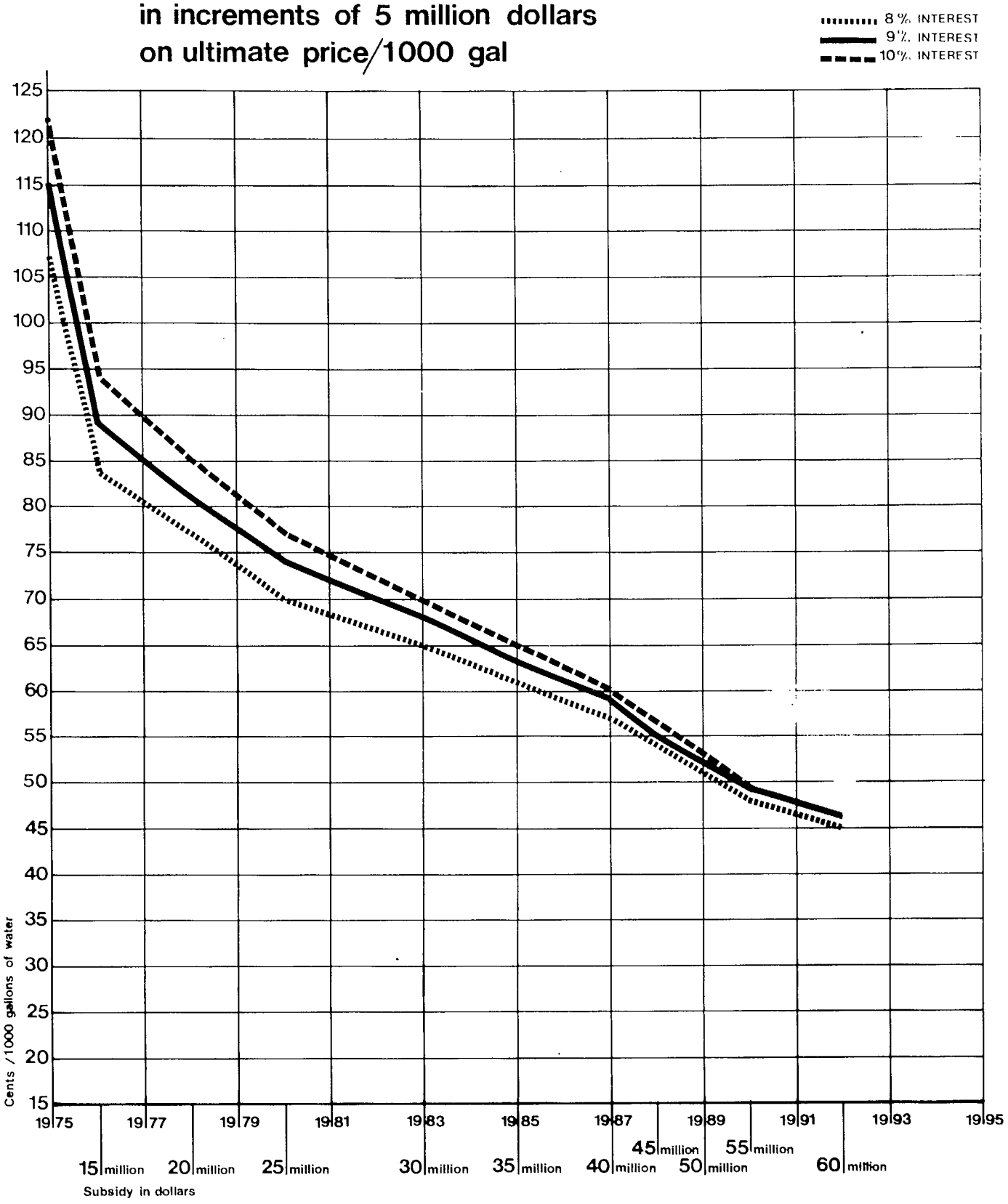
Effect of subsidy to capital costs in increments of 5 million dollars on ultimate price/1000 gal



FENCO

At 5.5 % escalation

Effect of subsidy to capital costs in increments of 5 million dollars on ultimate price/1000 gal



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Chapter 11

CHAPTER 11

ORGANIZATIONAL ASPECTS OF REGIONAL WATER MANAGEMENT

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CHAPTER 11

ORGANIZATIONAL ASPECTS OF REGIONAL WATER MANAGEMENT

SYNOPSIS

Organizational aspects of regional water management have been presented and analysed in this Chapter. Because of the need to proceed immediately with the design and construction of key components of the regional system (identified as packages No. 1, 2, and 3), and the current deliberations to determine among others, the nature, size and policies for a regional government in the north-eastern section of the Avalon Peninsula, the objective of this Chapter is to examine an interim water management organization, and to assess a near "model" water management organization that could be considered and adopted as the ultimate management organization. A summary of the findings and recommendations is as follows:

- Three alternative management organizations have been considered viable to accord with local conditions. These are:

  - Provincially Oriented Organization,
  - Central - City (St. John's) Oriented Organization,
  - Regional Oriented Organization,

- For the interim water management organization the following order of appropriateness is recommended for consideration:

  (i) Regional Oriented Administration
  (ii) Provincial Oriented Administration
  (iii) Central-City (St. John's) Oriented Adminstration

- Distinction should be made between water resource management and water use management. The former should be administered by the Province; the latter should be the responsibility of the Regional Water Administration.

- Control of watershed activities could be done by enforcement of water protection statutes.

- A regional system, in the idealized definition of the term, suggests production, conveyance and distribution of water. Such a system is undoubtedly a natural function of regional government. It is, therefore, recommended that a regional-oriented water management organization be considered as the "model" for the study region, since it would come closest to fulfillment of the above cited function. It would also be most compatible with future regional government. Flexibility could be employed in the implementation of the above concept of regional system.

- Proposals have been included for the structure of the Regional Water Board, and the structure of the operating departments.

I. INTRODUCTION

1. The Approach

The forecast water supply needs for the St. John's Regional Water System poses a necessity to proceed immediately with the design and construction of key components of the regional system (identified in previous chapters as packages No. 1, 2 and 3). Time constraints, therefore, do not permit the development and establishment of the ultimate management organization to timeously make and administer initial decisions.

In addition, another important and relevant factor which bears heavily on the formulation of an ultimate management organization, at this stage, is the current deliberations to determine among others, the nature, size and policies for a regional government in the north-eastern section of the Avalon Peninsula. It has been considered prudent, therefore, to relate the form of any ultimate water management organization proposed so that it is compatible and can merge with any of the future regional government alternatives currently postulated in another study.

The scope of this chapter is, therefore:

(a) to study and make recommendations for an interim water management organization, and

(b) to assess and report on a near "model" water management organization that could be considered and adopted as the ultimate manage-

ment organization, having regard for the constraints of "time" and "local government" as summarised above.

Our basic approach, in defining the aforementioned goals, has been to draw on experience from existing regional water supply administrations, preferably from those that have been studied and reported on in depth as to the factors affecting management. We have identified such a study in the "Institutional Patterns in Evolving Regional Programs for Water Resource Management" by the University of Massachusetts[1].

The first part of this Chapter presents organizational considerations and concepts on regional systems. A study of three alternative management organizations then follows, culminating in recommendations for the interim water management administration.

The second part of this Chapter discusses the different aspects of water management and reports on a possible near "model" organization that we consider could be compatible with alternative future regional government postulations.

2. Alternative Management Organizations

The three alternative management organizations that have been considered viable to accord with local conditions are provincially oriented, central-city (St. John's) oriented, and regionally oriented.

a. Provincially Oriented Organization

This organization would be an agency of the Provincial Government, and would probably have an independent status. Its Administrative Board could comprise of three to five commissioners, one of whom will act as chairman. They would be Provincial appointees, desirably for (contract) terms of some five years. They would probably be full time salaried officials, who should reside in the region, and preferably one at least should be from St. John's.

b. Central-City Oriented Organization

The Administrative Board of this organization and its chairman would be appointed by the Mayor of St. John's (being the centre-city in the region). The Water Department (responsible for system planning and operation) would be a department of the City of St. John's Government.

The Board could include three to five commissioners all of whom might reside in St. John's. Alternatively, provisions could be made for the Board to comprise five to seven commissioners of whom only three or four, respectively, would reside in St. John's, and the remaining members would be from the region at large.

c. Regional Oriented Organization

The basic concept of this organization is that the "user communities" of the regional system would be represented on the Administrative Board, on a

basis reflecting proportional representation, modified by obvious common sense constraints.

Board members could be appointed by the Province as representatives of all the participating municipalities and the province, or as representatives of the larger municipalities, the region at large, and the province. Alternatively, the larger incorporated municipalities could appoint their own representatives while the Province would appoint the provincial representatives and those from the region at large or the unincorporated communities.

The number of Board members would depend on whether the "user communities" are fully or partially represented.

For the interim management organization, however, we envisage an equal representation by the Province and the City of St. John's as a practical, workable and expeditious approach. Each of these two participants could have three or four representatives. In the case of the Province, representatives of various departments with a major interest in the subject service could be appointed to the Board. The City representation on the Board could be from the elected councillors or alternatively, from financial, judicial, engineering and planning entities of the City. The Chairman of the Board would be appointed by the Premier.

Board members would serve overlapping terms. With hold-over members guaranteed, this procedure would yield a reasonable balance between continuity of programming and injection of new and inovative management policies into the decision making functions of the Board.

It is generally well accepted that regional water supply systems should be publicly controlled. Since water belongs to the community at large, the management of water use should come under an administration responsible and responsive to the community at large. From this standpoint, all three alternative management structures must be considered to contain elements of public domain and control.

II. REGIONAL SYSTEM CONCEPTS

There are some basic concepts applicable to any type of management organization which we feel should be taken into account when such an organization is being considered, as they significantly affect the possible objectives, goals and policies of a management organization. These concepts are presented in this section.

1. Availability of Supply

When nearby sources of supply become limited, in quantity and/or qualitative terms, adequate supply has to extend to more remote sources and/or to treated water. This requirement necessitates major engineering at considerable expense. Only a regionally

oriented scheme can reasonably afford adequate intake works, treatment and quality control, pumping and conveyance over a wide area. It is this factor as well as other impersonal variables such as geography, topography, hydrology, economics, engineering technology, population, etc., that are critical in regional program development.

2. Multiple-Service Functions

Though not included in the terms of reference, some relevant thoughts on regional multiple system concepts are given here.

The administration of water supply and (by inference) sewage disposal more or less under the same "roof" appears to be a "natural" consequence of regionalization. Some pros and cons for this multiple-service function are presented below.

The civil engineering involved in sizing and design of pipes and pump stations for both functions are certainly similar. However, those arguing for two separate administrations claim that the treatment of sewage effluent is not related to treatment of drinking water; that sewage disposal agencies do not have to worry about adequacy of supply, or where to obtain it; that water supply agencies worry about delivery, but not discharge; that costing and billing problems are dissimilar.

Those advocating a single multiple function agency claim that the above arguments are primarily valid for systems that are purely local. However, once either function has been regionalized, there is a new perspective to the problem, namely - the type and location of waste water discharges in relation to locations of water supply; the consequences of water supply on waste water discharges and the impact of these two systems on development, rendering of these services across local municipal boundaries and, as such, the extent to which water supply and sewage disposal lines are to be kept separate under ground.

Water supply and sewage disposal are particularly suited as intermunicipal service functions, and hence, both are equally susceptible to the notion of regionalization. It would, therefore, appear that either one administration or two closely co-ordinated administrations, are needed to decide questions raised by rendering these services.

3. Aspects of Law

The enabling legislation, giving authority to, and constraining the operations of the regional agency, irrespective of its administrative orientation, would undoubtedly evolve around traditions and precedents of the Province. It is not within the scope of this study to elaborate on different aspects of law that affect a "regionally" administered program. However, it is felt that some comments

should be included on two most important features of law - the extent to which it is compelling or permissive, and the extent to which it is specific or general.

a. Compulsory vs. Permissive Law

The law creating a water management authority would have to spell out the extent to which the agency functions, to which its terms are binding, and the controls which it can exercise over the municipalities in the region. Acts to this effect could be prepared in a manner that will give the regional agency administrative decision-making discretion ("permissive") in running and developing the system. On the other hand, the law could be detailed ("compulsory") in its specification of what the regional agency may do and how it may do it, forbidding any action without legislative authorization.

b. General vs. Specific Law

General provisions within the law may give direction to the regional agency without dictating means. Detailed legal specifications may set the allowable discretionary range of activity by the regional agency within severe limits. In the former approach ("general") the law would specify the goals to be attained and would leave most of the details on how to attain these goals to the agency it created. The latter ("specific") arrangement could result in the law specifying most of the details of how water supply is to be obtained, how and where

it is to be sold, how programs are to be implemented, how rates are to be structured, how the operating departments are to be structured, and the like. Under these conditions, the regional agency officials would essentially be administering the general engineering details of pipe installation, pumping requirements and the like.

Experience has shown that generally most effective regional management occurs where decision-makers were given maximum discretion and where laws provided policy guidelines without constraining actual administration.

III. ASSESSMENT OF (3) ALTERNATIVE MANAGEMENT ORGANIZATIONS

In this section key factors affecting regional supply management will be presented. The effectiveness and success of each alternative management organization (as previously outlined), having regard for these factors, will then be discussed.

1. Planning

Water supply system planning, even if it strives to be "comprehensive", as in the case of this project, is by nature "incremental". This is primarily so because the planning is based on forecasts which have to and should be reviewed and adjusted, say every five years. These reviews require to be related to longevity of water system life, and its attendant

heavy investment costs, and the fact that decisions once made are very difficult to reverse.

Since water supply systems have substantial bearing on development, a "Central-City" management organization might be suspected by the surrounding municipalities of "self-fulfilling" forecasts. Also, under the specific conditions of this project, decisions would have to be made on the staged implementation of the proposed plan. A "Central-City" decision would be more susceptible to actual and supposed potential conflicts. It is of course possible for the enabling legislation to dictate how the plan should be implemented. This we consider might be a heavy constraint on the "Central-City", as it should have some bargaining power in negotiating the implementation of the program with local municipalities (see also next section).

A "Provincial" administration would eliminate most of the above cited (real and/or imaginary) conflicts. However, the Centre-City (St. John's) may feel that it is "sacrificing" on behalf of the surrounding communities.

A "Regional" agency where all, or at least major participants, have a say in its administration, could resolve planning and implementation of programs in a more democratic manner.

2. Power

Because of the magnitude of cost of a regional water supply system, any expansion to serve municipalities in the area will necessitate a binding commitment from these participating communities prior to construction; that is, there could be no trial period nor any option of withdrawing as a user of the system.

In a "Central-City" or "Provincial" administration, the smaller municipalities would lose their bargaining power once they have joined the system. From the point of view of the smaller municipalities it would be better to form a "Regional" agency so that they could have representation on the governing Board rather than just contract individually with the "Provincial" or "Central-City" agency, and have no specific involvement as to how the system was to be administered.

Opposition to a "Provincial" administration could come from the Centre-City (St. John's) who may feel that it is asked to relinquish some of its jurisdictional prerogatives for the benefit of the smaller municipalities.

Legislative acts might be structured to overcome many of such possible (hypothetical) situations. For example, an act prohibiting communities

in the region from expanding their water supply systems beyond the status and capacity that existed on a certain specified date would give power to the administrative board of a "Provincial" or "Central-City" management to effectively compel municipalities having inadequate supply systems to join the Region. This kind of an arrangement would certainly not be welcomed by the communities as it defeats the basic principle of voluntary co-operation, and the concept of self-determination. At least a tacit agreement of the participating municipalities should be obtained before a regional plan can be effectively implemented. A "Regional" administration would obviously be a more amenable body to seek resolutions along a voluntary and co-operative approach.

3. Authority

When "the chips are down", a "Provincial" agency if so established, would be making regional policy decisions for all the municipalities including the centre-city, while on the other hand, regional questions in a "Central-City" type administration would be decided by a City. This is not to imply that in practice, the above basic difference in authority might be as significant as theory would lead to expect. However, experience does show that a "Provincial" agency usually does not show significant preference (say in rates or type of service) for the centre-city as opposed to outlying communities. On the other hand, a "Central-City" administration could make city oriented types of decisions.

4. Control Over Distribution

Production of water and its conveyance to municipal boundaries is essentially the practice of "wholesale" water. If one were to add the responsibility of distribution of water to the above functions it would result in the customer service being rigidly controlled from the source to the consumer, by the one agency.

Criteria relating to rates, billing procedures, sizing of local mains, house connections and the like may vary from community to community. Consequently, if a single agency is not responsible for water supply from "pond to tap", the regional conveyance system assessments may be confused by a varied approach as to the efficacy and appropriate charges for a distribution system, leading to (perhaps) inequitable water rates, and differential local service quality.

Local distribution would primarily be dependent on each local capability. Experience has shown excessive differentiation in this regard. Constant and dependable supply of good quality water and at adequate pressure would be guaranteed at municipal connections by the regional system. However, local customers may have no more assurance that their (local distribution) water supply will meet high standards of service than they would have had if the entire service (production, conveyance and distribution) were locally controlled. The full benefit of

regional supply may thus be compromised.

The plan developed for the region includes some conveyance-distribution trunks and service reservoirs within local municipal boundaries (e.g. City of St. John's, Conception Bay South, Kilbride and the Goulds). If water were to be contracted for "wholesale" at the municipal connections, the ownership and maintenance of these types of facility may create conflicts.

Control over distribution is best considered as part of the regional system. It would appear that in terms of short-term goals, this concept could readily be implemented in the smaller communities, whereas the long-term goals, compatible within regional government could include St. John's distribution system.

It is hard to conceive that a "Central-City" administration could control the distribution systems of the smaller municipalities in the region. A "Provincial" administration, with proper and special machinery, could probably do it, but would likely meet opposition, especially from the centre-city. However, policies and formulae are available*, or could be devised to resolve what appears to be a dichotomy (namely, the City losing control of its investment, and by inference its destiny).

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* e.g. Acquisition of "Bowaters" water supply by the City of Corner Brook.

5. Equity and Program

There appears to be a significant relationship between the success of water supply regionalization and the extent to which system participants have focused on program rather than equity considerations.

Grounds for development of equity conflicts are more profound in a system containing "middlemen" who charge "retail" mark-up on "wholesale" rates; that is, local municipalities charging water rates for distribution on top of the rates charged by the region for production and conveyance of the water to the municipality.

Free negotiations for membership in the region, including acquisition of any local facilities so that there is no double responsibility, the provision of only a single ownership by the region of the capital plant, and all rights to its maintenance, would result in unity of command and substantial absence of the "issue". Such a system could be standardized because the region is "in charge" throughout the district. Member municipalities could not argue inequitable rates (except by comparison outside the region), neither could they argue jurisdictional equity because they would have no jurisdiction whatever over the function. In the developing and implementation of programs, the region's sole concern would be that of quality of service, planned well into the future.

Again, the "Regional" administration would appear to be the best suited and most acceptable to provide and control this function. Implementation of this concept could entail short and long terms goals as discussed earlier.

IV. SUMMARY AND RECOMMENDATIONS

A regional system, in the idealized definition of the term, suggests production, conveyance, and distribution of the water. Such a system provides the best possible quality of service and virtually eliminates conflicts. It is undoubtedly a natural function of regional government. However, in the absence of the latter, a regional-oriented water management organization would come closest to fulfillment of this function. It would also be most compatible with future regional government.

Flexibility could be employed in the implementation of the above concept of regional system. During the interim period until regional government is formed, the smaller municipalities could be fully regionalized within the system. Eventually, this could expand to include the entire region.

In the regionalization of a water supply system, local municipalities would have to relinquish their rights to certain jursidictional prerogatives. A full or partial partnership in a "Regional" administration may be considered a compensation and substitute for this sacrifice. Although

in special cases (e.g. St. John's perhaps relinquishing source rights, etc., or Wedgewood Park relinguishing distribution rights) particular agreements may be necessary to protect established equity and future independence. These matters of course, apply to the whole sphere of municipal infrastructure which must be resolved under the "umbrella" of "total regionalization".

From the preceding discussion and experience, it could be said that smaller municipalities would prefer to rely on a "Provincial-oriented" water management organization rather than a "Central-City" one, whereas the centre-city may be very reluctant to relinquish its rights to existing or planned programs unless an adequate and satisfactory arrangement can be worked out. However, for a regional system to be effective and economical, participation should be by both the centre-city and the smaller municipalities. To achieve this end, more than a resemblance of co-operation is required.

Among the three types of management organization presented, it is recommended that the following order of appropriateness be considered:

(a) Regional oriented administration.
(b) Provincial oriented administration.
(c) Central City (St. John's) oriented administration.

Possible structure of the Administrative Board of each organization has been presented in Section I of this Chapter.

It is further recommended that recruitment for the operating staff start as soon as possible with the hiring of a project manager, who would eventually become the key technical member of the agency upon its formulation.

A detailed discussion of water management aspects leading to a near "model" management administration and organization structure is presented in the second part of this chapter.

V. BASIC MANAGEMENT CONCEPTS

1. General

Management concerns itself with three basic types of processes, namely:

(a) Goal Determination - this process involves forecasting, planning, co-ordination, liaison, negotiation and consultation operations.

(b) Realization of Goals - encompassed in this process are all the services required for production, technical support, undertaking of control and tutelage.

(c) Provision of Means for the Determination of Realization of Goals - this process includes all administrative services such as personnel, purchasing, financial, legal.

The vehicle with which management executes the above basic processes is the administrative organization. It would, therefore, be appropriate to define here some key administrative concepts and techniques relating to organization.

2. Administrative Activities and Operations*

a. Categories of Activity

In virtually every area of administration five basic categories of activities may be identified as they relate to this study's central interest. These categories are as follows:

(i) Administrative activities concerned with the improvement of knowledge. This may include the upgrading of local conditions and requirements related to water supply, as well as the provision of technical, scientific and economic information and data, all as needed to prepare long range forecasts and planning.

(ii) Administrative activities related to the operation-production of services. These activities are concerned with the operations by which the administration produces the water for supply to the communities within its region.

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* The framework for this section was taken from Reference 2 modified to suit this project.

(iii) Administrative activities concerned with conveyance within the administrative area. Such activities ensure that the interested communities in the region will have water conveyed to within their municipal boundaries.

(iv) Administrative activities related to protection and security in the provision of services. This involves the application of measures designed to maintain water supply of a designated quality, quantity and pressure.

(v) Administration activities concerned with improvement-development of the services. This may involve the expansion of facilities to improve and/or add production and conveyance capacities of water to any given part of the region.

Given these five categories of activity, the next area of concern is how are they carried out? The following section deals with the topic.

b. Types of Operations

Ten different kinds of operations may be distinguished, as follows:

(i) Those contributing to the collection and analysis of data. They may include surveys, censuses, investigations, experiments, data processing, and preparation and presentation of reports that cover such aspects as:

(a) Forecasts for water supply based on dynamic changes in local conditions and requirements.

(b) Technological and economic developments whose application may improve and/or economize the services rendered by the administration.

(c) Annual operating, financing and inventory statistics.

(ii) Those contributing to planning. They should include the development of objectives, and the formulation and application of policies to meet those objectives.

(iii) Those that are related to the production of water. This is concerned with the actual performances by an administrative department of mechanical operations of intake and treatment works that lead to the production of water.

(iv) Those that are related to the supply of water. This is concerned with the actual performance by an administrative department of mechanical operations and maintenance of conveyance mains and pumping stations that lead to the supply of water to the communities within the administration's region.

(v) Those by which the administration puts equipment to extend and improve water supply to the interested communities within its region. This would include construction activities such as extensions of conveyance mains and treatment, pumping and storage facilities.

(vi) Those concerned with finances. This may involve such programs as price setting, issuance of debentures, arrangement of grants and subsidies.

(vii) Co-ordination of operation, both within the various administrative departments and among intra administration and governmental agencies, in order to make their action cohesive and complementary.

(viii) Those by which the administration exercises controls and renders services to public agencies or private individuals. These operations involve such matters as control of activities in the water-shed, rights of ways, standardization of equipment and material, supervision, inspection, conciliation, approbation of plans and standards, reviews of specifications.

(ix) Negotiation and advice-information operations by which the administration comes in contact with the interested communities within its region in order to realize a common objective.

(x) Those by which the administration gives assistance to various parties. This is concerned with advice, information, data dissemination, promotion, lectures, films, publications.

The foregoing discussion has outlined five major categories of administrative activities, and ten broad types of operations which might be undertaken in connection with these activities. It would be appropriate at this stage, prior to defining the administrative organization for St. John's Regional Water System, its departments and their roles, to examine the following:

(a) Specific characteristics of water management for the study area which would make its administration different from that of other administrative areas.

(b) Research project(s) of existing administrations of regional water systems.

VI. SPECIFIC ASPECTS OF WATER MANAGEMENT

Water management requires the examination of specific functional characteristics that significantly bear on its administration. These are the community characteristic, the multifunctional characteristic, and the mobility characteristic.[2]

1. Community Characteristic

Water is vital to everyone and is generally accepted as a "community vocation". As a general rule, water is regarded as unappropriable since it fulfills a universal need, and does not have to be restricted by political boundaries.

Water, whether stagnating or flowing, is located over land. This land may be under Crown, public, or private ownership. The title to Windsor Lake watershed land, for example, is shared by the City, the Province, and private individuals. There follows an obvious problem of defining the relation between both the management of water and the land over which it is located. Since the goals of water management essentially differ from the goals of land management, the former being necessarily public (as required by the community vocation of water), but not the latter, a distinction between water management and land management seems warranted.

2. Multifunctional Characteristic

As a resource, water may be used for various purposes simultaneously. Bay Bulls Big Pond Water, for example, is used for power generation, recreation, maintenance of down-stream flows, and is now being recommended for development as a source of communal water supply.

The multifunctional aspect of water use leads to two types of management concerns. First, there is the need to determine allocations and priorities among

the competitive uses of the resource. Second, there is the need to establish management responsibilities of the resource. There follows, therefore, a distinction between the responsibilities concerning water resource management and water use management. The first area of concern requires an administration which should be specifically responsible for the water as a resource, ensuring the preponderance of the conservation objectives over irrational objectives, as far as the future is concerned. However, once the use(s) of a water resource has (have) been authorized, a water use administration should be created to accept management responsibility over this specific resource.

3. Mobility Characteristic

Since water is "mobile", a given administrative activity in a given location may result in defects elsewhere in the catchment, or in defects at a later time in the same place. This means that activities such as water withdrawals for power or other purposes, disposals, recreation, may compromise the potential quality-quantity capability aspects of the water resource. For this reason, it seems warranted to distinguish water use activities from quality-quantity control activities.

4. Practical Implications

The significance of the characteristics outlined above in relation to administration and management of a water system is that (water) management

responsibilities should be vested in two different administrations, as follows:

a. Water Resource Administration

This management institution will be responsible for all the water resources (watersheds) with conservation objectives being its prime policy. It will authorize water uses and will praticipate in, or will exercise supervision over, the water use management organizations. It will bear ultimate responsiblity for the quality-quantity control of the water use resource. By the nature of its functions, this should be a provincial government administration. Indeed, such responsibilities have been bestowed on a number of ministerial departments, as will be seen in the next section. There is also local precedent of authorization of water uses and management of water use. Examples are Windsor Lake, authorized to be used by the City of St. John's which also bears management responsibilities, and Bay Bulls Big Pond which is being used and managed by the Newfoundland Light and Power Company.

b. Water Use Administration

A management organization should be created specifically for the water use administration of definite water resource(s). The water use could be single or multiple purpose. Because of the essentially public nature of the responsibility concerning water use management, a public agency of an administrative nature would be preferred for this task. This administration will be

responsible for the activities and operations outlined previously in Section V.2 of this Chapter. The crux of the next part of this Chapter is to define the administrative agency proposed for the St. John's region, and propose a formula to organize same.

VII. WATER RESOURCE MANAGEMENT

1. Existing Management Policies

The property in and the right to the use, and the flow of all water in the Province are, for all purposes, vested in the Crown. The Province, however, under any statute, valid grant, lease, licence, or other instrument, may confer rights of property, use and flow of water on any municipal authority or person (excerpts from the Department of Provincial Affairs, and Environment Act, 1973).

The above cited policy appears to support our basic concept of two levels of water management, namely resource management and use management. Furthermore, we feel that existing legislative Acts provide an adequate tool for the Province to effectively manage its water resources. A review of key Acts that may have a bearing on this study, in terms of water resources conservation and control, and authorization of water use, are presented below.

a. The Department of Provincial Affairs, and Environment Act, 1973.

This is an Act that provides for the abatement and control of pollution of air, soil and water, and for the conservation and use of water as a natural resource of the Province. It provides an aid toward the centralization and coordination of the multiform controls over the use of water, generally, by the creation of an authority as an arm of government.

The Department of Provincial Affairs and Environment is responsible for the administration of this Act.

b. The Waters Protection Act, 1964.

This is an Act to secure the purity of water. "The Minister of Health shall have the general oversight and care of all inland waters, whether standing, running or below ground, for the purpose of keeping them wherever possible fit for drinking and domestic purposes and free from any condition which is or might be injurious to the public health."

c. Department of Health Act, 1965

This Act provides for the "preventing the pollution, defilement, discolouration or fouling of all lakes, rivers, streams, pools, springs and waters, so as to ensure their sanitary condition."

Another responsibility bestowed on the Ministry of Health is the protection of water supply sources under the Public Health (Sanitation) Regulations, 1963.

d. Other Acts pertaining to water resources control management include the Waste Material (Disposal) Act, 1973 (under the Minister of Provincial Affairs, and Environment), and the Pesticide Control Act, 1970 (under the Minister of Provincial Affairs and Environment).

e. Local Government Act, 1966

This Act pertains to water use as it states that the "establishment of a public water supply system is subject to the approval of the Minister of Municipal Affairs and Housing".

f. Other Acts pertaining to water use include the Crown Lands Act CH174 RSN1952, which authorizes water leases for power generation (under the Minister of Mines and Energy).

2. Controlling Watershed Activities

The Provincial Government through statutes and authority, bestowed on two ministerial departments (Provincial Affairs and Environment, and Health) conserves and controls its water resources. However, once the Province authorizes the use of a water resource for public supply and approves the water supply system (through the Departments of Municipal Affairs and Housing, and Provincial Affairs and Environment), a more stringent control of watershed activities may be required, to ensure that the source water quality is sustained in a condition most compatible with the capability of any proposed treatment facilities, to produce

water quality of the adopted standards. Various means are available for this purpose, and the two most effective ones, purchase of watershed lands and enforcement of water protection statutes, are discussed in this section.

a. Purchase of Watershed Lands.

Purchase of all of the watershed lands gives complete control over the activities that take place in the area. In some cases, the purchase of only the lower lying watershed lands will provide the necessary protection.

b. Enforcement of Water Protection Statutes

The Department of Provincial Affairs and Environment Act (1973), and the Waters Protection Act (1964), contain provisions to protect public water supply sources. Enforcement of these Acts lies with the Province, the former being the responsibility of the Environmental Management and Control Division of the Department of Provincial Affairs and Environment; the latter is the responsibility of the Department of Health.

An examination of the above two protection methods relative to the two sources of supply for the St. John's Regional Water System implies the following protection strategy.

c. Protection Strategy

(i) Windsor Lake Watershed

The watershed lands are owned by the City of St. John's, the Crown and private enterprise. Water use management is bestowed on the City of St. John's which utilizes Windsor Lake as a source of supply. There are only limited residential activities in the watershed, and they are confined to the upper watershed area. All other activities are strictly controlled by enforcement of water protection statutes. The sanitary survey that we have carried out within this study (see Chapter 5) indicate that although this protection method is reasonably effective, more stringent enforcing measures would be desirable.

(ii) Bay Bulls Big Pond Watershed

The watershed lands are owned by the Crown and private enterprise. Substantial portion of the watershed is owned by the Newfoundland Light and Power Company. Water use management is presently the responsibility of that company which utilizes Bay Bulls Big Pond as a source for power generation. There are limited residential activities in the lower watershed area, and limited commercial and agricultural activities in the upper reaches of the watershed. Water based recreational activities are also conducted in the watershed. Except for a relatively recent freeze on new development, there as yet has been no significant enforcement of water protection statutes that we could determine.

In view of the above conditions, the results of our sanitary survey (see Chapter 5) indicate that Bay Bulls Big Pond water is not of (too) inferior quality, despite development in the catchment. Having regard for the type of treatment recommended for this source water (see Chapters 5 and 8), and in light of the experience at Windsor Lake, we feel that water use management oriented towards public water supply with strict enforcement of water protection statutes will provide the degree of control desired for this watershed.

3. Practical Implications

Rights of property and water use management of resources utilized for public water supply, be it a single use (as in the case of Windsor Lake) or one of multiple uses (as in the case of Bay Bulls Big Pond) should be conferred by the Province on the agency responsible for administering that water supply system. The quality-quantity balance requirement in water use management is by far a more dominant factor when the resource is to be utilized for public water supply.

By conferring water use management rights on the St. John's Regional Water System administration, the Province should not relinquish its responsibility to determine allocations of water, in case of competitive uses, nor the responsibility for strict enforcement of water protection statutes. However,

to carry out these functions effectively and successfully, a co-operative and co-ordinated relationship should exist between the water resource management organization(s) (i.e. the Province) and the water use management agency (i.e. the St. John's Regional Water System administration). For example, it is often claimed that a provincial organization is by its necessary nature not able to timeously enforce and strictly adhere to water protection statutes. We envisage in this regard, therefore, that the St. John's Regional Water System administration should carry out rigorous sanitary surveys and accordingly file complaints with the Province.

To best assist the Province to act promptly and efficiently on such complaints, a provincial participation in the latter administration should be considered. This provincial participation will in turn provide the administrating organization with a "platform" to present their views on water allocations.

VIII. WATER USE MANAGEMENT

1. The Approach

In considering the organizational structure of the St. John's Regional Water System administration for water use management purposes, we have taken the following basic approach:

a. This administration should be a public one because its status must be of the same type as the responsibility that has been bestowed upon it. Since water belongs to the community, the management of water use should come under an administration responsible to the community (from a statutory standpoint).

b. Experience should be drawn from existing regional water supply administrations, preferably from ones that have been studied in depth and reported on as to the factors affecting management. We have identified such a study in the "Institutional Patterns in Evolving Regional Programs for Water Resource Management" by the University of Massachusetts[1].

2. Comparing Regional Water Supply Systems

A team of researchers from the University of Massachusetts studied in depth, over a period of some three years (from 1967 to 1970), four regional water supply systems, their organizational forms and service functions. A resume of these four (4) systems is presented below.

a. Boston Metropolitan District Commission (MDC)

A regional system of water supply, sewage disposal, and parks (with minor activity in boulevards and solid waste disposal), developed around the turn of the century. An agency of the state with compelling legal constraints and a heavy focus on equity

considerations. Territorially extensive but not consolidated. Water supply system services some 2,000,000 people in 43 municipalities. Agency supplies and transmits water; local communities distribute. Wholesale price: $120 per m.g., but is generally less outside the District. As presently constituted, MDC is administered by a Commissioner and four Associate Commissioners, all appointed by the State.

b. Detroit Metropolitan Water Services (DMWS)

A regional system for water supply and sewage disposal developed on a "reluctant" basis from 1950 to 1954 and on a positive expansionist basis since. An agency of the centre-city (Detroit) with very few legal prescriptions and considerable policy discretion which reflect constant changes due to changes in policy making personnel. Territorially extensive but not consolidated. Water supply system serves roughly 4,000,000 people in 84 municipalities. Agency supplies and transmits water; local communities distribute. Wholesale price: average $150 per m.g., but varies according to managerial costing criteria. DMWS is administered by a Board of seven Water Commissioners, four of which must be from Detroit, appointed by the Mayor. The latter also designates the President and Vice-President of the Board of Water Commissioners.

c. Springfield Water Department

A regional system, for supply of water only, developed primarily between 1910 and 1930. An agency of the

centre-city (Springfield) with considerable dependence on special acts of the State Legislature. Territorially limited and consolidated, but members are loosely federated, and frequently seek independence from the Springfield supply system. System serves some 250,000 people in nine municipalities. Agency supplies and transmits water; local communities distribute except in one case. Wholesale price: $125 per m.g. The Springfield Board of Water Commissioners comprises three members, the Mayor and two Commissioners appointed by the Mayor.

d. Hartford Metropolitan District Commission (MDC)

A regional system for water supply and sewage disposal with minor activity in regional planning and highways, and authority to give regional solid waste disposal service. Developed since 1929, a quasi-agency of the state with compelling general prescriptions, but with considerable discretionary power over details of policy. Financial practices indicate attention to quality of service and inattention to problems of equity. Territorially limited and consolidated. Water supply system serves some 400,000 people in 10 municipalities with additional minor service to small areas along its supply lines. Agency supplies, transmits, and distributes water except to one municipality which has its own distribution system. There is no general wholesale price and therefore, retail price is on a sliding scale based primarily on volume of use. Retail cost, on average, is probably slightly higher than in the Boston and Springfield systems, but close

to cost in the Detroit system. The Commission, the governing Board of the District, comprises 22 members appointed by the State. Seven are appointed as representatives of the member city and towns for 2 year terms, and 15 are appointed at large for 6 year overlapping terms.

Following is a review of what the researchers considered to be the most important findings resulting from their extensive investigation of the four regional water supply systems.

(i) Extent of population around the urban core and availability of local alternative water supply sources are the two most important factors dictating size of territory covered by the regional supply system. These are the inexorable, limiting variables. If the population is too sparse, or local communities have local water supplies, they can develop easily, there is a tendency for each community to develop its own water supply system and to resist federation into a larger water supply network. By the same token, regional supply systems tend to grow only where population is concentrated, and other supply alternatives do not exist or can only be obtained at prohibitive cost.

It should be noted here that the approach taken in our econometric model study is essentially in line with this finding.

(ii) Despite the pre-eminence of these (above) two compelling factors, the general type of organizational framework, within ("to shape a region") which the regional water supply decisions are made, (was also found to) make a difference. In this regard, two important variables were determined - the extent to which agency orientation is toward the region or toward the central city as a specific entity in the region; and the extent to which local "home rule" is operative either by dint of a formal grant of powers by the (Province) or by dint of informal "home rule" traditions.

The researchers believe that the placing of regional responsibility on central-city agencies has hampered the efforts of both Detroit and Springfield to regionalize water service in the full sense of the word, that is regional production, conveyance and distribution of water.

The researchers found that Hartford MDC, as a model of multipurpose state-sponsored regional administration, may serve to highlight the advantages of control by a level of administration somewhere between local and state control.

(iii) Constraints on administration were also found to be important. Both expertise and tenure appear to be significant factors affecting quality of regional decision-making in the areas of both policy and administration. Quality of

decision-making was found highest where qualified, career administrators were given substantially free reign to decide the best course of action.

(iv) The number and type of services offered by the regional agency were found to affect regional "success". While agreeing with Springfield officials that there are theoretical justifications for single purpose administration, the researchers noted that the joint administration of both water supply and sewage disposal seemed to be a positive factor encouraging regional government. Yet, the accretion of unrelated services beyond these basic two, by a regional agency, can serve to impair the effectiveness of any one service by atomizing the amount of attention given each. This seemed especially true for unrelated services such as park administration.

(v) A Corollary of the multiple agency question is the multiple customer question. At the very least, there is evidence that differences between domestic and industrial customers can be important.

Major industrial customers can be an important influence either constraining, or encouraging regional water supply development. Whether "constraining or encouraging" depends on the circumstances and political orientation of both the industrial customers and the regional authorities. However, where industrial customers

use large volumes of water, their desires (i.e., what is best for the industry) can usually be imposed on the regional decision makers.

(vi) The number and type of legal enactments governing the regional agency and its relations with other agencies were found to be important, especially with respect to how general or specific and how compelling or permissive they (enactments) are. Generally, most regional management was found where decision-makers were given maximum discretion and where laws provided policy guidelines without constraining actual administration.

(vii) A final factor influencing regional "success" was found to be the extent to which agency administrators are required to consider, or voluntarily engage in consideration of, extraneous or tandem problems such as fiscal or jurisdictional equity questions or personnel matters. This relates to point (vi) above in that such concerns are often dictated by legal enactments; but also, there appears to be an idiosyncratic personality factor involved such as whether the administrator has an inclination to make political or technical decisions.

Certain organizational forms appear to encourage a focus on service quality and away from equity concerns. One most important factor was found

to be whether or not local communities are given a substantial part to play in the regional operation. Where the regional program amounts to a federation of quasi-independent local units, equity concerns predominate. Where the regional program is administered by an agency with substantially full control of regional program, the emphasis tends to be on quality of service and equity problems tend to be minimized.

3. The Organization Structure

There are two elements to be considered in the organization design, the structure of the Board, and the structure of the organization operating the day-to-day functions. On the basis of previous discussions, these are presented below.

a. Structure of the Board

Representation on the Board would be held by each community within the regional water system, and provincial government delegates. A proposed representation on the Board is shown in Table 11.1. Participation on the Board for water resources and system development matters, would be by all representative members, however, participation in financial obligations would commence upon consumption of water by a community.*

* To accord with Regional Water Management (or Original Government) formulations, it might be that communities in the region-at-large who do not (or will not) receive water from either of the major regional sources, nevertheless might wish member participation. The level of participation, however, would probably vary from community to community depending on their needs (e.g. inability to maintain their system or protect their source, etc.)

TABLE 11.1

PROPOSED REPRESENTATION

ST. JOHN'S REGIONAL WATER SYSTEM BOARD

COMMUNITY/GOVERNMENT	REPRESENTATIVE	BOARD MEMBERS
Department of Municipal Affairs and Housing	Delegate	1
Department of Provincial Affairs and Environment	Delegate	1
Department of Health	Delegate	1
City of St. John's	Mayor and Two Delegates	3
St. John's Metropolitan Area Board	Board Chairman	1
Town of Conception Bay South	Mayor	1
Town of Mount Pearl	Mayor	1
New Town Mount Pearl	Appointed by N. & L. H. C.	1
Region At Large	Provincial Appointee	2
Total Membership of Board		12

Responsibility for the Board would lie best with the Minister of Municipal Affairs and Housing.

We have not attempted to define in detail the role and/or responsibilities of the staff of the management organization since many variables (i.e. type of future Regional Government, possible joint "Sewerage and Water Board"), which have to be determined outwith this particular study's remit will obviously affect size, shape and other aspects of a "management agency" for the Region's water or other municipal services infrastructure. Also, it is perhaps obvious, but bears mentioning, that the goals size, shape and other features of the tentative target organization postulated, will tend to be self modifying as alloted fiscal programmes are made and with the passage of time.

The Board members, who should be unpaid, will take an active part in administrative decision-making only when presented with questions by the staff. Various sub-committees could have recommendatory functions on various aspects of agency activity. Experience at Hartford, Connecticut, demonstrated that quality of decision-making was highest because career administrators were given substantially free reign to decide the best course of action. It is accordingly recommended that this approach be adopted in this case, and the Board members would act as the agency giving a stamp of officialdom to what are basically staff recommendations.

It is further recommended (based on Hartford, experience), that the Board be given maximum discretion; that is have the laws provide policy guidelines without constraining actual administration.

It is also recommended that the Board concern itself with long range planning as a first priority rather than concentrating on maximum dollar value.

Whereas this study was based on the premise to supply water in bulk to community members (through production and conveyance only), it is recommended that these communities be encouraged to entrust with the Board the responsibility to distribute water within the community. This will ensure efficient and high quality service.

Another point of interest found in the study of the "four regional water supply system" is the merit of having the water supply and sewage disposal agencies under the same administrative roof. We would advocate that this approach should be considered in due course when the formulations for waste treatment in the general area of this (water) study are complete.

b. Structure of Operating Organization

Under the directorship of a career General Manager, five general departments will operate:

(i) Planning, Engineering, and Technical Services.
(ii) Treatment Plant Operations.
(iii) Water Supply System Operations.

(iv) Administrative Services
(v) Treasury

Figures 11.1 through 11.6 show the general structure of these departments, and identify the major categories of work force. This proposed structure is not necessarily final, and some modification may be required prior to implementation.

The functions and responsibilities of each department, relative to the ten different kinds of operations as distinguished in Section V.2.b. of this Chapter, are envisaged to be as follows:

(i) Planning, Engineering and Technical Services (Fig.11.2)
This department will render key engineering services.

The planning section will develop long range design objectives, and formulate application policies for implementation of these objectives. Terms of reference for future works will be drawn-up by this section for undertaking by in-house forces or outside consultants. In-house design activities will be the responsibility of this section. Liaison with outside consultants will be through this section.

The construction section will supervise all construction activities such as extensions of conveyance mains, and treatment works, pumping and storage facilities, undertaken

FIGURE 11·1

TARGET ORGANIZATION

WATER USE ADMINISTRATION

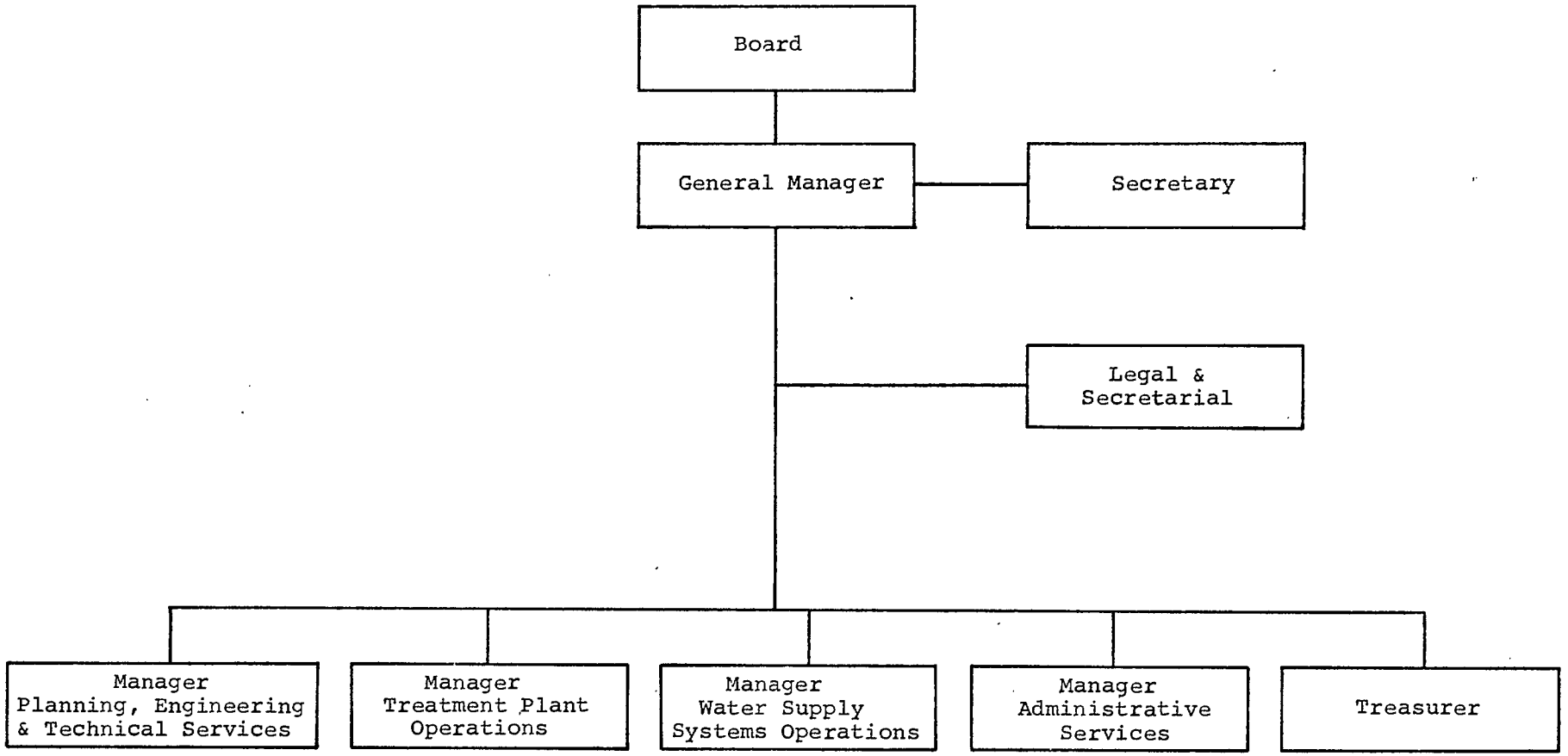

FIGURE 11·2 FIGURE 11·3 FIGURE 11·4 FIGURE 11·5 FIGURE 11·6

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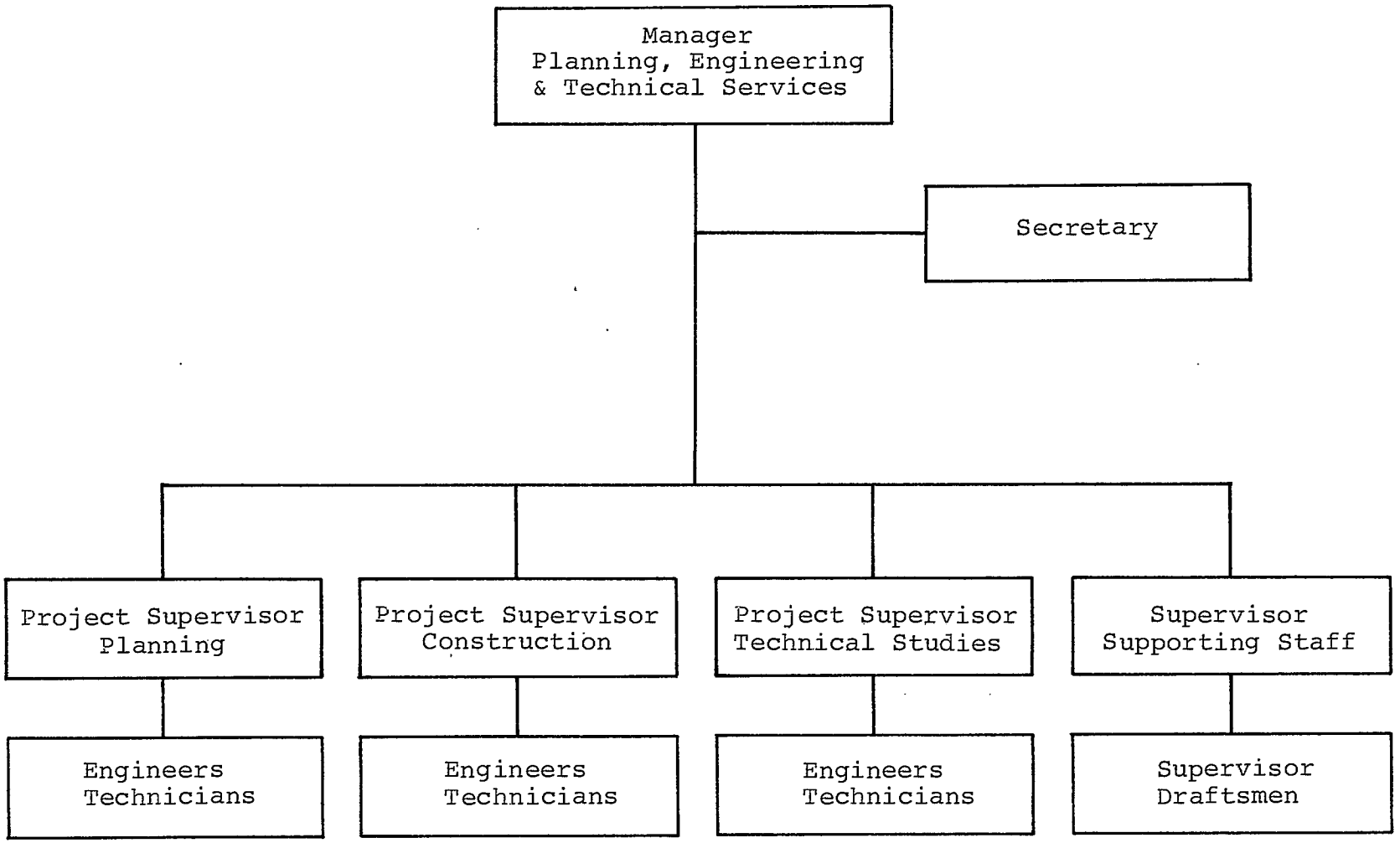
FIGURE 11·2

DEPARTMENTAL ORGANIZATION



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by in-house forces or outside contractors.

The technical studies section will carry out surveys, censuses, investigations, experiments, data processing and other similar activities covering such aspects as:

(a) Forecasts for water needs and supply.

(b) Technological and economic developments that may improve and/or economize services.

(c) Standardization of equipment and material.

(d) Annual operating, financing and inventory statistics.

(e) Watershed water quality.

The above three sections will have a supporting staff of surveyors and draftsmen to assist them in their work.

(ii) Treatment Plant Operations (Fig. 11.3)

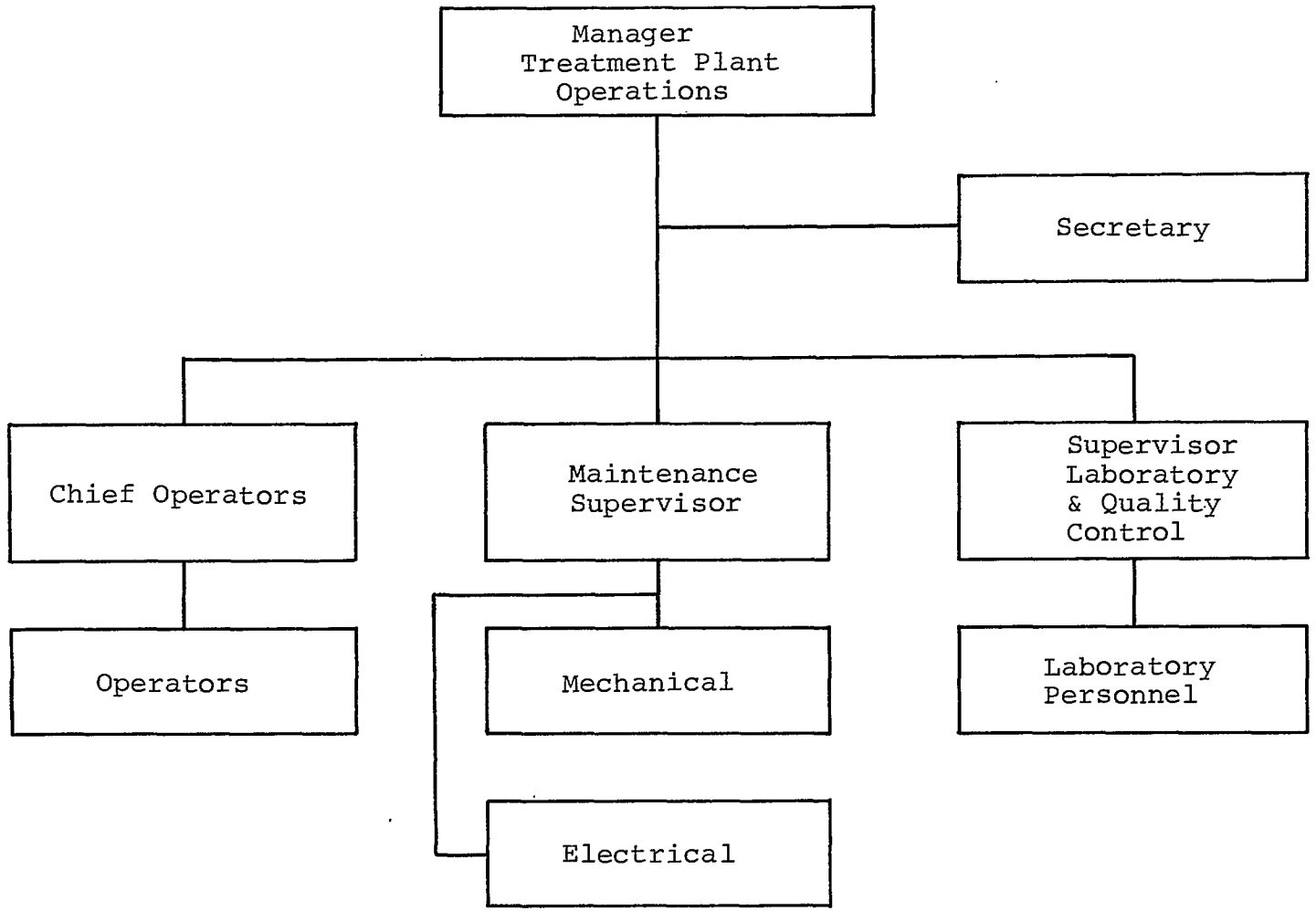
This department will be concerned with the actual performances of mechanical operations of intake and treatment works that lead to the production of water.

Three basic sections will operate within this department - operations, maintenance, and quality control.

Operational staff will man the treatment plant(s) three shifts a day. A chief operator will head

FIGURE 11-3

DEPARTMENTAL ORGANIZATION



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a team of plant operators per shift. The number of operators per shift may vary.

The maintenance crew, headed by a supervisor and comprising mechanical and electrical trades, will operate during the day shift. A skeleton team, say of one or two maintenance personnel, could man the treatment plant(s) during the afternoon and night shifts to cope with emergency situations.

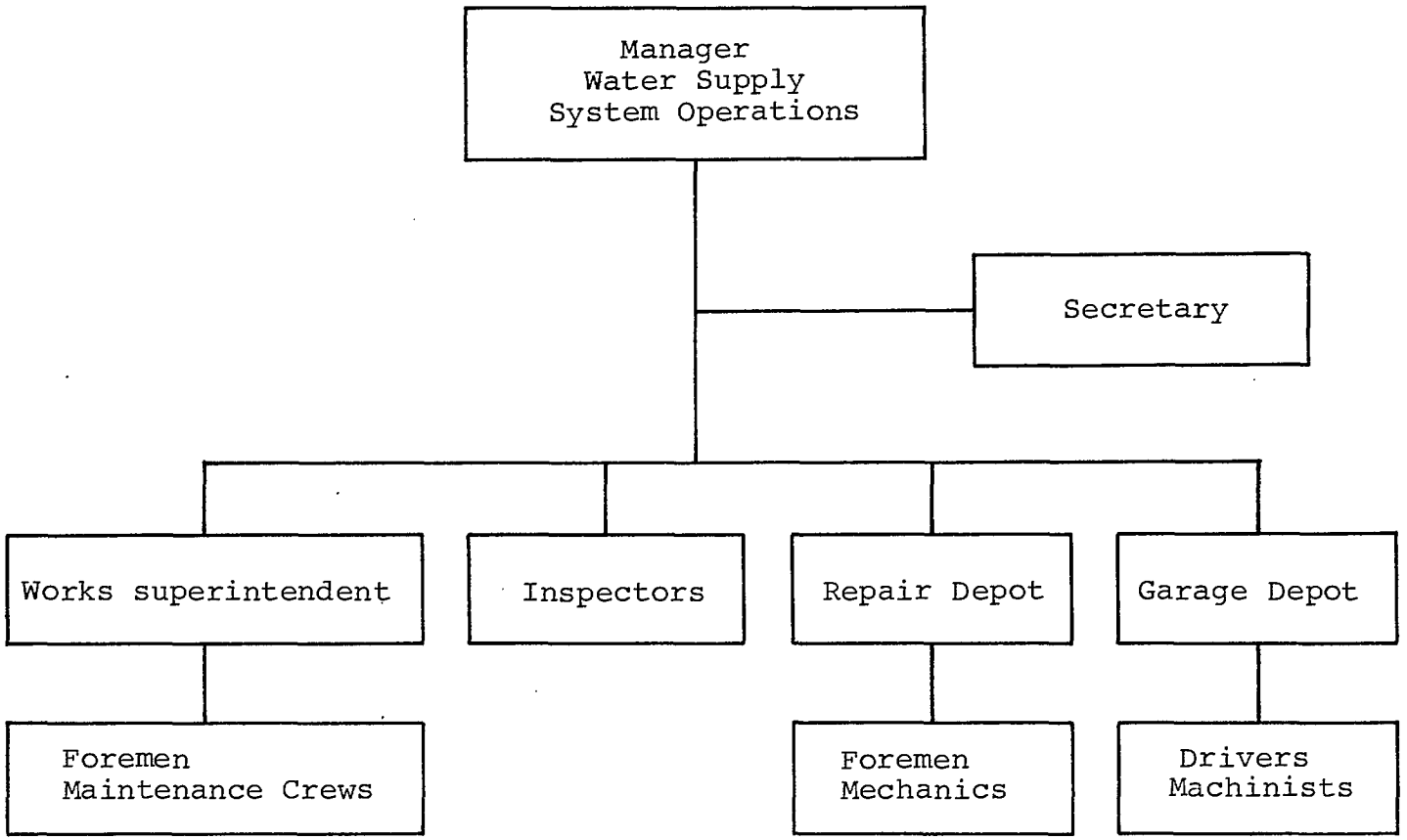
A laboratory will provide the analytical work required for the routine control of water quality. In addition, this laboratory could undertake special analytical programs such as those associated with sanitary survey of the watershed, and bench scale studies of treatment processes.

(iii) Water Supply System Operations (Fig. 11.4)
This department will be concerned with the actual performance of mechanical operations and maintenance of conveyance mains and pumping stations that lead to the supply of water to the communities within the region.

Works superintendents will be responsible for the maintenance in a good operating condition, and for repair of existing conveyance facilities, as well as the construction of new such facilities (by in-house forces). They could be organized territorially or according to tasks.

FIGURE 11·4

DEPARTMENTAL ORGANIZATION



Each maintenance crew will be headed by a foreman, and will carry out the servicing, repair and construction when necessary, of all components of the supply system.

This department would also be responsible for maintaining and operating the repair depot and garage depot of the region.

(iv) Administrative Services (Fig. 11.5)
In addition to the conventional functions of office and personnel services, this department will be responsible for public relations, purchasing, and inventory control. We find it advantageous that the latter two functions be carried out separately, each being directly supervised by the department manager.

(v) Treasury (Fig. 11.6)
By nature of its functions, the treasurer's department should include three sections; that of the chief accountant, that of the budget director, and that of the supervisor of billing and collection.

The chief accountant's section will carry out basic accounting functions and maintenance of accounting records.

The budget director's section is basically entrusted with control functions over flow of monies handled by the chief accountant's section. As a separate section, the budget director

FIGURE 11·5

DEPARTMENTAL ORGANIZATION

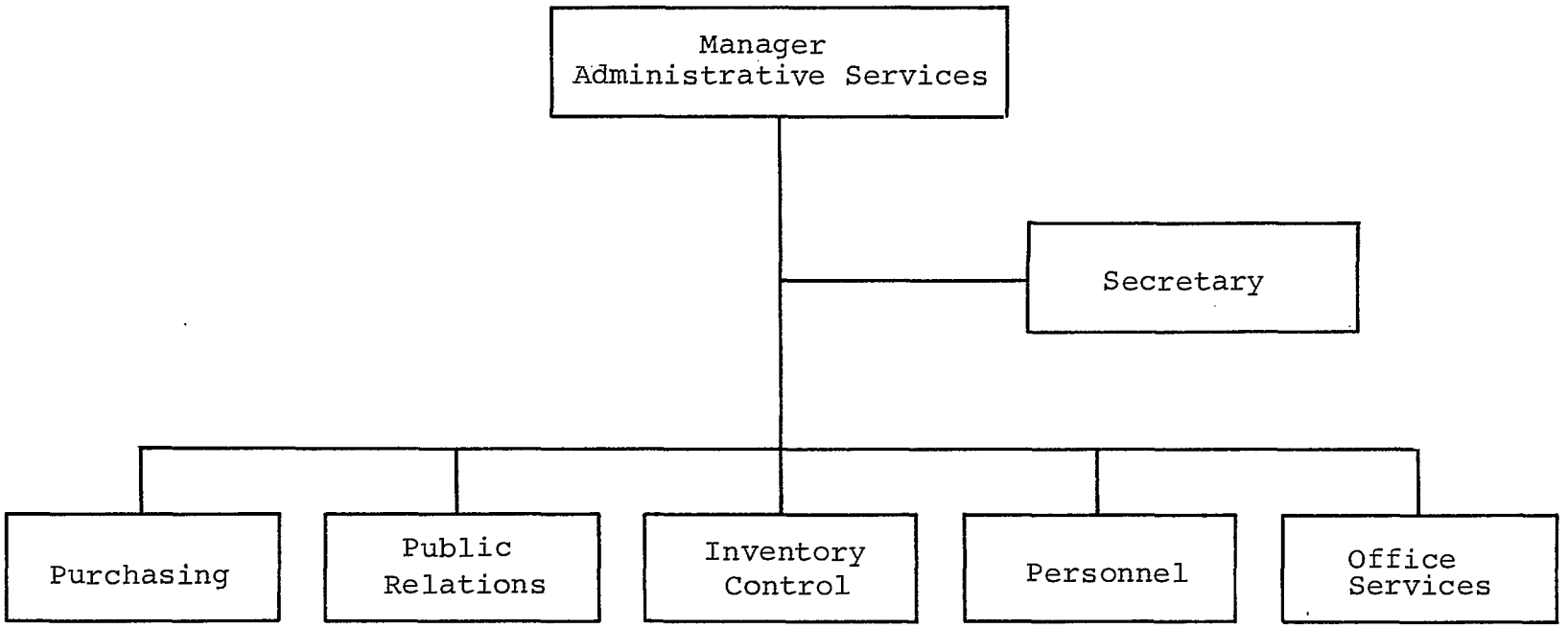
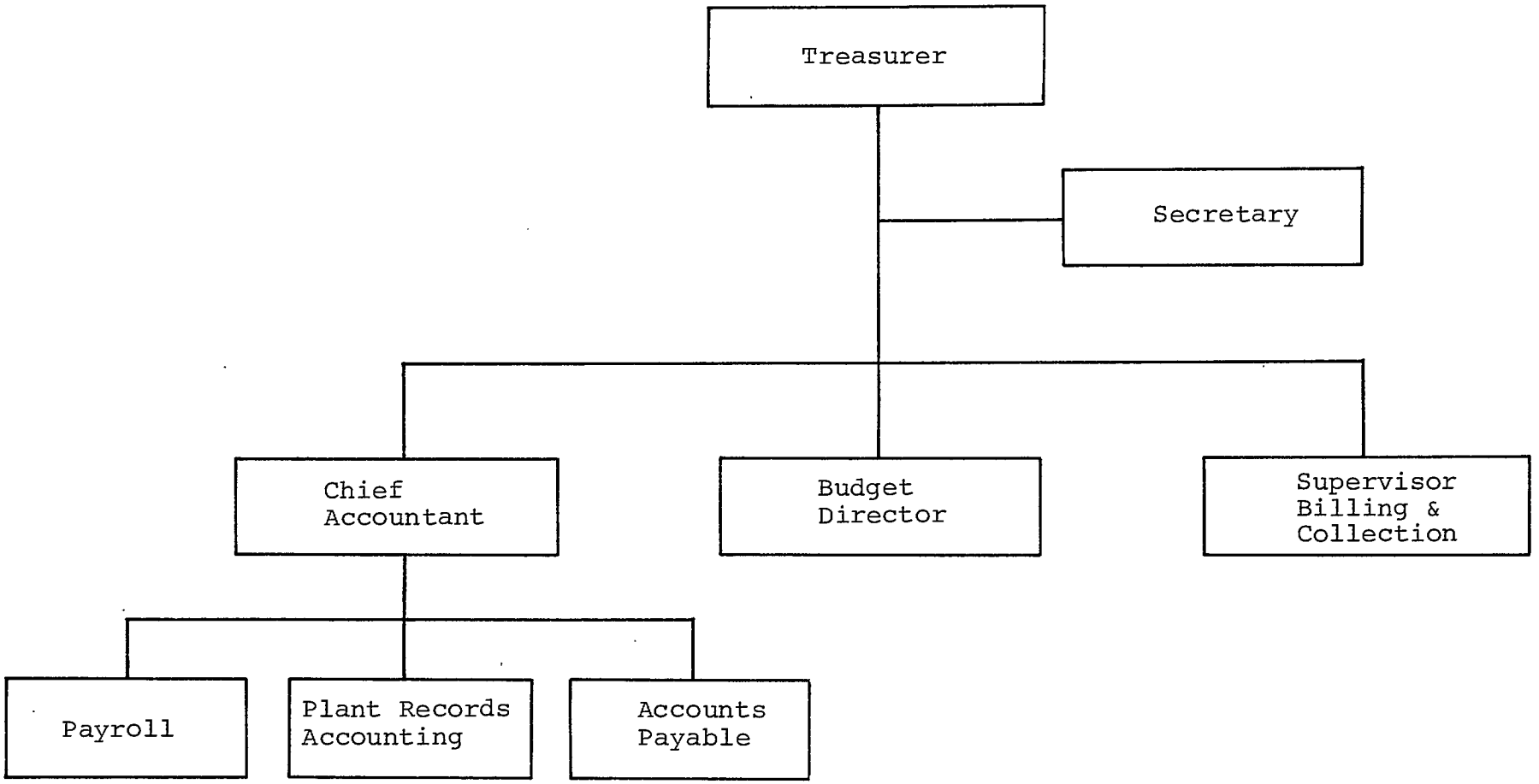


FIGURE 11 · 6

DEPARTMENTAL ORGANIZATION



could deal more efficiently with other operational groups.

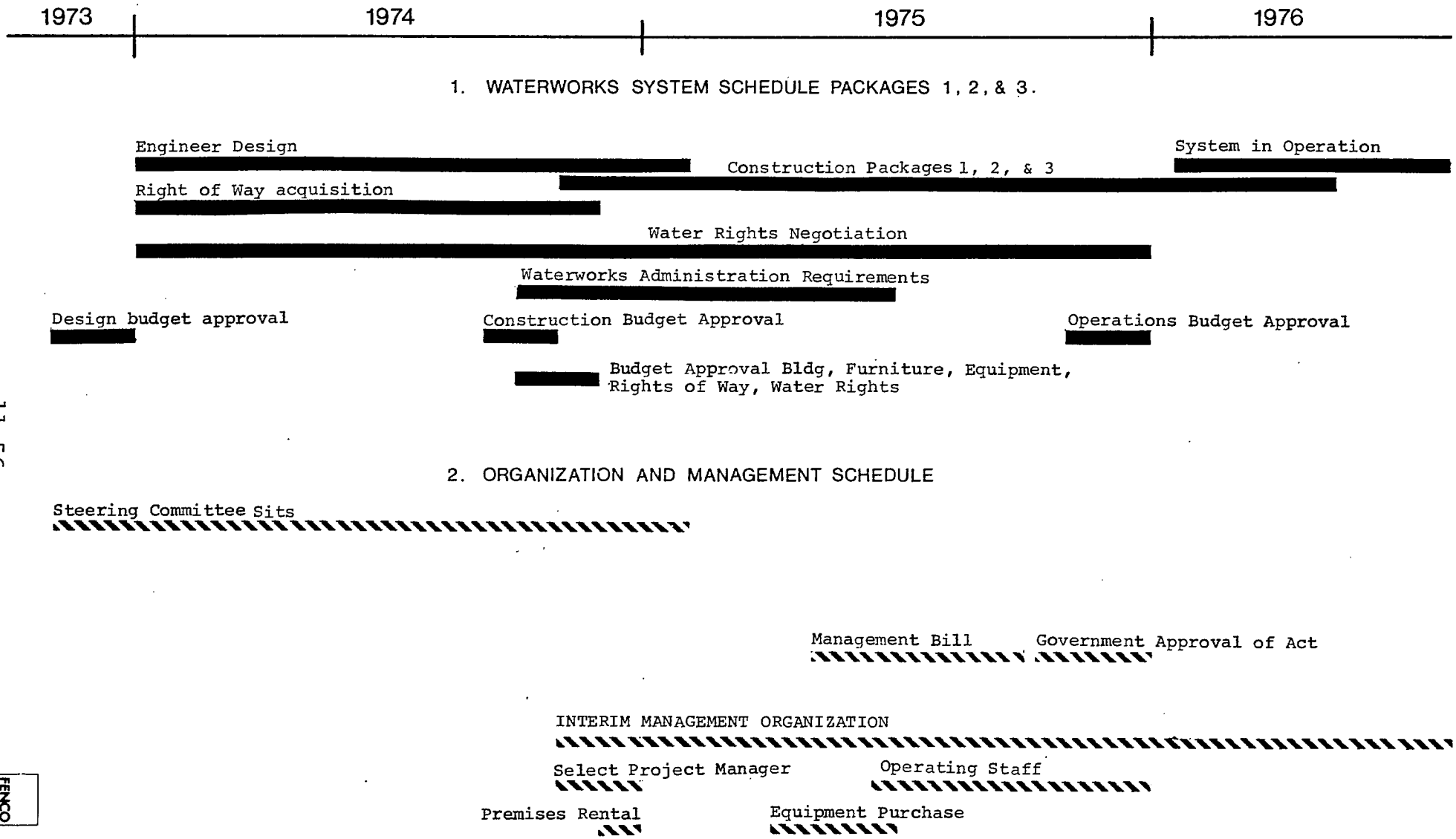
The volume and type of work involved in billing and collection justify direct control of these functions in a section responding directly to the treasurer.

IX. EVOLUTION OF THE MANAGEMENT ORGANIZATION

1. The Approach

As noted previously in this Chapter, the forecast water supply needs for the St. John's Regional Water System poses a need to proceed immediately with the design and construction of key components of the regional system (identified as packages No. 1, 2, and 3). The time element necessitated the formation of a "Steering Committee", comprising the provincial members of the study sub-committee, with authority to manage the engineering activities related to the design of the immediate development works (packages 1, 2, and 3). The end of 1975 has been tentatively adoped as the target date for putting in operation this first stage of the regional water supply system. The end of 1976 would appear to be a more realistic date. To meet this requirement we recommend that the task and organization schedules as shown in Figure 11.7 be adopted as the objectives of the "Steering Committee".

FIGURE 11 - 7 SCHEDULE FOR DEVELOPMENT OF ST.JOHN'S REGIONAL WATERWORKS SYSTEMS



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The "Steering Committee" will be replaced, in due course, by an "Interim Management Organization" as discussed in the first part of this Chapter, to be responsible for the construction of the first stage works and the establishing of "machinery" to settle administrative matters and the core of operating departments.

2. Evolution Stages

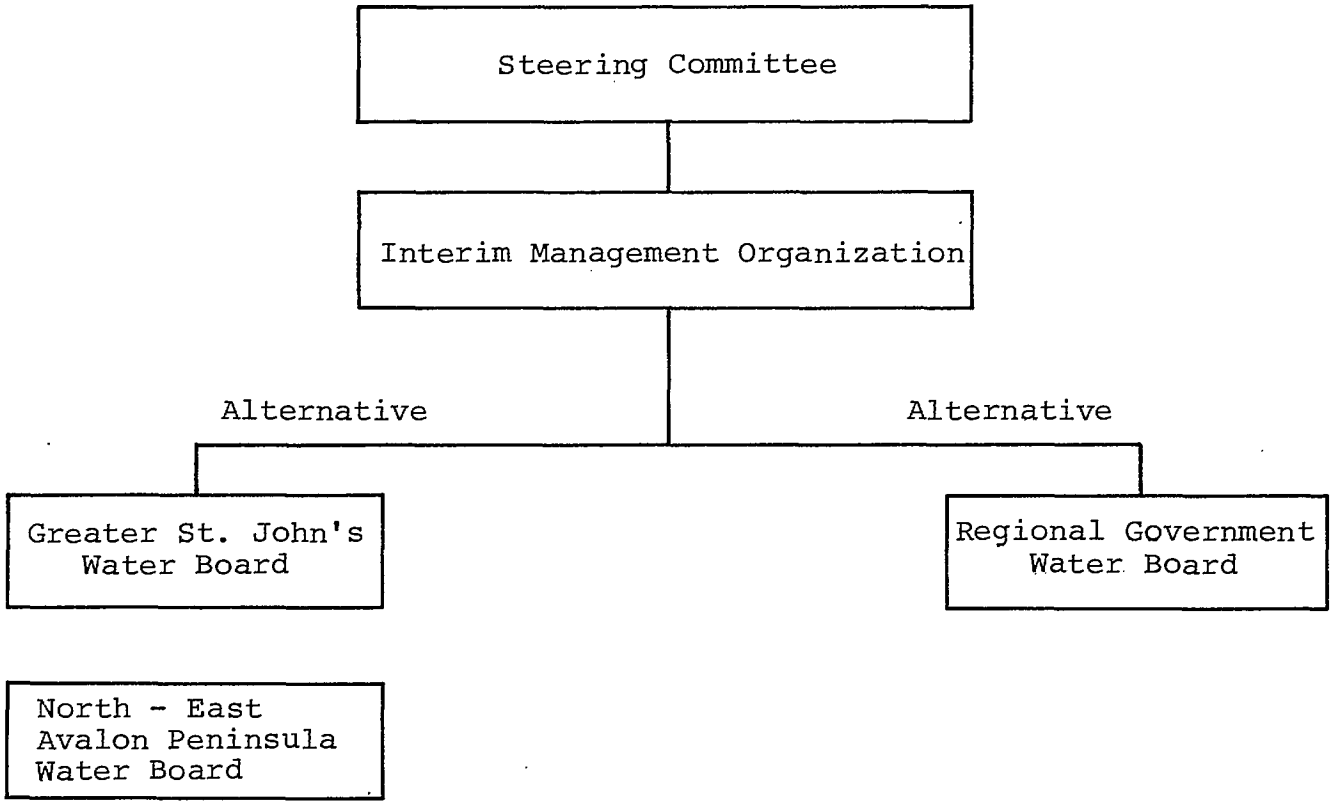
We envisage the management organization to evolve in the stages shown on Figure 11.8.

It can be seen that two courses of development are possible, one - parallel to the regional government, the other - to look after the water needs of the entire north-eastern section of the Avalon Peninsula, through regional and sub-regional systems.

A decision to this effect would have to be made in due course based on the dictate of local socio-political conditions and requirements.

FIGURE 11·8

EVOLUTION OF THE WATER MANAGEMENT ORGANIZATION



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