NEWFOUNDLAND AND LABRADOR HYDRO

AN INVENTORY OF SMALL HYDRO SITES FOR ENERGY SUPPLY TO THE ISLAND GRID

VOLUME I

METHODOLOGY & FINDINGS

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1. INTRODUCTION

1.1 Background

Nature has generously endowed the Island of Newfoundland with the landforms, abundant and evenly distributed precipitation which favour the development of small scale hydro electric schemes (capacity between 1 MW and 20 MW). Although many studies of individual small hydro schemes have been carried out in recent years, as yet no comprehensive survey of the entire Island has been undertaken. It was the objective of this study to undertake a comprehensive survey of hydro power resources on the Island of Newfoundland and to compile an inventory of small hydro sites which may be economically developed within the foreseeable future.

1.2 Scope of Work

Newfoundland and Labrador Hydro's Terms of Reference called for an inventory survey of small hydro schemes meeting the following guidelines:

(a) the study were to be limited to schemes with capacities ranging from 1 MW to 20 MW (schemes greater than 20 MW were to be identified but not analysed),

(b) the study was to consider only those schemes which could be economically connected to the existing Island transmission system,

(c) small hydro sites previously studied were to be excluded,

1.2 Scope of Work (Cont'd)

(d) the following areas were to be excluded:

Gros Morne National Park
Terra Nova National Park
Bay du Nord River, Main River and Terra Nova River basins

(e) potential environmental impacts were to be noted, but no further investigations undertaken.

1.3 Authorization

This study was authorized by L. G. Sturge, Manager of Engineering, Newfoundland and Labrador Hydro and confirmed by means of Purchase Order #66505 dated May 30, 1986 following acceptance of ShawMont's proposal of April 30, 1986.

EXECUTIVE SUMMARY

A comprehensive survey of small scale hydro sites on the Island of Newfoundland was undertaken in this study. The purpose of this survey was to compile an inventory of small scale hydro sites (1 MW - 20 MW) which could be feasibly connected to the existing Island power grid. This survey encompassed the entire Island, with the exception of the following areas:

-- Gros Morne National Park
-- Terra Nova National Park
-- Bay du Nord, Main and Terra Nova river basins.

It was based primarily on topographical information taken from 1:50,000 topographic mapping, regionalized hydrologic relationships and standardized conceptual plant layouts. Extensive use was made of the SHYDRO computer model and other computational aids to facilitate the examination of the very large number of sites involved.

Site investigations also included examination of the advantages of significant watershed diversion, upstream storage developments and group developments.

Altogether a total of 198 sites were selected for cost analysis, from which 160 were found to be potentially feasible, benefit/cost ratios $\geq$ 1.0. Of this number, seven sites were judged to be very attractive (B/C $\geq$ 2.8) and probably feasible under current economic conditions. Fifteen sites were relatively attractive (B/C 2.2 - 2.8) and possibly feasible under current economic conditions; while the remaining 138 sites may be feasible at some future date. These results are summarized in Table 3.1.

In the analyses all plants were assumed to operate as run-of-river plants and were treated essentially as "fuel savers" for the purposes of economic evaluation.

The results of analyses of the benefits of upstream storage developments, watershed diversions and group developments are shown in Tables 3.5, 3.6 and 3.7, respectively. These results confirm that substantial economic advantages may be obtained from including these features in the scope of small scale hydro developments.

- RECOMMENDATIONS

The following recommendations are noted to assist Hydro in planning the next phase of the investigation into Small Scale Hydro potential on the Island. It is recommended:

(i) that more detailed investigations be carried out on all sites having benefit/cost ratios greater than 2.2 with priority given to sites with B/C > 2.8. Such investigations should include, as a minimum, preparation of 1:2000 scale maps with 2m contours from aerial photos, API, site reconnaissance (walk-over) visits and preliminary environmental evaluation;

(ii) that investigations should be on a group basis where several sites are close together or form a natural unit;

(iii) that possibilities for upstream storage and watershed diversions be further reviewed. [In areas where access to upstream structures is difficult, consideration should be given to innovative design and construction approaches, such as use of winter roads, transport by all terrain vehicles, etc.].

- RECOMMENDATIONS (Cont'd)

(iv) that the advantages of providing additional storage to permit operation of plants to maintain a significant level of firm monthly energy production be investigated [Under the assumed run-of-river mode of operation many plants would be out-of-service during periods of low flow, which often occur during winter months when system capacity and energy demands are at their maximum].

3. FINDINGS

3.1 Preamble

The methodologies applied in this study were designed to meet the standards normally expected in preliminary studies; that is, to provide order of magnitude estimates of costs and benefits of sufficient accuracy to reasonably separate potentially feasible schemes from non-feasible schemes.

As noted previously, the unit cost assumed for civil works were based on assumed average conditions, that might be optimistic in some cases. In instances, where site conditions were known to be much different from average, suitable adjustments to unit costs have been made; however the majority of site analyses were based on "average" unit costs.

Economic feasibility was evaluated from benefit-cost analyses in which annual costs were based on an effective interest rate of 6% = 1.5% to cover insurance, interim replacement and O & M; while annual benefits were evaluated at a "levelized" rate of 60 mills/kWh, in constant 1986 dollars, as suggested by Hydro. Schemes having benefit/ cost ratios greater than 1.0 were considered as being potentially viable. The above economic assumptions, imply a relatively high evaluation of benefits and optimistic estimates of cost, due to ommission of the usual conservatism in unit cost estimates. The resulting benefit/cost ratios may thus be regarded as giving optimistic assessments of Island hydro potential.

It should be emphasized that these benefit-cost ratios are only intended to provide a relive ranking of site feasibility and should not be taken as absolute indicators of economic feasibility. However, for this type of study, it was judged preferable to err on the optimistic side so that the inventory of sites obtained would comprise a complete list of all sites which could be ultimately viable within the foreseeable future.

3.2 Environmental Observations

The Terms of Reference for this study did not include detailed environmental assessment of hydro sites; but requested only that potential environmental problems be identified where-ever possible. In most of the areas studied the major environmental problem would be adverse impacts on salmon habitat. Such impacts could include obstruction of salmon migration routes, inundation and/or silting of salmon spawning areas and reduction in flows on schemes involving watershed diversions. Where sites were upstream of spawning areas or inaccessible to migrating salmon, there should be no adverse impact on salmon habitat; accordingly, environmental problems related to salmon, were only identified (*in Tables 3.1 and 3.2) at sites on sections of river accessible to salmon [typically at sites on the lower sections of the larger rivers]. Data collected in the "Catalogue of Rivers in Insular Newfoundland" by Porter et al, Environment Canada (Fisheries & Marine Service), 1978 was used to identify areas of salmon habitat.

3.3 Site Analysis

Each site analysis comprises a data sheet(s), cost analyses and, in the case of sites having B/C ratios > 1.0, a site map showing a schematic layout of the scheme is also included. Potential environmental problems and other observations or suggestions were also noted on the data sheet(s). In essence, each such compilation is a miniature engineering report. These miniature reports are filed by Hydrologic Region and compiled in Volume II of this report.

3.4 Discussion of Results

The main objective of this study was to produce an inventory list of all potentially feasible small hydro schemes [1MW - 20MW] which could be economically connected to the existing Island power grid [including the proposed transmission line into the Hope Brook Mine]. The entire Island, excluding the Gros Morne and Terra Nova

3.4 Discussion of Results (Cont'd)

National Parks, Bay du Nord, Main River and Terra Nova river basins, was searched for potential small hydro schemes. A total of 198 sites were selected for preliminary cost analysis of which 160 were found to be potentially feasible [with B/C $\geq$ 1]. These sites are listed in Table 3.1 in descending order of benefit/cost ratio.

Hydro schemes analysed and found to be infeasible [with B/C < 1.0] are listed in Figure 3.2.

In order to facilitate interpretation of the results, Table 3.1 has been sectioned by drawing two lines through it, one corresponding to a benefit cost ratio of 2.80 with the other corresponding to 2.2. The lines permit classification of the results as follows:

B/C $\geq$ 2.8 sites very attractive, probably feasible under current economic conditions

B/C 2.2 - 2.8 sites relatively attractive, possibly feasible under current economic conditions

B/C 1.0 - 2.2 sites that may be feasible in the future.

The first of these dividing lines (B/C = 2.2) was based on an assumed "current" interest rate of 12% [+1.5% for O + M] and a"levelized" energy value of 50 mills/kWh, in constant 1986 dollars, as suggested by Hydro. The second line (B/C = 2.8) assumes, in addition, a contingency of +30% on project capital cost to allow for unfavourable site conditions and prices.

On the basis of this classification, seven schemes were judged to be very attractive, a further fifteen to be relatively attractive and 138 to be marginal.

For the sake of completeness, small hydro sites previously studied [and therefore outside of the scope of work of this study] are listed in Table 3.3; while sites larger than 20 MW are listed in Table 3.4, which includes sites previously studied as well as several large sites identified for the first time, in this study.

The post-glacial topography of the interior of the Island offers many opportunities for development of upstream storage reservoirs or watershed diversions; but, as previously noted, only relatively large upstream storage and watershed diversion schemes were studied. In cases where diversion schemes robbed water from neighbouring plants, the pros and cons of such diversions were investigated and only those diversions where the benefits outweighed the losses* were included in the final site analysis.

The results of analyses of upstream storage and watershed diversion schemes are summarized in Table 3.5 and 3.6 (details are included with the corresponding site analyses in Volume II). As can be seen in these summaries the benefit/cost ratios of upstream storage and watershed diversion schemes can be very high and thus substantially improve economics of the related hydro schemes.

In areas where several sites are located close together, substantial economic advantages may be obtained by group development since common facilities such as access roads, transmission lines, construction camps, etc. may be shared among several sites.

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* Where B/C ratio of diversion was greater than B/C ratio of neighbouring plant/plants.

3.4 Discussion of Results (Cont'd)

Several such groupings have been evaluated, on an approximate basis, using SHYDRO and the results are summarized in Table 3.7. Two facts emerge from an examination of Table 3.7.

(i) the advantages of group developments tend to be more substantial at remote sites and

(ii) several group developments have combined installed capacities and energy outputs in excess of 30 MW and 140 gWh per annum approaching the same order of magnitude as some "large" hydro sites.

3.5 Conclusions

On the basis of this inventory study it is estimated a total potential of 850 MW in small hydro schemes may be available on the Island within reach of the existing Hydro power grid. Of this total, 172 MW in 22 plants is considered to be relatively attractive in terms of current benefit and cost parameters. The most attractive sites are generally to be found on the Northern Peninsula, West and South West coasts, where topographic relief is greatest.

The following recommendations are noted to assist Hydro in planning the next phase of the investigation into Small Scale Hydro potential on the Island. It is recommended:

(i) that more detailed investigations be carried out on all sites having benefit/cost ratios greater than 2.2 with priority given to sites with B/C > 2.8. Such investigations should include, as a minimum, preparation of 1:2000cale maps with 2m contours from aerial photos, API, site reconnaissance (walk-over) visits and preliminary environmental evaluations;

(ii) that investigations should be on a group basis where several sites are close together or form a natural unit;

(iii) that possibilities for upstream storage and watershed diversions should be further reviewed [In areas where access to upstream structures is difficult, consideration should be given to innovative design and construction approaches, such as use of winter roads, transport by or all terrain vehicles, etc.]

(iv) that the advantages of providing additional storage to permit operation of plants to maintain a significant level of firm monthly energy production be investigated [Under the assumed run-of-river mode of operation many plants would be out-of-service during periods of low flow, which often occur among winter months when system capacity and energy demands are at their maximum].

TABLE 3.1

LIST OF POTENTIALLY FEASIBLE SMALL HYDRO SCHEMES

Rank	River	Site No	Location Latitude	Location Longitude	D.A. (sq. km)	Head (m)	Qav (cu.m/s)	Capacity MW	Energy GWh	Cost $(million)	Benfit \ Cost
1	Great Coney Arm River	1	49 53 18	56 50 15	83.0	153.0	3.16	5.9	25.5	$4.86	4.20
2	Lewaseechjeech Brook	3	48 34 15	57 48 20	58.0	200.0	2.02	4.9	28.8	$6.76	3.41
3	Parsons Pond	1A	49 56 15	57 29 30	84.0	282.0	2.80	9.6	46.2	$11.48	3.22
4	Steady Brook	1	48 57 05	57 49 15	72.0	182.9	2.51	5.6	24.2	$6.03	3.22
5	Great Cat Arm River	1	50 08 15	56 45 40	55.0	198.0	2.09	5.1	21.8	$5.51	3.17
6	Kings Harbour River	3	47 39 35	57 32 00	214.0	137.0	9.16	15.3	69.8	$18.21	3.07
7	Northwest Brook (Garia Bay)	1	47 42 43	58 35 17	108.0	137.2	6.16	10.3	47.0	$12.93	2.91
8	Northwest Arm Brook (Connoire Bay)	2	47 45 30	57 54 45	222.0	61.0	11.26	8.4	38.2	$11.06	2.76
9	Castors River	2	50 52 15	56 46 30	82.0	114.0	3.25	4.5	20.6	$6.12	2.69
10	Grand Lake	3	48 39 45	58 02 45	44.0	159.0	1.81	3.5	17.6	$5.39	2.62
11	Torrent River	4	50 36 50	57 08 15	615.0	25.0	24.37	7.4	34.8	$10.74	2.59
12	Gisborne Lake	1	47 48 00	54 55 45	158.0	160.0	5.51	10.8	62.9	$19.53	2.57
13	Paradise River	1	47 36 40	54 26 15	490.0	37.0	18.63	8.4	38.3	$12.08	2.54
14	Black River	1	47 54 10	54 10 00	155.0	45.0	5.89	3.2	14.7	$4.66	2.53
15	Red Indian Brook (Grand Lake)	5	48 44 25	57 39 55	170.0	234.0	6.20	17.7	80.7	$25.56	2.53
16	Eel Brook	1	49 06 00	55 13 00	80.0	90.0	1.65	1.8	9.8	$3.22	2.45
17	Lloyds River	5A	48 26 00	57 27 15	1020.0	38.0	37.18	17.3	82.6	$27.30	2.42
18	Rose Blanche Brook	1	47 39 15	58 43 30	56.0	91.4	3.19	3.6	16.2	$5.68	2.29
19	Castors River	4X	50 54 45	56 52 30	483.0	37.0	17.60	8.0	34.4	$12.29	2.24
20	Gull Pond (White Bay)	1	49 49 30	56 24 30	76.0	122.0	1.93	2.9	12.4	$4.48	2.22
21	Lloyds River (Portage Lake)	4A	48 25 30	57 27 45	181.0	92.0	6.14	6.9	34.6	$12.57	2.20
22	D'Espoir Brook	1	47 53 45	56 11 30	278.0	77.4	11.46	10.8	49.3	$17.93	2.20
23	Portland Creek	2	50 05 45	57 21 00	65.0	400.8	2.36	11.5	52.6	$20.32	2.07
24	Little Coney Arm River	1	49 57 42	56 47 30	21.0	198.0	0.73	1.8	7.6	$2.95	2.07
25	Bottom Brook	1	47 47 55	56 19 50	175.0	107.0	6.66	8.7	39.6	$15.41	2.06
26	Grand Lake	1	48 50 42	57 41 55	40.0	173.0	1.60	3.4	14.6	$5.68	2.06
27	Crabbes River	1	48 00 10	58 37 30	80.0	106.7	5.58	7.3	33.1	$13.03	2.03
28	Torrent River	1A	50 38 55	56 53 50	218.0	79.3	9.50	9.2	41.4	$16.29	2.03
29	Cinq Cerf Brook	1	47 48 50	58 05 30	88.0	144.8	4.18	7.4	33.7	$13.35	2.02
30	Kings Harbour River	2	47 39 20	57 34 40	118.0	76.2	4.86	4.5	20.6	$8.24	2.00
31	Portland Creek	7	50 11 08	57 27 45	407.0	61.0	12.26	9.1	43.7	$17.52	2.00
32	Crabbes River	4A	48 04 30	58 39 25	258.0	45.7	18.60	10.4	47.3	$19.00	1.99
33	Northwest River (Clode Sound)	1	48 25 00	54 16 00	570.0	30.0	16.50	6.0	29.3	$11.81	1.98
34	White Bear River	2	47 51 45	57 16 50	99.0	125.0	4.39	6.7	30.5	$12.36	1.98
35	Little Barachois Brook	1	48 25 50	58 03 35	18.0	198.1	0.66	1.6	7.6	$3.10	1.97
36	South Brook	1	49 16 15	56 08 15	370.0	30.0	7.62	2.8	12.7	$5.20	1.96
37	Northern Arm River (Fourche Hr.)	1	50 32 13	56 22 30	160.0	168.0	6.34	13.0	56.2	$23.00	1.95
38	Great Rattling Brook	1	48 55 45	55 31 30	1260.0	15.3	29.96	5.6	25.5	$10.47	1.95
39	Shanadithit Brook	1	48 40 00	57 10 15	250.0	61.0	8.56	6.4	29.0	$12.06	1.93
40	Grand Lake (Conners Brook)	6	48 49 15	57 33 15	74.0	158.0	2.58	5.0	22.7	$9.53	1.90
41	Pipers Hole River	1	47 56 00	54 17 30	768.0	30.0	26.78	9.8	44.7	$18.98	1.88
42	Lloyds River (Otter Brook)	6	48 29 15	57 20 15	48.0	113.0	1.60	2.2	11.1	$4.71	1.88
43	Maccles Lake	1	48 38 30	54 03 30	202.0	55.0	5.60	3.8	21.5	$9.16	1.88
44	Paradise River	2	47 39 20	54 28 20	460.0	30.0	17.49	6.4	29.2	$12.45	1.87
45	Three Brooks	1	48 22 00	58 21 30	71.0	107.0	3.04	4.0	18.1	$7.75	1.87
46	Whites River (Upper Humber)	2X	49 27 30	57 18 15	255.0	90.0	10.90	12.0	51.8	$22.17	1.87
47	Barneys Brook	1	49 21 45	56 11 00	274.0	45.0	6.94	3.8	17.4	$7.46	1.86
48	Shoal Brook (Chimney Bay)	1A	50 54 45	56 16 05	197.0	61.0	7.49	5.6	24.1	$10.56	1.83
49	Grand Lake (Little Pond Brook)	7	48 58 01	57 20 15	64.0	158.0	2.13	4.1	18.7	$8.22	1.82
50	Crabbes River	2	48 03 35	58 36 40	53.0	137.2	4.03	6.8	30.8	$13.68	1.80

TABLE 3.1

LIST OF POTENTIALLY FEASIBLE SMALL HYDRO SCHEMES (Cont'd)

Rank	River		Site No	Location Latitude	Location Longitude	D.A. (sq. km)	Head (m)	Qav (cu.m/s)	Capacity MW	Energy GWh	Cost $(million)	Benfit \ Cost
51	Torrent River		2	50 39 40	56 57 15	46.0	137.0	2.04	3.4	14.5	$6.49	1.79
52	Hughes Brook		1	49 03 50	57 48 50	41.0	106.7	1.43	1.9	9.6	$4.30	1.79
53	Southwest Brook (St.Georges Bay)		4	48 27 40	57 59 20	69.0	84.0	2.41	2.5	11.3	$5.05	1.78
54	Great Coney Arm River		3	49 50 40	56 51 42	18.0	153.0	0.60	1.1	4.8	$2.18	1.78
55	Cascade River		1	50 23 40	56 32 10	178.0	76.2	7.34	6.8	29.5	$13.30	1.77
56	Spout River		1	47 00 45	52 58 30	85.0	76.0	3.77	3.5	15.9	$7.28	1.75
57	Crabbes River		3A	48 03 20	58 30 50	142.0	76.2	10.38	9.7	44.0	$20.21	1.74
58	Middle Arm Brook (White Bay)		3	49 48 05	56 20 50	222.0	33.0	5.63	2.3	11.4	$5.28	1.73
59	Noel Paul's Brook	*	1	48 45 00	56 16 30	961.0	21.0	25.89	6.6	30.2	$14.36	1.68
60	Little Rattling Brook		1	48 55 30	55 37 45	112.0	52.0	2.49	1.6	7.2	$3.43	1.68
61	Northwest Brook (Bay le Moine)		1	47 40 40	58 06 40	46.0	106.7	2.19	2.9	13.0	$6.22	1.67
62	Adies Pond (Upper Humber)		1	49 21 00	57 14 15	466.0	42.0	19.94	10.2	50.2	$24.01	1.67
63	Long Harbour River (Fortune Bay)	*	1	47 54 45	54 55 30	630.0	46.0	21.97	12.3	56.2	$27.11	1.66
64	Southwest River (Port Blandford)		1	48 17 00	54 13 00	415.0	53.3	12.50	8.1	37.1	$17.90	1.66
65	Southeast River (Placentia)	*	1A	47 14 00	53 53 35	135.0	53.0	4.92	3.2	14.5	$7.12	1.63
66	Sheffield Lake		1	49 20 00	56 38 45	340.0	45.0	10.23	5.6	30.5	$15.01	1.63
67	Grand Lake		4	48 40 00	57 49 15	73.0	127.0	2.66	4.1	18.8	$9.24	1.63
68	Great Coney Arm River		2	49 53 20	56 49 15	86.0	61.0	3.27	2.4	10.5	$5.21	1.62
69	White Bear River		1	47 53 25	57 17 15	96.0	97.5	4.26	5.1	23.1	$11.44	1.62
70	Victoria River		1	48 43 30	56 41 07	782.0	37.0	23.55	10.6	48.5	$24.09	1.61
71	Back River (Salmonier)		1	47 12 30	53 21 50	65.0	38.0	2.47	1.1	5.2	$2.61	1.60
72	Rocky River	*	1	47 13 25	53 33 30	296.0	16.7	11.25	2.3	10.6	$5.32	1.60
73	Little Harbour River		1	47 07 55	53 28 00	220.0	46.0	7.67	4.3	19.6	$9.96	1.58
74	White Hills		1	47 53 00	54 15 00	36.0	91.0	1.26	1.4	6.4	$3.24	1.58
75	Clench Brook		1	48 46 20	56 52 15	107.0	61.0	3.31	2.5	11.2	$5.73	1.57
76	Grey River	*	1	47 41 15	57 00 15	1387.0	30.5	52.76	19.6	89.5	$45.88	1.56
77	Portland Creek		10	50 05 35	57 21 10	124.0	152.0	4.52	8.4	36.3	$18.75	1.55
78	Dolland Brook		2	47 44 15	56 36 10	688.0	46.0	26.17	14.7	67.0	$34.84	1.54
79	Lloyds River		3	48 18 45	57 39 00	690.0	30.5	27.34	10.2	46.4	$24.29	1.53
80	Conne River		2	48 18 50	55 34 55	216.0	30.5	7.53	2.8	12.8	$6.71	1.52
81	West Arm Brook		1A	49 16 15	55 31 45	285.0	60.0	4.97	3.6	16.6	$8.73	1.52
82	Crabbes River		6A	48 07 35	58 43 25	470.0	30.5	31.70	11.8	53.8	$28.36	1.52
83	Nameless River (near Paradise River)		1	47 35 30	54 27 00	203.0	45.0	7.70	4.2	19.3	$10.21	1.51
84	Old Mans Brook		1A	49 07 15	57 55 00	139.0	85.3	5.07	5.3	22.8	$12.10	1.51
85	Salmonier Cove River		1	47 41 25	55 44 15	69.0	107.0	2.30	3.0	13.7	$7.36	1.49
86	Dolland Brook		1	47 46 55	56 37 30	526.0	46.0	20.01	11.2	51.2	$27.67	1.48
87	Little River		1	47 52 10	55 40 20	175.0	61.0	6.66	4.9	22.6	$12.30	1.47
88	Grey River		2	47 49 10	56 57 55	972.0	30.5	36.97	13.8	62.7	$34.18	1.47
89	New Bay River (Point Leamington)		1	49 19 15	55 24 00	188.0	46.0	3.28	1.8	9.9	$5.42	1.46
90	Castors River		1	50 54 30	56 45 30	44.0	92.0	1.67	1.9	8.1	$4.44	1.46
91	Grand Codroy River		1	47 55 45	58 50 00	66.0	61.0	5.02	3.7	17.0	$9.36	1.46
92	Middle Arm Brook (White Bay)		1	49 50 40	56 25 20	343.0	45.0	8.69	4.8	20.6	$11.39	1.45
93	Whites River (Upper Humber)		1	49 28 30	57 18 45	245.0	61.0	10.48	7.8	33.7	$18.77	1.44
94	Squid Cove Brook		1	50 53 30	56 56 45	21.4	213.0	0.75	2.0	8.4	$4.70	1.43
95	Lewaseechjeech Brook	*	2	48 34 40	57 39 55	150.0	76.0	4.99	4.6	21.1	$11.78	1.43
96	Lomond River	*	1	49 21 30	57 37 45	163.0	30.5	6.72	2.5	10.8	$6.09	1.42
97	Exploits River at Exploits Dam		1	48 45 45	56 36 00	4823.0	7.0	138.00	1.0	5.8	$3.28	1.41
98	Mary March's Brook	*	1	48 54 30	56 27 15	450.0	21.0	12.13	3.1	17.8	$10.10	1.41
99	Middle Arm Brook (White Bay)		2	49 49 20	56 23 00	240.0	53.0	6.09	3.9	17.0	$9.72	1.40
100	Goose Arm Brook		1	49 14 05	57 43 45	61.0	76.0	2.32	2.2	9.3	$5.33	1.40

TABLE 3.1

LIST OF POTENTIALLY FEASIBLE SMALL HYDRO SCHEMES (Cont'd)

Rank	River	Site No	Location Latitude	Location Longitude	D.A. (sq. km)	Head (m)	Qav (cu.m/s)	Capacity MW	Energy GWh	Cost $(million)	Benfit \ Cost
101	Southwest Brook (St.Georges Bay)	6	48 30 30	58 12 00	482.0	50.0	16.80	10.3	46.7	$26.92	1.39
102	Isle aux Morts River	2	47 38 47	59 00 00	74.0	30.5	5.28	2.0	9.0	$5.16	1.39
103	Sandy Harbour River	2	47 48 15	54 27 20	67.0	45.0	2.54	1.4	6.4	$3.67	1.38
104	Lloyds River	2	48 13 55	57 50 55	500.0	15.2	23.78	4.4	22.2	$12.81	1.38
105	Conne River *	1	47 55 40	55 40 35	604.0	30.5	21.06	7.8	35.7	$20.69	1.38
106	Isle aux Morts River	1	47 43 00	59 00 00	33.0	45.7	2.51	1.4	7.5	$4.37	1.38
107	Portland Creek	3	50 03 40	57 20 25	71.0	152.0	2.48	4.6	21.0	$12.22	1.37
108	Stony Brook	1	48 55 25	55 40 15	186.0	32.0	4.13	1.6	7.4	$4.31	1.36
109	Southwest Gander *	1	48 42 00	54 59 00	560.0	30.5	14.20	5.3	24.1	$14.13	1.36
110	Southwest Brook (St.Georges Bay)	1	48 28 00	57 51 55	29.0	99.0	1.06	1.3	6.2	$3.66	1.36
111	Grand Codroy River	2	47 56 40	58 56 35	45.0	45.7	3.14	1.8	8.0	$4.74	1.35
112	Grand Bay River	1	47 38 10	59 08 30	46.0	61.0	2.33	1.7	7.9	$4.74	1.33
113	Little Harbour Deep River	5	50 15 28	56 40 15	409.0	46.0	16.85	9.5	40.9	$24.57	1.33
114	Thomey Cove Brook	1	47 52 28	56 10 10	34.0	107.0	1.35	1.8	8.0	$4.87	1.32
115	Grandys Brook (Burnt Island)	1	47 47 10	58 50 00	143.0	30.5	10.88	4.1	18.5	$11.19	1.32
116	East Arm Brook (Hooping Harbour)	1	50 37 55	56 12 45	174.0	110.0	6.07	8.2	35.2	$21.50	1.31
117	Harry's River	4	48 41 45	58 14 30	510.0	21.0	21.00	5.4	24.5	$15.04	1.30
118	Great Rattling Brook	2	48 58 00	55 32 45	1470.0	32.0	34.90	13.6	62.1	$38.11	1.30
119	Crabbes River	5	48 04 30	58 39 25	162.0	30.5	11.30	4.2	19.2	$11.87	1.29
120	Sandy Harbour River	1	47 43 20	54 23 00	426.0	30.0	16.20	5.9	27.0	$16.76	1.29
121	Harry's River	5	48 37 15	58 17 45	550.0	23.0	22.60	6.3	28.9	$17.93	1.29
122	Sandy Brook via Diversion Lake	1	48 51 15	55 50 50	290.0	30.0	6.90	2.5	13.1	$8.19	1.28
123	River of Ponds	2	50 28 15	57 00 20	92.0	61.0	3.79	2.8	12.2	$7.74	1.26
124	Devil Brook	1A	47 17 00	55 17 30	82.0	83.0	3.25	3.3	15.0	$9.56	1.26
125	River of Ponds	1	50 25 45	57 03 55	100.0	61.0	4.12	3.1	13.8	$8.80	1.26
126	East River	1	50 39 15	57 07 05	123.0	46.0	4.48	2.5	10.9	$6.94	1.25
127	Northwest Arm Brook (Connoire Bay)	1	47 45 00	57 54 50	74.0	61.0	3.52	2.6	11.9	$7.64	1.25
128	Lewaseechjeech Brook *	1A	48 33 15	57 42 15	166.0	46.0	5.75	3.2	15.1	$9.67	1.25
129	Northwest Gander *	2	48 35 30	55 27 00	1000.0	30.5	25.40	9.5	43.1	$27.68	1.25
130	Portland Creek	4	50 07 15	57 21 30	36.0	266.0	1.31	4.3	18.4	$12.04	1.22
131	Little Harbour Deep River	6	50 14 30	56 34 30	462.0	30.3	19.00	7.1	30.6	$20.06	1.22
132	South Brook (Baie Verte)	1	49 57 00	56 08 18	86.0	61.0	1.77	1.3	5.7	$3.76	1.21
133	Bay de Vieux Brook	1	47 42 30	57 11 10	43.0	152.0	1.63	3.0	17.5	$11.55	1.21
134	Buchans Brook	1	48 49 10	56 47 40	104.0	31.0	3.21	1.2	5.5	$3.67	1.21
135	Grand Lake	2	48 40 48	58 06 58	88.0	61.0	3.77	2.8	12.1	$8.05	1.21
136	North Brook (Deer Lake)	1	49 10 30	57 33 55	49.0	76.0	1.63	1.5	6.5	$4.39	1.19
137	Southwest Brook (St.Georges Bay)	3	48 27 00	57 58 30	64.0	69.0	2.23	1.9	9.1	$6.13	1.19
138	Little Harbour Deep River	2	50 17 15	56 42 50	205.0	76.0	8.77	8.1	35.2	$23.71	1.19
139	North East Brook (East Bay)	1	47 45 05	55 19 50	125.0	76.2	4.56	4.2	21.6	$14.62	1.18
140	Cooks Brook	1	48 58 15	58 04 00	95.0	27.4	3.61	1.2	5.2	$3.55	1.18
141	Red Harbour River #1	1	47 18 30	55 00 00	49.0	91.0	1.78	2.0	9.0	$6.13	1.18
142	Salmon River (Pool's Cove)	1	47 42 30	55 29 35	178.0	30.5	6.21	2.3	11.9	$8.17	1.16
143	White Bear River	3	47 55 15	57 17 05	440.0	46.0	19.53	11.0	50.0	$34.82	1.15
144	Rocky Brook (Gambo Pond)	1	48 35 45	54 33 15	60.0	122.0	1.67	2.5	11.3	$8.05	1.13
145	Pacquet Brook	1	49 56 10	55 54 00	102.0	67.0	1.77	1.4	6.3	$4.55	1.11
146	Little Chouse Brook	1	49 37 45	56 46 00	38.0	105.0	1.02	1.3	5.7	$4.07	1.11
147	Southwest Gander (Dead Wolf Brook)	2	48 42 00	54 57 00	192.0	30.0	5.00	1.8	8.3	$6.03	1.11
148	Tommys River	1A	49 25 45	55 55 00	370.0	30.0	7.39	2.7	12.3	$8.92	1.11
149	Kane Brook	1	47 50 15	54 56 20	148.0	46.0	5.16	2.9	13.2	$9.69	1.09
150	Little Barachois Brook	2	48 25 30	58 00 00	118.0	30.5	4.30	1.6	7.3	$5.37	1.09

TABLE 3.1

LIST OF POTENTIALLY FEASIBLE SMALL HYDRO SCHEMES (Cont'd)

Rank	River	Site No	Location Latitude	Location Longitude	D.A. (sq. km)	Head (m)	Qav (cu.m/s)	Capacity MW	Energy GWh	Cost ($million)	Benfit \ Cost
151	Portland Creek	6	50 13 55	57 15 15	78.0	91.4	2.35	2.6	11.3	$8.38	1.08
152	Parsons Pond (Gambo Pond)	1	48 39 00	54 21 00	88.0	46.0	2.37	1.3	6.1	$4.50	1.08
153	North West River (Great Gull River)	3	48 34 00	55 21 00	350.0	30.0	8.90	3.3	14.9	$11.19	1.06
154	Southwest Brook (St.Georges Bay)	2	48 28 10	57 52 10	315.0	27.4	10.98	3.7	16.7	$12.67	1.06
155	Great Gull River	1	48 35 00	55 20 50	260.0	61.0	7.21	5.4	24.5	$18.69	1.05
156	Chance Cove Brook	1	46 45 00	53 02 00	72.0	97.0	2.97	3.5	16.0	$12.27	1.04
157	Portland Creek	9	50 04 00	57 20 30	42.0	198.0	1.53	3.7	16.0	$12.29	1.04
158	Isle aux Morts River	3	47 37 00	59 00 20	200.0	15.2	13.95	2.6	11.8	$9.20	1.03
159	Harry's River (North Brook)	2	48 43 00	58 17 00	92.0	69.0	3.79	3.2	14.5	$11.43	1.02
160	Bottom Brook	1A	48 32 13	57 59 58	87.0	76.2	3.31	3.1	14.0	$11.13	1.01

TABLE 3.2

LIST OF INFEASIBLE SMALL HYDRO SCHEMES INVESTIGATED

Rank	River	Site No	Location Latitude	Location Longitude	D.A. (sq. km)	Head (m)	Qav (cu.m/s)	Capacity MW	Energy GWh	Cost $(million)	Benfit \ Cost
1	Robinsons River	1	48 10 32	58 26 40	280.0	15.2	13.31	2.4	11.3	$9.17	0.98
2	White Bear River	4	47 51 35	57 16 35	682.0	46.0	30.27	17.0	77.4	$65.12	0.95
3	Red Harbour River #2	2	47 17 45	55 00 50	63.0	61.0	2.49	1.9	8.4	$7.11	0.95
4	Southwest Brook (Bloomfield)	1	48 22 00	53 55 00	145.0	20.0	4.60	1.1	5.1	$4.33	0.95
5	Great Cat Arm River	2	50 07 00	56 51 15	42.0	76.0	1.66	1.5	6.7	$5.69	0.94
6	Torrent River	3	50 37 08	57 00 45	315.0	30.5	12.98	4.8	21.7	$18.87	0.92
7	Pipers Hole River	2	47 57 45	54 19 50	33.0	76.0	1.15	1.1	4.9	$4.34	0.90
8	Otter Point Brook	1	49 41 45	56 44 30	25.0	137.0	0.67	1.1	4.8	$4.37	0.89
9	Shoal Harbour River	1	48 12 00	54 00 00	116.0	30.0	4.00	1.5	6.7	$6.07	0.88
10	Castors River	3	50 56 45	56 42 30	50.0	61.0	1.90	1.4	6.1	$5.57	0.88
11	Middle Brook	1	48 46 10	54 24 20	118.0	76.0	2.99	2.8	12.6	$11.68	0.87
12	Little Harbour Deep River	4	50 15 50	56 41 05	40.0	198.0	1.52	3.7	15.9	$14.80	0.86
13	Barachois Brook	1	48 09 20	58 31 25	73.0	30.5	3.24	1.2	5.5	$5.15	0.85
14	Morgan Brook	1	47 43 18	56 30 50	178.0	46.0	6.77	3.8	17.3	$16.59	0.83
15	Lloyds River	1	48 10 00	58 00 15	125.0	31.0	6.34	2.4	10.9	$10.62	0.82
16	Second Burnt Pond	1	48 45 10	54 24 30	118.0	76.0	2.99	2.8	12.6	$12.30	0.82
17	Harry's River	1	48 48 13	58 02 10	124.0	15.2	5.11	1.0	4.7	$4.65	0.82
18	White Bear River	5	47 56 00	57 18 15	64.0	46.0	2.84	1.6	7.3	$7.18	0.81
19	Grand Codroy River	4	48 00 48	58 46 50	95.0	15.2	6.63	1.2	5.6	$5.54	0.81
20	Salmon River (Main Brook)	1	51 06 45	56 09 15	413.0	15.0	12.44	2.3	10.2	$10.13	0.81
21	Indian Bay Brook *	1	49 02 30	53 56 30	530.0	15.0	12.60	2.3	11.3	$11.34	0.80
22	Salmonier River (Pinsents Fall) *	1	47 14 00	53 31 50	141.0	18.2	5.36	1.2	5.4	$5.43	0.79
23	Northern Arm River (Fourche Hr.)	2	50 32 13	56 22 30	36.0	153.0	1.31	2.4	10.6	$11.01	0.77
24	Salmon River (Clode Sound)	1	48 23 00	54 14 00	100.0	30.0	2.90	1.1	4.8	$5.12	0.76
25	Southwest Brook (St.Georges Bay)	5A	48 28 40	58 00 30	465.0	15.2	16.21	3.0	13.7	$14.71	0.75
26	Little Cat Arm River	1	50 09 32	56 37 45	38.0	168.0	1.20	2.5	10.6	$11.50	0.74
27	Phillips Brook	1	47 47 13	58 08 15	22.0	137.2	1.05	1.8	8.0	$8.75	0.73
28	Mint Brook	1	48 44 00	54 18 00	336.0	15.0	9.00	1.6	7.5	$8.23	0.73
29	Bottom Brook	2	48 32 30	58 04 00	134.0	46.0	5.10	2.9	13.0	$14.47	0.72
30	Colinet River *	1	47 15 00	53 32 40	193.0	15.0	7.34	1.3	6.1	$6.79	0.72
31	Popes Harbour River	1	48 16 00	53 36 45	56.0	45.0	1.77	1.0	4.4	$5.06	0.70
32	Grand Codroy River	3	47 59 15	58 46 10	73.0	15.2	5.55	1.0	4.7	$5.41	0.69
33	Fischells Brook	1	48 18 10	58 36 45	307.0	15.2	13.14	2.4	11.1	$13.57	0.66
34	Little Harbour Deep River	1	50 17 10	56 43 40	112.0	61.0	4.79	3.6	15.4	$19.19	0.64
35	Northwest Gander *	1	48 31 00	55 31 00	808.0	30.5	20.50	7.6	34.8	$44.42	0.63
36	Portland Creek	1	50 07 00	57 15 45	32.0	77.0	1.17	1.1	5.4	$7.27	0.59
37	Fox Island River	1	48 42 00	58 36 30	167.0	61.0	6.62	4.9	22.5	$31.98	0.56
38	Little Harbour Deep River	3	50 16 40	56 41 40	25.0	122.0	0.95	1.4	6.1	$12.41	0.39

* Possible environmental problems, see site data sheets - Volume 2.

TABLE 3.3 - LIST OF SMALL HYDRO SITES PREVIOUSLY STUDIED

RIVER	SITE	LOCATION		AREA	HEAD	CAPACITY	ENERGY	COST	BENEFIT-COST	REMARKS
		LATITUDE	LONGITUDE	km^2	m	MW	gWh	$ X 10^6	RATIO	
Ten Mile Lake		50°32'30"	56°51'30	355		6.3				From NLH files
Castor's River		50°55'10"	56°53'10"	435		6.8				From NLH files
Torrent River		50°35'10"	57°08'30"	355		4.6				From NLH files
Lake Michel		50°19'10"	57°07'10"	103	288.0	12.0	64			From SNL Report SMR-9-79
Little Grand Lake		48°37'20"	57°56'00"	466	76.0	12.0	84			Recent SNL studies indicated it was worthwhile to raise the level of Little Grand Lake to build head.
Great Rattling Brook		48°57'50"	55°32'10"	1458	36.0	15.0	49			ADB - Volume 4
Dry Pond Brook		47°43'10"	57°41'40"	144	96.3	5.2	37.2			From SNL Report SMR-9-79
Cloud River	1	50°48'40"	56°17'10"	435	90.5	14.5	72			From SNL Report SMR-9-79

TABLE 3.4 - SCHEMES WITH CAPACITY GREATER THAN 20 MW

RIVER	SITE	LOCATION		AREA	HEAD	CAPACITY	ENERGY	COST	BENEFIT-COST	REMARKS
		LATITUDE	LONGITUDE	km^2	m	MW @	gWh	$ X 10^6	RATIO	
Bay du Nord	1	47°48'10"	55°25'40"	1075	145	63	367	--	--	Paper by R. A. Robertson, Presented at 92nd EIC Annual Conference (1978).
Bay du Nord	2	47°48'10"	55°25'40"	3080	145	175				Same site as Bay du Nord #1, with diversions from neighbouring watersheds. NLH files.
Gisborne Lake		47°47'00"	54°56'00"	2608	--	172	--	--	--	Includes diversions from neighbouring rivers, NLH files,(Development without diversions listed in SmallHydro Inventory).
Grey River	1	47°41'15"	57°00'15"	1387	46	29.6	142	60.87	1.87	New
Exploits [Red Indian Falls]	2	48°52'00"	56°13'45"	6376	18.2	26.0	157	--	--	From paper by R. Robertson, Optimum head probably be higher than 18.2m. Dam would improve ice conditions in vicinity of Badger but would have negative environmental impact on salmon.
Exploits [Badger Chute]	3	48°56'20"	55°58'45"	7455	15.0	22.0	175	--	--	SNL files.
Exploits [Grand Falls Extension]	4	48°55'30"	55°40'30"	8415	43.0	21.0	125	--	--	Extension to utilize surplus flow and entire head between Goodyear Dam and Exploits Canyon (SNL files)
Lower Exploits	5	48°57'00"	55°35'30"	8749	13.0	23.0	180	--	--	Develops most of head between Grand Falls and Bishops Falls (SNL Files)
Terra Nova River [Mollyguajeck]	1	48°22'40"	54°28'20"	1826	57.9	44.0	239			From paper by R. A. Robertson
Terra Nova River [Clode Sound]	2	48°26'00"	54°07'20"	2538	89.9	100.0	543			From paper by R. A. Robertson
Star Lake		48°33'30"	57°12'10"	691	146	46	240			SNC Study for Newfoundland & Labrador Hydro.
Kitty's Brook	1	49°12'15"	56°54'15"	431	162	25.7	121	--	--	Includes Diversions from - Barney's, Burnt Berry, Upper Sheffield and Chain Lakes Brooks.

....Continued

TABLE 3.4 - SCHEMES WITH CAPACITY GREATER THAN 20 MW (Cont'd)

RIVER	SITE	LOCATION		AREA	HEAD	CAPACITY	ENERGY	COST	BENEFIT-COST	REMARKS
		LATITUDE	LONGITUDE	km^2	m	MW	gWh	$ X 10^6	RATIO	
Island Pond (Bay d'Espoir)		48°22'40"	56°22'40"	3359	23.0	30.0	187	--	--	From SNL Report SMR-19-86
Granite Canal (Bay d'Espoir)		48°10'50"	56°47'50"	2238	39.5	38.0	191	--	--	Acres study for Newfoundland and Labrador Hydro.
Upper Humber	1	49°32°50"	57°07'30"	486	256.0	100.0	327	--	--	From ADB Report Vol. 4 and SNL files. Dam located at lat. 49°35'50" long. 57°18'40" on plateau with tailrace discharging into Birchy Lake
Upper Humber (Little Falls)	2	49°17'15"	57°16'45"	1907	34.0	30.1	98	39.5	2.64	Results in extensive flooding inundating Squires Memorial Provincial Park; etc. also obstacle to salmon migration
Main River		49°47'00"	56°58'20"	759	248.1	110.0	490	--	--	From paper by R. A. Robertson
River-of-Ponds		50°29'10"	57°15'10"	679	61.6	35	108			From ADB Report Volume 4, also see Table 3.7 and River-of-Ponds S3, in Vol. 2
Pipers Hole	1	47°55'10"	54°15'10"	2499		126	--	--	--	Same site as Pipers Hole #2, including diversions from neighbouring watersheds, NLH files.
Pipers Hole	2	47°55'10"	54°15'10"	754		80	N/A	--	--	NLH files.
Southwest Brook (St. George's Bay)		48°30'50"	58°12'10"	583	77.1	30	98			Involves diversion of Southwest Brook into Bottom Brook. From ADB Report, Vol. 4.

TABLE 3.5 - UPSTREAM STORAGE DEVELOPMENTS

SCHEME	DRAINAGE AREA (km^2)	CAPACITY (MW)	ENERGY (Storage Ratio)		COST in $ x 10^6		PROJECT BENEFIT/COST RATIO		BENEFIT/COST RATIO
			NO STORAGE (gWh)	STORAGE (gWh)	NO STORAGE	STORAGE	NO STORAGE	STORAGE	UPSTREAM STORAGE ONLY
Maccles Lake S-1	202	3.8	17.09	21.50	8.44	9.16	1.62	1.88	4.93
Goose Arm Brk. S-1	61	2.2	7.50	9.30	5.00	5.33	1.20	1.40	4.33
Southwest Brook S-3	64	1.9	6.95	9.10	5.61	6.13	0.99	1.19	3.28
Harry's River, S-4	510	5.4	21.81	24.50	14.13	15.04	1.23	1.30	2.38
Southwest Brook S-2	315	3.7	16.16	16.70	12.34	12.67	1.05	1.06	1.32

TABLE 3.6 - WATERSHED DIVERSION SCHEMES

SCHEME	DRAINAGE AREA (km^2)			ADD'N PLANT CAPACITY (MW)	ADD'N ENERGY gWh p.a.	COST OF DIVERSION $ X 10^6			BENEFIT/COST RATIO DIVERSION	REMARKS
	BASE	DIVERTED	TOTAL			DIVERSION	PLANT EXTENSION	TOTAL		
Crabbes River S-4A	193	65	258	2.55	30.90	1.05	2.76	3.81	6.49	
Lloyds River S-4A	110	71	181	2.79	18.90	2.28	1.00	3.28	4.61	Benefits Lloyds S-4 Grand Falls, Bishops Falls
Parson's Pond, S-1A	38	46	84	5.30	22.80	1.07	3.40	4.48	4.07	Diversion and plant extension improve overall project B/C ratio from 2.55 to 3.22.
Crabbes River S-3A	77	65	142	4.25	30.90	1.75	4.67	6.42	3.85	
Portland Creek, S-6	61	17	78	--	3.21	0.715	-	0.715	3.59	Diversion improves overall project B/C ratio from 1.08 to 1.28.
Portland Creek S-2	28	37	65	6.55	29.87	3.22	3.93	7.15	3.34	
Shoal Brook S-1A	42	155	197	4.40	19.10	2.08	3.71	5.79	2.64	
Lewaseechjeech S-1A	96	70	166	1.40	11.10	1.86	1.82	3.68	2.41	
West Arm Brook S-1A	179	106	285	1.37	6.19	1.34	1.19	2.53	1.96	
Devil Brook S-1A	46	36	82	1.45	6.61	1.23	1.90	3.13	1.69	
Torrent River S-1	168	50	218	1.98	5.79	1.16	1.94	3.10	1.49	
Old Mans Brook S-1A	101	38	139	1.44	6.29	2.63	1.20	3.81	1.31	
Back River [Salmonier] S-1A	65	77	142	1.50	6.64	3.44	1.45	4.89	1.09	
Tommys River S-1A	212	158	370	1.23	5.62	2.62	1.62	4.24	1.06	

TABLE 3.7 - GROUP DEVELOPMENTS

GROUP (and development sequence)	DRAINAGE AREA (km^2)	CAPACITY (MW)	ENERGY gWh p.a.	COST $ x 10^6	B/C RATIO STAND ALONE	B/C RATIO IN GROUP	REMARKS
Portland Creek							
S-4A	137.0	16.2	70.0	19.66	2.85	2.85	There are several possible groupings of sites in the Upper Portland Creek area. The optimal grouping, based on order-of-magnitude cost cost estimates, involves diversions from S-2 and S-10 via S-8 into S-4. This layout eliminates S-2 and S-9 and reduces the potential of S-10. On the other hand S-8 can be developed to exploit a head concentration along the diversion route from S-2 to S-4. See Figure 3.1.
S-8	98.0	4.3	20.7	5.37	N/A	--	
S-3	71.0	4.6	21.0	6.57	1.37	2.56	
S-10A	82.0	5.5	24.0	9.24	N/A	--	
S-1	32.0	1.1	5.4	3.11	0.60	1.39	
TOTALS		31.7	141.1	43.95		2.57	
Cinq Cerf & Vicinity							
N. W. Arm S-2	222.0	8.4	38.2	11.06	2.76	2.76	
Cinq Cerf S-1	88.0	7.4	33.7	10.73	2.01	2.51	
N. W. Arm S-1	61.0	2.6	11.9	5.10	1.25	1.88	
Phillips Bk. S-1	22.0	1.8	8.0	4.39	0.74	1.46	
TOTAL GROUP		20.2	91.8	31.28		2.35	See Figure 3.2.
River of Ponds & Lake Michel							
Lake Michel	103	12.0	64.1	20.81	2.46	2.46	Lake Michel cost based on SHYDRO estimate using layout from SNL report SMR-9-79.
River of Ponds S-3X	690	21.1	107.5	38.69	2.22	2.23	
River of Ponds S-1	100	3.1	13.8	6.57	1.26	1.68	
River of Ponds S-2	92	2.8	12.2	7.65	1.26	1.26	
TOTAL GROUP		39.0	197.6	73.72		2.14	See Figure 3.3.
Crabbes River							
Crabbes River S-1	80.0	7.3	33.1	13.03	2.03	2.76	A common powerhouse can be used for S-4 and S-5.
Crabbes River S-4	193.0	7.9	35.8	13.53	1.89	2.51	
Crabbes River S-5	162.0	4.2	19.2	6.92	0.74	2.41	
Crabbes River S-2	53.0	6.8	30.8	11.84	1.80	1.88	
Crabbes River S-3	77.0	5.5	24.8	11.55	1.44	1.46	
TOTAL GROUP		31.7	143.7	56.87		2.02	See Figure 3.4.

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TABLE 3.7 - GROUP DEVELOPMENTS (Cont'd)

GROUP (and development sequence)	DRAINAGE AREA (km^2)	CAPACITY (MW)	ENERGY gWh p.a.	COST $ x 10^6	B/C RATIO STAND ALONE	B/C RATIO IN GROUP	REMARKS
Lewaseechjeech Brook & Vicinity							
Lewaseechjeech S-3	58	4.9	28.8	6.76	3.41	3.41	
Grand Lake S-4	73	4.1	18.8	8.69	1.63	1.73	
Lewaseechjeech S-2	150	4.6	21.1	9.84	1.43	1.72	
Lewaseechjeech S-1A	166	3.2	15.1	9.03		1.34	
TOTAL GROUP		16.8	83.8	34.32		1.95	See Figure 3.5.
Torrent River							
Torrent River S-4	615	7.4	34.8	10.74	2.59	2.59	
Torrent River S-2	46	3.4	14.5	5.25	1.79	2.22	
Torrent River S-1	218	9.2	41.4	16.29	2.03	2.03	
Torrent River S-3	315	4.8	21.7	16.62	0.92	1.05	
TOTAL GROUP		24.8	112.4	48.90		1.84	See Figure 3.6.
Northern Arm River & Vicinity							
Northern Arm River S-2	36	2.4	10.6	3.13	0.77	2.70	A common powerhouse can be used for
Northern Arm River S-1	160	13.0	56.2	23.00	1.95	1.95	S-1 and S-2 of Northern Arm River.
Eastern Arm River S-1	174	8.2	35.2	18.51	1.31	1.53	See Figure 3.7.
TOTAL GROUP		23.6	102.0	44.64		1.83	
Middle Arm Brook & Vicinity							
Gull Pond	76	2.9	12.4	4.48	2.22	2.22	
Middle Arm Brook S-3	222	2.3	11.4	5.17	1.73	1.77	
Middle Arm Brook S-1	343	4.8	20.6	10.78	1.45	1.53	
Middle Arm Brook S-2	240	3.9	17.0	9.28	1.40	1.47	
TOTAL GROUP		13.9	61.4	29.71		1.65	See Figure 3.8.

.....Continued

TABLE 3.7 - GROUP DEVELOPMENTS (Cont'd)

GROUP (and development sequence)		DRAINAGE AREA (km^2)	CAPACITY (MW)	ENERGY gWh p.a.	COST $ x 10^6	B/C RATIO STAND ALONE	B/C RATIO IN GROUP	REMARKS
Little Harbour Deep River								
Little Harbour Deep River	S-4	40	3.7	15.9	4.56	0.86	2.79	
Little Harbour Deep River	S-2	205	8.1	35.2	15.58	1.19	1.80	
Little Harbour Deep River	S-3	25	1.4	6.1	3.32	0.39	1.47	
Little Harbour Deep River	S-5	409	9.5	40.9	24.57	1.33	1.33	
Little Harbour Deep River	S-6	462	7.1	30.6	18.49	1.22	1.32	
Little Harbour Deep River	S-1	112	3.6	15.4	10.88	0.64	1.13	
TOTAL GROUP			33.4	144.1	77.40		1.49	See Figure 3.9.
White Bear River								
White Bear	S-2	99	6.7	30.5	7.43	1.98	2.08	S-2 powerhouse would be raised by
Bay de Vieux	S-1	43	3.0	17.5	7.39	1.21	1.90	about 20 m to avoid flooding by
White Bear	S-1	96	5.1	23.1	11.44	1.62	1.62	head pond of S-5.
White Bear	S-3	440	11.0	50.0	30.95	1.15	1.29	S-6 becomes economic in a group
White Bear	S-5	64	1.6	7.3	3.87	0.81	1.50	Total cost assuming stand-alone
	S-6		1.8	8.2	4.65	0.92	1.41	development = $142.48 x 10^6.
	S-4	682	17.0	77.4	59.09	0.95	1.05	
TOTAL GROUP			46.2	214.0	124.78		1.37	See Figure 3.10