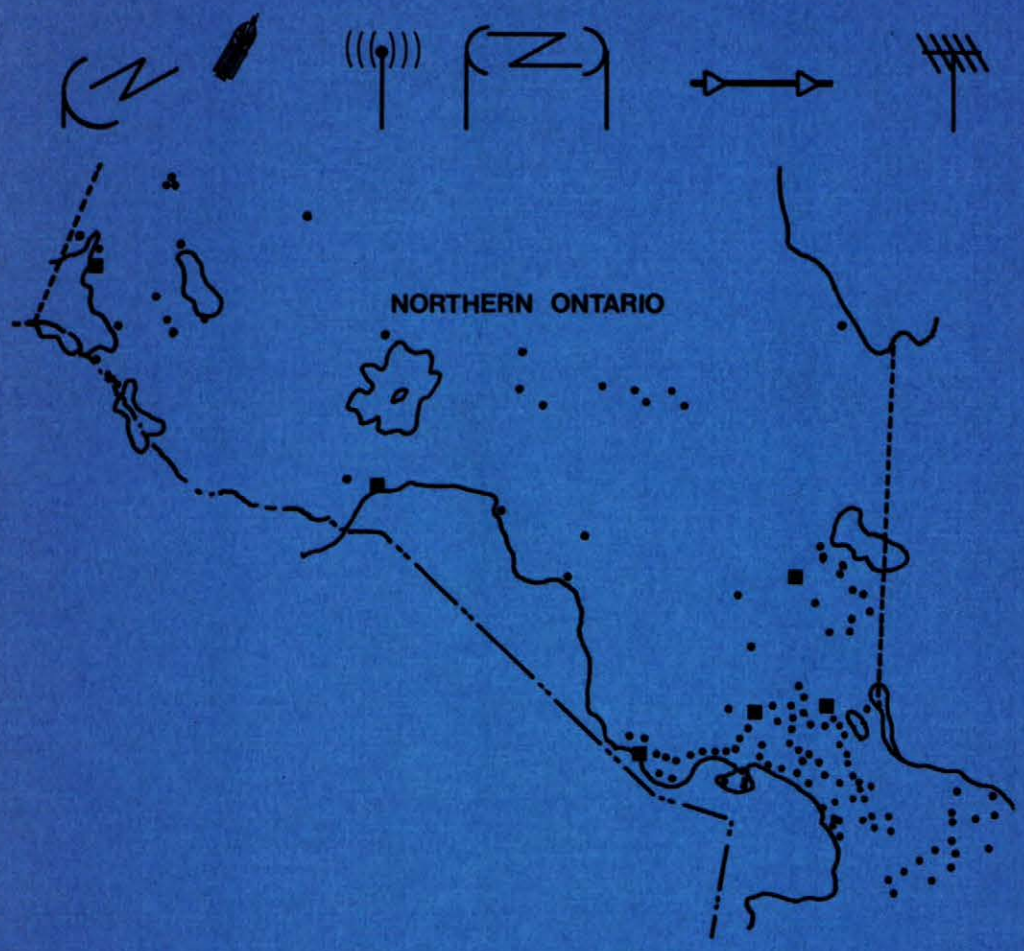
A TECHNICAL AND ECONOMIC STUDY TO IMPROVE CANADIAN TELEVISION SERVICES IN RURAL AND REMOTE NORTHERN ONTARIO COMMUNITIES



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BY

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FOREWORD

Many Canadians living in rural and remote areas have access to few or no television services. This is generally in sharp contrast with Canada's urban dwelling population which has access to a multiplicity of Canadian and foreign television services. The resulting disparities are the subject of public debate as both Federal and Provincial Governments examine how to extend and improve Canadian Television services to the rural and remote communities of the country.

The region of Northern Ontario is one of the areas in Canada where the rural and remote communities are underserved. The population living in 128 communities of 100 or more residences and a density of 25 residences per road mile have very limited or no television choices and no programs of local or regional interest.

Telecommunications technology can be used to transmit, distribute and exhibit at a reasonable cost existing Canadian television services which are not available in the underserved areas. The various technological systems of satellite broadcasting, terrestrial microwaving, very high capacity microwaving, cable distribution and rebroadcasting can be used to provide television services.

Doucet and Associates Consulting Ltd, under contract with the Ministry of Transportation and Communications of Ontario and the Department of Supply and Services acting on behalf of the Department of Communications of Canada, carried out a technical and cost study to evaluate various technical options for making available eight (8) Canadian Broadcast Television services to the population living in 128 rural and remote communities of Northern Ontario. This report presents and documents the technical concepts and cost options permitting the determination of the most technically and economically feasible solution(s) conducive to the area under study.

Based on the list of rural and remote communities and on the list of Canadian Television services chosen by the two (2) Governments, the study examined the characteristics of the communities, their existing television services, the transmission mode and broadcasting patterns for each service and developed alternative transmission, reception, feed and exhibition schemes including their capital and operating costs. The study selected the least cost schemes for integration to determine the best cost solution for providing the television choices defined.

The study is organized in three parts as follows:

Part 1 - EXECUTIVE SUMMARY contains a brief overview of the study and summarises the major findings and recommendations of the study.

Part 2 - MANAGEMENT REPORT describes the major technical and cost considerations of the study in six (6) sections namely: Introduction, Long haul transmission, Reception and feed, Exhibition, and Cost and technical integration of communication system.

Part 3 - DETAILED TECHNICAL AND COST APPENDICES present in detail the technical design and standard cost data as well as appropriate support analysis and computations for establishing the capital and operating cost estimates for various alternatives.

Several simplifying assumptions were necessarily made. Nevertheless, the cost method used for estimation and evaluation offers a reasonable basis for determining the most viable approach to improving Canadian Television services in the identified communities for the stated level of service. Definite costs for any community or group of communities will vary depending on factors such as: terrain, local and surrounding conditions, availability of new or existing television services, form of ownership, interference problems, acceptable level of services and level of quality desired.

ACKNOWLEDGEMENTS

The project team would like to extend special thanks to the members of the Departments of Communications (DOC) and the Ministry of Transportation and Communications (MTC) who provided most helpfull assistance during the study. The comments and contributions put forward by Mr. John O'Flynn of MTC and Mr. Benedict Ho of DOC were invaluable throughout the study and as such were much appreciated. We thank as well suppliers and external organizations who provided us with valuable information.

DEFINITIONS

This list consists of simplified definitions of terms and abbreviations used throughout this report. Terms limited to a particular section or analysis are defined as required.

Community:
Refers to a grouping of 100 residences or more with a minimum residential density of 25 residences per road mile in rural and remote areas of Northern Ontario which have been identified for improved television services by technical means developed in this study.

Cluster:
Refers to a grouping of communities contained within a 43 km radius circle.

Northern Ontario:
Consists of the Ontario area located north of an imaginary line crossing middle Ontario south of Algonquin Park and extending to the Ontario - Manitoba border and James Bay. (See appendix 2.1.2.2)

Long haul transmission:
Refers to the long distance transportation of television signals by terrestrial microwave networks or by satellite.

Reception and feed:
Refers to the local and cluster systems required to receive, process and feed television signals required for display by a community exhibition system.

Local exhibition:
Refers to the community system or plant capable of presenting to the television set in each residence the television services defined.

Capital cost:
Refers to the initial implementation cost including electronics, support material, labour and engineering required for the installation of the reception, feed and exhibition systems.

Service cost:
Refers to the cost of long haul transmission services obtainable from public common carriers on the basis of a 5 or 10 year contract.

Monthly capital equivalent cost:
Refers to the capital cost amortized monthly over 10 years at 15% interest per year compounded monthly.

Operating and maintenance costs:
Refers to electricity and maintenance costs together with spare parts and labour.

Penetration:
Refers to the number of subscriber - residences in relation to the total number of residences in service coverage area. The penetration percentage (%) is derived by dividing the number of actual or projected subscribers by the total number of potential residences in the service area.

Signal:
Refers to the video and associated audio message or program to be conveyed over the transmission, reception, feed and exhibition communication system.

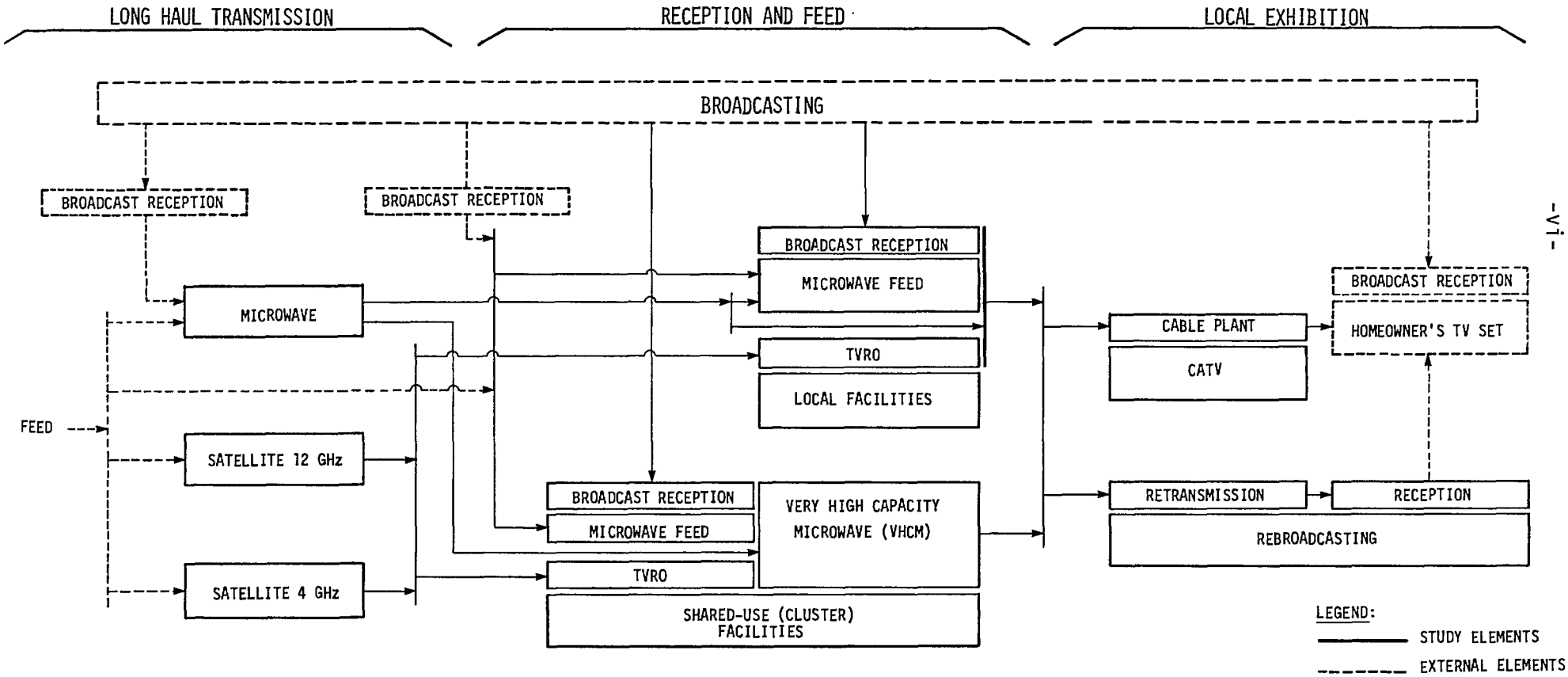
Contour B:
Refers to the extent of a television station's coverage as defined by the Department of Communications standards and procedures. The calculated B contour assumes the use of an outside antenna to display on a domestic TV set an acceptable quality picture.

Transmit pattern:
Refers to the ground footprint or coverage of a satellite transmitted signal to enable a receive station of appropriate characteristics to obtain a good quality signal.

Residence:
Refers to a household or appartment in a community the number of which is statistically reported by Post Canada.

A TECHNICAL AND ECONOMIC STUDY TO IMPROVE CANADIAN TELEVISION SERVICES
IN RURAL AND REMOTE NORTHERN ONTARIO COMMUNITIES

STUDY TECHNICAL ASPECTS SCHEMATIC



PART 1 - EXECUTIVE SUMMARY

Part 1 of this report presents a brief overview of the study and summarizes the major findings, conclusions and recommendations. Part 2 which follows describes the major study background considerations as well as the detailed technical and cost factors in providing eight (8) Canadian Television signals to rural and remote Northern Ontario communities. Part 3 presents support appendices on specific subjects or data used in the analysis presented in Part 2.

1.0 STUDY OVERVIEW

The purpose of this study was to cost and evaluate various technical options for improving broadcasting and/or cable television services in rural and remote communities of Northern Ontario. Cost and designs of typical cable television systems, very high capacity microwave distribution, low power rebroadcasting systems, satellite earth stations, and microwave networks were to be developed taking into consideration geographic and community characteristics.

The study was commissioned jointly by the Government of Canada and the Government of Ontario as part of their respective objective of improving television services to rural and remote areas of Canada and Ontario. The Department of Communications and the Ministry of Transportation and Communications retained the services of Doucet and Associates Consulting Ltd. to carry out this important study.

The improvement of television services to the native people's communities in Northern Ontario, recognized by both governments to be an important and worthwhile objective, was determined to require a separate study undertaking and therefore does not form part of this report.

1.1 Northern Ontario communities of interest

The priority area considered in detail in this report was that formed from the 128 rural and remote communities of Northern Ontario without cable television services, having 100 residences or more and a density of 25 residences or more per road mile. The study area was bounded by the Ontario-Manitoba border in the West, the Ontario-Quebec border in the East, James Bay in the North and a southern limit which ran through the districts of Muskoka, Haliburton, Hastings and Renfrew.

The approximate total population of the communities is 110,000. It is expected that the total population will decline slightly over the next 10 to 15 year period. The cover page indicates the distribution of the communities throughout Northern Ontario.

Pertinent data pertaining to number of households, density, terrain, and accessibility permitted the establishment of information of prime importance to the study. A classification of communities based on residential layout patterns and number of households was established. The average size community was determined to be 280 residences; the smallest was 100 residences and the largest 1,220 residences. Almost half of the communities had between 100 and 199 residences. The following table gives a classification of communities.

LAYOUT PATTERN	REFERENCE COMMUNITY	NUMBER OF RESIDENCES
Linear	Echobay	270
Linear with development	Emo	390
Spread development	Plantagenet	283
Semi-dense	Mattice	233
Dense	Mattawa	925
Dispersed	Caramat	136

The various layout patterns became the basis for estimating community cable television plant requirements and costs.

1.2 Canadian television signals of interest

The 128 communities making up the study area are significantly underserved in the area of television choices, particularly as it pertains to Canadian television services.

None had cable services in 1980. The following table presents the existing level of Canadian television services for the 128 communities.

NUMBER OF BROADCAST SIGNALS AVAILABLE	NUMBER OF COMMUNITIES
1	31
2	50
3	33
4	14

Sixty-three (63) percent of the communities have only 2 or less Canadian television choices. Other communities near the major Northern Ontario cities may have up to four (4) television choices, although this situation exists only for 11% of the communities.

The following table presents the availability of individual signals in the 128 communities.

BROADCAST SIGNALS	NUMBER OF COMMUNITIES
CBC English	121
CBC French	41
OECA	15
CTV	87
Global	14
TVA	11

There are not only disparities in the number of television choices but also in the availability of alternative television programming as regards to language and educational television let alone programming of a regional interest or from the U.S.

The television services considered in the study to be made available as a "package" to all 128 communities were the following:

. Basic Service
  1) CBC English
  2) CBC French
  3) OECA
  4) CTV

. Optional Service
  5) Global
  6) TVA
  7) CHCH-TV Hamilton
  8) CITY-TV Toronto

The quality of service was to conform with existing DOC standards and procedures in order that the ultimate viewer has access to an acceptable signal quality.

1.3 Communication system required to provide a full "package" service

To provide the eight (8) Canadian television services to these communities, consideration had to be given to the availability of each signal for each community. The signals not available locally would then have to be obtained from a location to be determined and then transmitted by appropriate technical means, also to be determined, to each community and then to each home for exhibition. These signals were identified to be available from nearby communities with cable television services, from existing satellite

television transmission services or from existing microwave television transmission networks. Only CHCH-TV and CITY-TV were not available at all in Northern Ontario.

The high number of signals not available locally required the communication system to be broken down into three (3) distinct components in order to facilitate the technical and economic evaluation. These components were identified as the following:

. Long haul transmission,which refers to the long distance transportation of remote television signals by terrestrial microwave networks or by satellite;

. Local or cluster reception and feed,which refers to the local or cluster systems required to receive, process and feed television signals required at the local headend for community display;

. Local exhibition refers to the community rebroadcast system or cable television plant capable of carrying the signals from the local head end into each residence for display. Direct to home satellite reception is also considered.

The local or cluster reception and feed component was specifically evaluated in order to take into account two (2) delivery options, namely:

. Direct delivery to each community;

. Indirect delivery whereby signals are delivered and assembled at a central point in a district-cluster and redistributed to individual communities in the surrounding area by way of shared use facilities.

1.4 Intended method of providing Canadian television signals

Each community was analyzed as to the intended method of access to each of the proposed television signals on the basis of signals to be obtained from the following origins:

. Outside the community or cluster area, requiring long haul transmission;

. Adjacent cabled community, requiring a feed from that community;

. Remote off-air reception inside or outside cluster area, requiring feed;

. Local off-air reception;

. Existing satellite service (CBC English, CBC French and OECA).

2.0 LONG HAUL TRANSMISSION

Five (5) of the eight (8) proposed signals were determined to be technically unavailable in some of the 128 communities. The two (2) CBC signals and the OECA signal were considered as technically available since being transmitted by satellite in 1980, they could be received in any community with a satellite earth station.

The Northern Ontario terrestrial microwave requirements were evaluated and the resulting annual common carrier service costs were established. The 6/4 GHz and 14/12 GHz satellite requirements were also evaluated and the corresponding annual common carrier service costs were calculated. The costs were compared and the least cost transmission method identified for each signal, namely:

SIGNAL	PREFERRED SOLUTION		LEAST ANNUAL COST
	MICROWAVE	SATELLITE	BUDGETARY ESTIMATE
CTV	x		$ 414,000
Global		x	1,000,000
TVA		x	1,000,000
CITY-TV		x	1,000,000
CHCH-TV		x	1,000,000
TOTAL			$ 4,414,000

Satellite long haul transmission was determined to be the least cost method for each signal except for CTV. However, the CTV evaluation only takes into consideration the Northern Ontario situation. Since a high percentage of Ontario homes receive CTV either by off-air pick-up or as a result of subscribing to cable television services, it is considered unlikely that the satellite transmission would be the least cost method even if all of Ontario was taken into consideration. It is believed that only the study of CTV signal rural and remote requirements across Canada would lead to a satellite preferred solution in this case.

The preferred transmission method costs were used to estimate the transmission cost per residence in the market area defined by the satellite and microwave coverage area. Market penetration assumptions were established in order to take into account this important variable. Since the satellite method was dominant, both Ontario 14/12 GHz coverage and Canada 6/4 GHz coverage were considered. The satellite monthly transmission cost per residence for each signal was determined to be relatively low, namely:

SIGNAL	ONTARIO 14/12 GHZ SERVICE	CANADA 6/4 GHZ SERVICE
	$	$
GLOBAL	0.87	0.03
TVA	0.05	0.03
CITY-TV	0.11	0.02
CHCH-TV	0.16	0.03

The CTV terrestrial microwave service costs per residence for the few communities requiring long haul transmission of the signal was determined to be very high, $14.04 per month per residence.

3.0 RECEPTION AND FEED

The various methods of reception and feed of all eight (8) signals were evaluated on the basis of two (2) alternative distribution options whereby a) each community establishes individual facilities or b) communities in a cluster area share the use of common facilities.

In both options, the availability of signals as a result of off-air broadcast, long haul or short distance microwave transmission of the CTV signal and satellite transmission was systematically analyzed to determine the least cost facility arrangements while maintaining Department of Communications signal quality levels and standards. Costs in this analysis included the capital and operating and maintenance costs of the required systems and associated facilities for the reception, processing and feed of signals. These would include receive antennas, (off-air broadcast, microwave), headends and satellite earth stations, as well as tower and shelter arrangements to meet the requirements of the alternative distribution option. In the case of the cluster arrangements, a Very High Capacity Microwave (VHCM) system to feed the signals to each community was also integrated into the technical and cost evaluation.

The costing of the two (2) distribution options for the 128 communities and the 29 clusters respectively was based on two (2) satellite earth station cost alternatives, one alternative using existing 4 and 12 GHz satellite earth station market costs and the other alternative using predicted satellite earth station costs. The cost predictions whereby satellite earth station costs are expected to fall significantly over the next few years are based on technological advances and increased production runs by manufacturers.

The technical and cost evaluation also considers the impact of key variables on the choice of the least cost distribution option and on the establishment of the least cost system and facility arrangements, namely:

. The long haul transmission of signals by microwave would lead to the selection of the shared use of common facilities option as the least cost option;

. The long haul transmission of signals by satellite as proposed (except for CTV), and the costing of facilities and arrangements at 1980 market costs for good quality signals, would lead to the selection by thirty-three (33) communities grouped in 14 clusters of each community establishing its own facilities, and the other 95 communities grouped in 15 clusters to share the use of common facilities;

. The costing of satellite earth stations at predicted future reduced costs would lead to the selection of the shared use of common facilities option by only 27 communities grouped in 6 clusters;

. The increase in the number of signals to be offered in the package would tend to lead to the selection of the shared use of common facilities, particularly the microwave long haul

transmission of foreign signals;

. The addition of communities as a result of modifying the number of residences and density criteria would tend to lead to the selection of the shared use of common facilities option; this would also be true if existing cable communities were included since none in Northern Ontario provide their subscribers with the full eight (8) Canadian signals "package".

On the basis of the reception and feed optimization analysis using 1980 costs for all equipment except TVRO's where future predicted costs were used, and the inclusion of cabled communities whenever technically and economically feasible, the following table provides an indication as to the range of costs (per month) per residence:

CLUSTER/ COMMUNITY / COST CATEGORIES $	CLUSTER MARKETS PENETRATION 80%			INDIVIDUAL COMMUNITY MARKETS PENETRATION 80%			
	<2,000 res.	2,001 to 5,000 res.	>5,001 res.	<150 res.	151 to 275 res.	276 to 400 res.	>401 res.
<2.00	-	-	-	-	-	-	3
2.01 to 5.00	1	2	-	-	8	9	8
5.01 to 8.00	3	-	-	6	21	-	-
8.01 to 11.00	-	-	-	26	-	-	-
11.01 to 15.00	-	-	-	10	1	-	-
>15.01	-	-	-	7	2	-	-
TOTAL	4	2	-	49	32	9	11

It appears that under the best circumstances costs for reception and feed would range widely between a low of $2.00 per month per residence to more than $15.00 per month per residence. A significant portion of the Northern Ontario communities would be in the range of $8.00 to $10.00 per month per residence. Since this represents a reception and feed only cost estimate, without long haul transmission costs and exhibition costs, it is questionable whether these costs would be acceptable to local and

regional entrepreneurs or to other interested parties. Furthermore, there would be uncertainty as to the acceptability of the corresponding subscriber rates which would result.

4.0 EXHIBITION

The third component of the communication system which was evaluated is local exhibition. Three (3) exhibition technical options were analyzed namely:

. Local cable television plant;
. Local rebroadcasting station;
. Direct broadcast satellite home reception.

The technical requirements for each option were established and the corresponding capital and operating and maintenance costs were determined. Care was taken to define systems and costs in such a manner as to permit cost comparison with a view to selecting the least cost option. The cost per residence was computed in order to effect the cost comparison.

It was found that with the implementation of Direct Broadcast Satellites in the future, home terminals would certainly prove to be an economically viable solution to improving television services in rural and remote area of Northern Ontario although existing delivery and exhibition options would continue to play an important role. On the basis of a future $500 home terminal assuming high power DBS services for the full eight (8) television signals, it was shown that 105 of the 128 communities should choose the satellite home terminal option. However, important obstacles will require several years to overcome.

The study ends its exhibition analysis with a cost comparison of cable television plant vs rebroadcast stations.The cost comparison established the technical and cost viability of both options.

The following summary table indicates the least cost option for different types of small communities.

COMMUNITY DENSITY PATTERN	CABLE TELEVISION		REBROADCAST STATION	
	NUMBER OF COMMUNITIES	MONTHLY COST PER RESIDENCE $	NUMBER OF COMMUNITIES	MONTHLY COST PER RESIDENCE $
Linear	28	7.81	-	-
Linear with development	14	7.93	-	-
Aspley	-	-	1	7.33
Bala	-	-	1	7.38
Spread development	15	14.22	-	-
Semi-dense	45	7.40	-	-
Dense	9	7.28	-	-
Bancroft	-	-	1	4.12
Barry's Bay	-	-	1	4.64
Burks Falls	-	-	1	6.62
Cobalt	-	-	1	5.40
Ear Falls	-	-	1	6.42
Englehart	-	-	1	5.02
Little Current	-	-	1	6.33
Longlac	-	-	1	5.10
Massey	-	-	1	6.63
Red Lake	-	-	1	5.02
South River	-	-	1	6.46
Mattawa	-	-	1	4.95
Dispersed	3	13.79	-	-
TOTAL	114		14	

For 114 communities a cable plant is the least cost exhibition option and for 14 communities, mainly in the dense category of 400 or more residences and a 2 mile settlement radius, the rebroadcast station is the least cost option. It should be noted that this latter option would require in-depth engineering analysis in order to eliminate possible technical problems.

The table also indicates a wide range of exhibition cost per residence, varying between a low of $4.12 per month and a high of $14.22 per month. The bulk of the communities would be in the $7.00 to $8.00 per month range which would be compatible with costs associated with existing cabled communities.

5.0 COST AND TECHNICAL INTEGRATION OF COMMUNICATION SYSTEM

Each element of the communication system has been evaluated as to technical options and least cost solutions. The study, confined to the Northern Ontario area, established the conditions whereby several technical options were feasible for providing eight (8) Canadian television signals to all 128 communities at the least possible cost. The options retained in the study were the following:

	Retained Options
. Long haul transmission	1) Satellite (4GHz and 12GHz) 2) Microwave
. Reception and feed	1) Individual community reception and feed 2) Shared use of common reception and feed facilities
. Local exhibition	1) Cable television plant 2) Rebroadcast station

The resulting six (6) options take into consideration signal-by-signal requirements for each of the 128 communities. The integration of each

element and its appropriate option to ensure the quality provision of the television signals to each residence is therefore a unique analysis involving the 6 basic options.

The three (3) integration tables on the following pages present the technical and cost summary for each element and each community. All three (3) tables must be taken together to identify the particular elements to make up viable communication systems. The tables also include two (2) satellite cost alternatives, one using 1980 satellite earth station costs and one using projected mid-1980's satellite earth station costs. The tables furthermore provide other integration data pertaining to market coverage, capital investment, common carrier service costs, operating and maintenance costs and monthly cost per residence.

6.0 RESULTS AND CONCLUSIONS

The work carried out in the course of this study has shown the potential application of several technical options to be technically and economically feasible and necessary for the provision of an eight (8) Canadian television signal package to rural and remote communities of Northern Ontario.

The integration of the elements making up the communication system appears to be economically attractive for some communities but not all communities, depending on signal availability, remoteness, type of community layout and low number of residences. The cost per residence could be as low as $13.00 or $14.00 per month but also in some cases higher than $25.00 per month.

Satellite transmission should be the preferred long haul transmission method to improving Canadian television services in rural and remote Northern Ontario. The CTV signal, required by only 9 communities, was the only signal where the terrestrial microwave method was less costly.

SUMMARY: LONG HAUL TRANSMISSION - 8 SIGNALS

COSTS SUPPORTED EXCLUSIVELY BY COMMUNITY USERS							COSTS SUPPORTED BY SIGNAL PROVIDER		
TERRESTRIAL MICROWAVE	SATELLITE						SATELLITE		BASE ALTERNATIVES
	12 GHz			4 GHz			12 GHz	4 GHz	MODE
STUDY SPECIFIC CLUSTERS CTV	ONTARIO			CANADA			ONTARIO	CANADA	OPTION
	CHCH CITY TVA	CHCH CITY GLOBAL	CHCH CITY / GLOBAL TVA	CHCH CITY TVA	CHCH CITY GLOBAL	CHCH CITY / GLOBAL TVA	OECA	CBC-E CBC-F	MARKET COVERAGE
2,458	2,992,518	1,398,242	3,087,977	9,716,017	9,241,742	12,425,972	N/A	N/A	SIGNALS
-	-	-	-	-	-	-	-	-	EXPECTED MARKET : CUMULATIVE SIGNAL - RESIDENCES (TABLES 14 , 16)
414,000	3,000,000	3,000,000	4,000,000	3,000,000	3,000,000	4,000,000	-	-	CAPITAL INVESTMENT - $
-	-	-	-	-	-	-	-	-	ANNUAL SERVICE COSTS - $ (TABLE 11)
RANGE 1.79 TO 54.55 AVERAGE 14.04	.32	1.14	1.19	0.08	0.08	0.11	-	-	OPERATING & MAINTENANCE COSTS - $
									MONTHLY COST / RESIDENCE - $ (TABLES 15 , 16)
MOOSONEE LONGLAC STRATTON ARMSTRONG PICKLE LAKE	BARRY'S BAY BANCROFT GOODERHAM	COBALT KING KIRKLAND RAMORE	ALL OTHERS (23)	BARRY'S BAY BANCROFT GOODERHAM	COBALT KING KIRKLAND RAMORE	ALL OTHERS (23)	N/A	N/A	STUDY CLUSTERS

(1) Relative market size is demonstrated by adding up the number of residences for each signal contained in the identified signal package. The cumulative total can not be utilized to compute directly the monthly cost/residence.

SUMMARY: OPTIMIZED LOCAL OR CLUSTER RECEPTION AND FEED - 8 SIGNALS

1980 COST FOR TVRO'S						EXPECTED MID 1980'S COST FOR TVRO'S						
LOCAL BROADCAST RECEPTION, TVRO		SHARED USE OF BROADCAST RECEPTION, TVRO AND VHCM				LOCAL BROADCAST RECEPTION, TVRO		SHARED USE OF BROADCAST RECEPTION, TVRO AND VHCM				BASE ALTERNATIVES
ONE (1) COMMUNITY		CLUSTER		CLUSTER WITH CABLED COMMUNITIES		ONE (1) COMMUNITY		CLUSTER		CLUSTER WITH CABLED COMMUNITIES		OPTION
OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	MARKET COVERAGE
33	*7	95	24	113	24	101	*15	27	24	33	30	SIGNAL RECEPTION
7,391	-	21,311	-	93,779	-	20,817	-	7,885	-	13,142	-	NUMBER OF COMMUNITIES (TABLE 28, 30; 21, 26)
2,930,400	-	9,644,849	-	10,184,849	-	4,214,375	-	2,903,021	-	3,083,021	-	EXPECTED MARKET - RESIDENCES (TABLE 28, 30)
-	10,500	-	7,500	-	7,500	-	16,500	-	6,000	-	6,000	CAPITAL INVESTMENT - $ (TABLE 21, 23, 27)
22,400	-	31,380	-	31,380	-	48,310	-	9,923	-	9,923	-	SERVICE COSTS / MONTH - $ (TABLE 21' APPENDIX 4.3.2.2)
RANGE 2.57 TO 45.64 MATTAWA MICHIPICOTEN AVERAGE 10.62		RANGE 5.16 TO 22.26 SUNDRIDGE HUDSON AVERAGE 8.87		RANGE 0.45 TO 8.33 ST-CHARLES GOODERHAM AVERAGE 2.10		RANGE 1.40 TO 33.51 MATTAWA MICHIPICOTEN AVERAGE 6.26		RANGE 6.35 TO 10.24 BARRY'S BAY GOODERHAM AVERAGE 7.74		RANGE 2.46 TO 7.73 STRATTON GOODERHAM AVERAGE 4.87		OPERATING AND MAINTENANCE/MONTH (APPENDIX 4.3.1.2, 4.3.2.2, 4.4.1.3)
												MONTHLY COST / RESIDENCE - $ (TABLE 30, 28)

BONFIELD	DUBREUILVILLE	BARRY'S BAY	(5)	(+1)	SAME, PLUS:		BARRY'S BAY	(5)	(+1)	CLUSTER / COMMUNITIES
CALLANDER	MICHIPICOTEN R.	BANCROFT	(5)	(+1)	BALA	CRYSTAL FALLS	BANCROFT	(5)	(+1)	( ) NUMBER OF COMMUNITIES IN CLUSTER
CORBEIL	FAUQUIER	GOODERHAM	(6)	(+2)	BAYSVILLE	FIELD	GOODERHAM	(6)	(+2)	
MATTAWA	MOONBEAM	SPRUCEDALE	(13)	(+3)	DORSET	HOGAN	LONGLAC	(3)	(+1)	
POMASSAN	OPASATIKA	SUNDRIDGE	(7)	-	DWIGHT	MARKSTAY	STRATTON	(4)	(+1)	
IRON BRIDGE	VAL RITA	MAGNETAWAN	(5)	(+1)	HONEY HARBOUR	NOELVILLE	EAR FALLS	(4)	-	
SPANISH	CALSTOCK	ST-CHARLES	(12)	(+2)	HUNTER	RIVER VALLEY				
SPRAGGE	MOOSONEE	WEBBWOOD	(6)	(+1)	MILFORD BAY	SKEAD	( ) NUMBER OF COMMUNITIES IN CLUSTER			
THESSALON	KAKABEKA FALLS	LITTLE CURRENT	(4)	(+1)	NOVAR	ST-CHARLES				
COBALT	MINAKI	ECHOBAY	(7)	(+1)	PORT CARLING	VERNER				
LATCHFORD	REDDIT	KING KIRKLAND	(8)	(+2)	PORT SYDNEY	WAHNAPITAE				
TEMAGAMI	SIOUX NARROWS	LONGLAC	(3)	(+1)	ROSSEAU	CARTIER				
FOLEYET	HERON BAY	HUDSON	(4)	(+1)	SPRUCEDALE	KILLARNEY				
GOGAMA	ARMSTRONG	EAR FALLS	(4)	-	UTTERSON	MASSEY				
HOLTYRE	PICKLE LAKE	STRATTON	(4)	(+1)	BURK'S FALLS	NAIRN CENTER				
MATHESON					EMSDALE	WEBBWOOD				
RAMORE					KATRINE	WHITE FISH				
VAL GAGNE					KEARNEY	LITTLE CURRENT				
					SOUTH RIVER	MANITOWANING				
					SUNDRIDGE	MINDEMOYA				
					TROUT CREEK	WIKWEMIKONG				
					ARNSTEIN	BATCHAWANA BAY				
					BRITT	BRUCE MINES				
					LORING	DESBARATS				
					MAGNETAWAN	ECHOBAY				
					MCKELLAR	HILTON BEACH				
					NOBEL	RICHARDS LANDING				
					POINTE AU BARIL	SEARCHMOUNT				
					ALBAN	EARLTON				
					DINORWIC	ELK LAKE				
					HUDSON	ENGLEHART				
					VERMILLION BAY	KEARNS				
					WABIGOON	KING KIRKLAND				
						LARDER LAKE				
						MATACHEWAN				
						VIRGINIATOWN				

* INCLUDED IN OFF-AIR, SATELLITE AND LONG HAUL MICROWAVE TOTAL

SUMMARY: OPTIMIZED LOCAL EXHIBITION - 8 SIGNALS

CATV						REBROADCAST		
LOCAL COMMUNITY - CABLE						LOCAL COMMUNITY-2 MILE RADIUS		MARKET COVERAGE
DENSITY PATTERNS						BREAK - EVEN RESIDENCES		DETERMINANT COST VARIABLE
LINEAR	LINEAR WITH DEVELOPMENT	SPREAD	SEMI-DENSE	DENSE	DISPERSED	LINEAR WITH DEVELOPMENT > 525 RESIDENCES	DENSE > 575 RESIDENCES	
28	14	15	45	9	3	2	12	NUMBER OF COMMUNITIES (TABLE 34)
3,666	2,214	2,000	8,302	3,487	385	848	7,800	EXPECTED MARKET - RESIDENCES (TABLE 40)
788,276	481,806	780,000	1,681,074	759,840	146,224	335,040	2,295,000	CAPITAL INVESTMENT - $ (TABLE 37) CALCULATIONS, 33, 34)
197,069	120,452	195,000	420,268	189,960	36,556	12280	73680	OPERATING AND MAINTENANCE ANNUAL COSTS- $
7.81	7.93	14.22	7.40	7.28	13.79	RANGE 7.33 TO 7.38 AVERAGE 7.35	RANGE 4.12 TO 6.63 AVERAGE 5.36	MONTHLY COST / RESIDENCE - $ (TABLE 42)

ALBAN BATCHAWANA BAY BRITT COE HILL COMBERMERE CORBEIL DORSET EMSDALE HAGAR HERON BAY KATRINE KEARNEY LORING MADAWASKA MAYNOOTH MINDEMOYA NOBEL NOELVILLE QUADEVILLE RIVER VALLEY SEARCHMOUNT SPRAGGE SPRUCEDALE STRATTON UTTERSON VAL GAGNE WILBERFORCE ELMO BAY	ARMSTRONG BARWICK BRUCE MINES CRYSTAL FALLS DESBARATS DINORWIRC HOLTYRE MACTIER NORLAND NOVAR VERMILLION BAY WHITE FISH WIKWEMIKONG EMO	FIELD GOODERHAM HONEY HARBOUR KINMOUNT MILFORD BAY MINAKI PORT CARLING ROSSEAU SIOUX NARROWS SKEAD ARNSTEIN DWIGHT MCKELLAR POINTE AU BARIL PORT SYDNEY	ALL OTHERS (45)	CALLANDER CHALK RIVER EARLTON LARDER LAKE MATHESON POWASSAN RAINY RIVER SUNDRIDGE THESSALON	CARAMAT CENTRAL PATRICIA-PICKLE LAKE REDDIT	APSLEY BALA	BANCROFT BARRY'S BAY BURKS FALLS COBALT EAR FALLS ENGLEHART LITTLE CURRENT LONGLAC MASSEY RED LAKE SOUTH RIVER MATTAWA	COMMUNITIES

However, this would not be the case if the Canadian market requirement for this signal was taken into account.

Satellite transmission could be established to cover Ontario alone using Anik 12 GHz transmission or to cover Canada using Anik 4 GHz transmission. The former has the advantage of specializing the signal "package" to meet Ontario resident needs; the latter has the advantage of potentially costing ten (10) times less if the costs were to be supported by community users.

The introduction of satellite transmission and the continued fall in satellite earth station costs would appear to favour the establishment by each community of receive and feed facilities. This trend would have to be verified in light of possible increases in the number of communities needing improved television services and of the need to also provide popular foreign signals which might only be made available on a microwave basis. These factors would tend to make the shared use of common receive and feed facilities more attractive.

Local community cable television plants were demonstrated to be an economical and attractive solution to exhibit the eight (8) television signals in the majority of communities. There are small size community types where rebroadcast stations would be economically attractive. This latter solution would appear to have technical and economic limitations beyond the provision of 8 signals and beyond a coverage of 4 miles when compared with the cable television option.

The cost estimated for each element was based on typical conditions and 1980 market costs. It would be possible that some of the basic capital and service costs could be reduced on the basis of further investigation in the following areas:

. Optimization of satellite transmission costs as a result of "package" transmission;

. Back-haul requirements and engineering;

. Detail design of reception and feed facilities and exhibition cable plant or rebroadcast station when applied to specific communities or clusters;

. Development of low cost equipment "package" for rural and remote community television services;

. Establishment with DOC of overall multi-link telecommunication system quality levels and standards, not presently available;

The study also raises other issues which should be the subject of further investigation, namely:

. Establishment of implementation responsibilities;

. Encouraging the participation of local and regional entrepreneurs in the television service improvement process;

. Adding local and regional television content to the Canadian television package;

. Possible future television service developments;

. Establishing the appropriate costs to be supported by rural and remote communities for the improved services;

. Integrating the requirements for foreign television signals as part of meeting the overall television needs of rural and remote communities.

7.0 RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations can be formulated to pursue the development of policies which will have the effect of improving Canadian television services in Northern Ontario rural and remote communities.

1) A market study taking into account not only the costs developed in this study but also the added entrepreneurs costs to initiate and operate the various service elements making up the communication system should be conducted to establish the full economic impact including the market acceptability of tariff rates to community users;

2) An analysis of the implementation requirements with a view to obtain the full cooperation of each industry associated with the improvement of television services in Northern Ontario and elsewhere and including local and regional cable operators, broadcast undertakings, common carriers, government departments and municipal governments.

   One particular aspect of such an analysis would relate to the possible organization structures at local, cluster, provincial and national levels which would have operating and maintenance responsibilities for all parts of the communication system;

3) The development by governments of technical and economic models of the television communication system with a view to speeding up and increasing the depth of the analysis of impacts due to new technology developments. It is suggested that a modeling tool and its subsequent use, by simulating technical or cost changes would assist industry and government policy makers to adapt more rapidly to changing technology, thereby accelerating television service improvements to the rural and remote communities;

4) The analysis of Department of communications quality and reliability factors in order to develop norms and standards which could be applied when considering a full communication system involving the tandeming of long haul transmission systems with receive and feed systems and with local exhibition systems. Such an analysis would perhaps ensure that the television needs of rural and remote communities could be met in the most economical way possible as a result of optimizing certain quality and reliability factors;

5) The two (2) governments should continue research studies which would lead to design guidelines and standard specifications for certain system and equipment components associated with receive and feed technology and local exhibition technology. This approach could lead to quantity purchasing of equipment as well as reduced engineering costs.

PART 2 - MANAGEMENT REPORT

Part 2 of this report describes the major technical and cost factors in providing the 128 identified communities of Northern Ontario with the proposed 8 Canadian television services. This part of the report is addressed to the reader interested in an overview of the key technical and cost considerations contained in the study.

The background considerations which have influenced the choice of communities and television services to be studied are discussed in the Introduction section. The technical and cost factors are presented in three technical sections, namely: Long haul transmission, Reception and feed, and Exhibition: these three sections define the essential elements of an integrated communication system capable of satisfying the television needs of rural and remote communities. The last section concerns the overall cost of services per residence using cost estimates developed in the previous sections.

2.0 INTRODUCTION

The growth of television services in Canada over the last three (3) decades has been impressive. Canadians living in the major southern cities have more choice of television programming than almost any other citizens in the world. However, there are many thousands of Canadians who are underserved, by any standard, in several rural and remote areas of the country.

The broadcasting disparities in Canada have recently been examined by the Committee on Extension of Service to Northern and Remote communities created by the Canadian Radio-Television and Telecommunications Commission (CRTC).

The Committee was formed to "issue a report on how the number and variety of television services to northern and remote communities in Canada might best and most expeditiously be increased...". The report concludes that "immediate action must be taken to meet the needs of the many Canadians who believe that, as regards broadcasting, they are being treated as second class citizens".

Northern Ontario is one such area in Canada which can be designated as underserved as regards alternative television programming and availability of programs of direct local or regional interest. For example, eighty (80) communities of 100 residences or more and a residential density of 25 residences or more per road mile receive only two (2) or less Canadian television signals to satisfy entertainment and information needs.

As part of their respective policy objectives, the Department of Communications - Canada and the Ministry of Transportation and Communications - Ontario initiated the present study. The purpose of the study was to evaluate the technical ways and means of improving television services to the rural and remote Northern Ontario communities without existing cable television services.

2.1 Objectives of the study

This study is intended to provide both Governments technical and cost data that can then be used to develop policies facilitating the improvement of television services in rural and remote Northern Ontario communities through the use of the most cost effective telecommunications and broadcast technologies.

More specifically, the objectives are the following:

2.1.1 To determine the costs and evaluate the various technical options for improving broadcasting and/or cable television services in Northern Ontario communities having 100 residences or more and a residential density of 25 or more per road mile;

2.1.2 To develop a data base on cost and designs of typical cable television systems, Very High Capacity Microwave distribution systems, low power rebroadcasting systems and Satellite Earth stations (TVRO) which would be applicable to the identified Northern Ontario communities.

The improvement of television services to the native people's communities in Northern Ontario are recognized by both Governments to be important and worthwhile objectives. However, more than extension of existing services must be considered since preservation of language and maintenance and development of cultural identities are essential pre-requisites to any evaluation of required facilities. The study of the various technical schemes to improve television services in rural and remote native people's communities would be the subject of a separate study undertaking.

2.2 Terms of reference

In December 1979 an unsolicited proposal to study various technical options for improving broadcasting and/or cable television services in 123 Ontario communities was submitted to the Ministry of Transportation and Communications - Ontario (MTC) and to the Department of Communications - Canada (DOC). The proposed study was approved and separate contracts were awarded to Doucet and Associates Consulting Ltd by both Governments in February 1980.
It was agreed that the two (2) Governments would share equally the total cost of the study, and that the nature, scope and work plan be the same for both contracts.

A Committee consisting of a representative of DOC and a representative of MTC was established to direct and advise the consultant on the study to be executed.

2.2.1 Scope of work

2.2.1.1 Develop with the committee the basic study parameters as to Ontario communities of interest, level of Canadian television services and depth of technical and economic analysis;

2.2.1.2 Develop the technical options for improving television services in Northern Ontario;

2.2.1.3 Develop alternatives and prepare cost estimates for the long haul transmission of television signals by terrestrial microwave and satellite. The cost for each television signal should be identified separately. The most economically feasible alternative should be indicated;

2.2.1.4 Develop alternatives and prepare cost estimates for the local and cluster reception and feed of television signals. The most economically feasible alternative should be indicated;

2.2.1.5 Develop alternatives and prepare cost estimates for the local community exhibition of the television services in the Northern Ontario communities. The most economically feasible alternative should be indicated;

2.2.1.6 Integrate the most feasible alternatives and their respective cost estimates. Present the cost per residence for each set of alternatives. Compare the cost options;

2.2.1.7 Formulate appropriate conclusions and recommendations;

2.2.1.8 Present the results of the study in a final report.

2.2.2 Work plan

To meet the objectives and to monitor the progress of the contracted work, the study was carried out in several phases over a 9 month period, namely:

2.2.2.1 Phase I - Basic data information gathering

Define, collect and examine economic, demographic and technical data pertaining to:

2.2.2.1 (cont'd)

- areas and communities to be served;
- availability of television services;
- coverage of Canadian television services in Ontario;
- microwave and satellites services used by broadcasters and cable operators;
- aerial photos and maps for each community;
- Canadian television services to be carried and distributed.

The data obtained was presented in an interim report. This report was the basis for initiating modifications to the study as originally defined.

2.2.2.2 Phase II - Technical evaluation of the options

Identify, examine and evaluate the technical options permitting the efficient long haul transmission, reception, feed and exhibition of the television services including:

- identification of technical characteristics of each option;
- determination of requirements and specifications for each option to conform with Department of Communications standards and procedures;
- identification of technical alternatives for each option;
- determination of standard equipment and installation models for costing purposes.

2.2.2.3 Phase III - Cost evaluation of the options

Identify non-technical characteristics for each option. Cost out the technical options. Determine cost effective solutions.

- Budgetary prices were obtained for each technical option including capital and operating and maintenance costs;

- Where applicable, public common carrier service costs were used;

- Estimation of capital costs included equipment, support facilities, installation, transportation and engineering;

- Costs were presented on an incremental channel basis;

- Estimation of operating and maintenance costs (O&M) included power, snow clearing at sites, transportation, labour time and spare parts;

- Satellite transmission costs for each television signal were broken down into their respective markets;

- Total capital and total monthly costs (i.e. capital equivalent cost plus service costs plus O&M costs) were calculated to compare alternatives;

2.2.2.3 (cont'd)

- Identified cost improvement possibilities were calculated.

2.2.2.4 Phase IV - Integration of cost effective solution

Cost integrate the most economically feasible options and determine the cost per residence for the television services. The participation of existing cabled communities offered an increased market base for costing the television services on a per residence basis.

2.2.2.5 Phase V - Preparation of reports

At regular intervals, review meetings were held by the committee to discuss results to date and major outstanding study issues. Essential information was presented for each meeting and minutes were written.

Three (3) reports were prepared, namely:

2.2.2.5.1 Phase I / Interim report

2.2.2.5.2 Phase II, III, IV / Preliminary final report

2.2.2.5.3 Final report

2.3 Study modifications

2.3.1 Original objectives

The originally stated objectives concerned the improvement of television services for the non-cabled Ontario communities of 500 population or more, as indicated in Appendix 2.1.1. The interim report demonstrated that most of the 101 identified communities were located in Southern Ontario and that these were served by 4 or more broadcast signals.

The committee decided that the non-cabled communities in Northern Ontario of 100 residences or more and a residential density of 25 or more per road mile with limited television services should be the study focus area, as listed in Appendix 2.1.2.

The consultant was therefore directed to modify the original objectives in order that the study concern itself with small rural and remote Northern Ontario communities.

2.3.2 Work program

As a result of the modified objectives, the original work program was also modified in order to study the technical options which were more appropriate to the area to be served. The committee directed the consultant to pursue on a priority basis satellite transmission and distribution alternatives.

The committee also decided to revise the economic analysis. It was originally planned to develop service tariff rates and evaluate market acceptability of these rates. Such an analysis would have to consider ownership, full cable services including carriage of U.S. broadcasting stations, and return on investment considerations. It was decided to limit the study to establishing the cost of the proposed services in relation to the number of residences served.

2.4 Rural and remote Northern Ontario communities

Rural and remote Northern Ontario communities of interest to the study were defined as including non-cabled communities outside urban centers having 100 residences or more and a density of 25 residences or more per road mile. The study priority area was delineated by the Ontario - Manitoba border in the West, the Ontario - Quebec border in the East and the James Bay in the North. The southern limit of the area was determined by examining the television contours and choices available to the communities located in the districts of Muskoka, Haliburton, Hastings and Renfrew. The limit was fixed when the number of television choices was reduced to fewer than 4. The dots on the map illustrating the front cover show the location of the communities forming Northern Ontario.

2.4.1 List of communities

The communities were chosen from the Ontario Household Figures published by Post Canada. The communities were verified as to density and non-cable criteria by MTC, DOC and the consultant. The final list of communities making up the study area, 128 in total, is presented in appendix 2.1.2.

2.4.2 Size of communities

The 128 rural and remote Northern Ontario communities represent a total of 35,878 residences and a population estimated to be 110,000 people. The distribution of community sizes is shown in the following table:

TABLE 1

Community size grouping Residences	Number of Communities
100 - 199	62
200 - 299	27
300 - 399	15
400 - 499	6
500 - 599	6
600 - 699	5
700 and above	7
TOTAL:	128

2.4.2 Size of communities (cont'd)

The average size community numbers 280 residences. According to the Ministry of Treasury and Economics Municipal Assessment Branch, the identified communities are not expected to grow in population over the next ten (10) years. The projected population for 1991, indicated in appendix 2.1.2, totals 97,545, approximately 12,500 fewer people than the present estimated population of 110,000.

2.5 Existing Northern Ontario Canadian Television services

Present level of television services in the rural and remote areas of Northern Ontario is well below that available in the metropolitain areas. Studies by the Department of Communications show that the population living in the major southern Ontario cities has access to more than 13 different Canadian and American television broadcast and cable services.

Community cable services have increased the availability of television services in Ontario. Approximately 57% of the Ontario communities of 500 population or more are cabled. Nonetheless, approximately 83% (1) of the Ontario population is living in these communities. The largest cabled community is the Toronto metropolitain area with 943,619 potential subscribers and the smallest is Horseshoe Valley with 121 potential subscribers. Appendix 2.3.2 lists the Ontario cabled communities.

(1) CRTC Fact Digest 1979.

2.5.1 Level of Canadian Television services offered to cabled communities as cable services

Appendix 2.3.2 demonstrates that four (4) or more Canadian television services (16 exceptions) are offered as cable services to the cabled communities of Ontario. Many also provide a community channel of local interest. This level of service is also offered in several Northern Ontario cabled communities, for example: Sault Ste-Marie, Sudbury, Kenora, Hearst, etc...

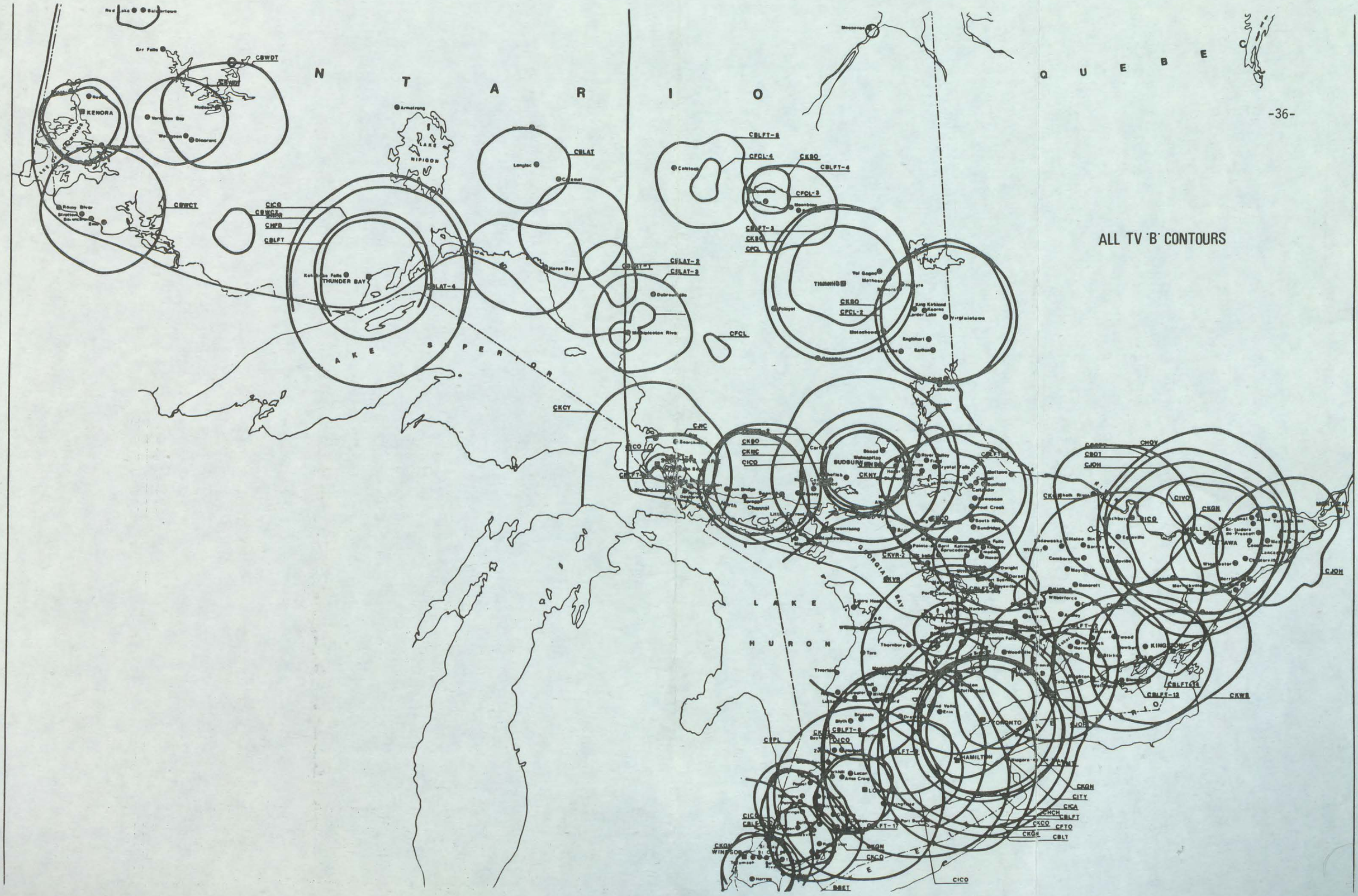
2.5.2 Television services in rural and remote communities

2.5.2.1 Canadian television coverage by broadcast stations

The figure on the following page presents the coverage for the Canadian television stations broadcasting in Ontario. Appendix 2.2 presents the coverage for each broadcaster, namely: CBC English, CBC French, OECA, CTV, Global, TVA, CHCH-TV, CITY- TV, and other local non-affiliated broadcaster.

The broadcast coverage area indicated (and used throughout the present study) is defined on the basis of contour "B" lines. These lines indicate the extent of a television station's coverage area within which an acceptable quality signal is obtained with a normal outside house antenna.

ALL TV 'B' CONTOURS



2.5.2.2 Level of services in communities

The rural and remote communities of Northern Ontario have access to a limited number of Canadian broadcast services. Appendix 2.3.1 indicates the availability of Canadian Television services for each community. The distribution of the level of services is shown in the following table:

TABLE 2A

Number of Broadcast signals available	Number of communities	%
1	30	24
2	50	39
3	34	26
4	14	11
TOTAL	128	100

2.5.2.3 Availability of Canadian Television services

The distribution of television services is shown in the following table

TABLE 2B

Broadcast signal	Number of communities	% of communities (128)
CBC English	121	95
CBC French	41	32
OECA	15	12
CTV	87	68
Global	14	11
TVA	11	9

2.6 Proposed Canadian Television Services

One of the television needs for the Northern Ontario rural and remote communities is for more choice of programming, more information and more entertainment. This study only concerns the provision of existing Canadian Television services to meet part of those needs. The provision of signals originating from the U.S., although certainly in much demand, is left for future consideration and study.

The proposed Canadian television services to be made available to the population living in the 128 communities are the following:

2.6.1 Basic service

The improvement in television services includes the availability on a priority basis of the following signals:

2.6.1.1 CBC English

2.6.1.2 CBC French

2.6.1.3 OECA

2.6.1.4 CTV

2.6.2 Optional service

The improvement in television choices includes the availability of alternative signals, namely:

2.6.2.1 Global

2.6.2.2 TVA

2.6.2.3 CHCH-TV

2.6.2.4 CITY-TV

2.6.3 Quality of service

For the purpose of this study, quality of service is to conform with existing DOC standards and procedures in order that the ultimate television viewer has access to an acceptable signal quality.

A comparison between table 2B in subsection 2.5.2.3 and the list of proposed services indicates that the provision of the full eight (8) signal television package in each community will be a major undertaking.

2.7 Method of providing proposed television signals

The provision of all the proposed television signals to the rural and remote communities of Northern Ontario would be a major technical and entrepreneurial undertaking. The signals not available locally would have to be obtained from a location to be determined and then transmitted by appropriate technical means, also to be determined, to each destination. Once the signals are assembled at their respective destinations, these would have to be locally delivered to each home for exhibition.

2.7.1 Signal availability

Appendix 2.3.1 identifies the Canadian broadcasting signals available off-air to each community as a result of the existence of television broadcasting undertakings in the areas.

Some signals are also technically available in different locations by other means, namely:

2.7.1.1 Nearby community cable television services.

Existing cable operators have made arrangements to obtain by microwave, or otherwise, television services not available off-air in the general area. These signals would be technically available for distribution to other communities. Appendix 4.5.2 presents the cabled communities in Northern Ontario and the Canadian Broadcast services they offer their subscribers.

2.7.1.2 Satellite Television Transmission

CBC English and French networks as well as OECA presently transmit their respective programs by satellite. The CBC has contracted with Telesat to use ANIK-B 6/4 GHz bandwidth services. OECA's experimental transmission project using ANIK-B 14/12 GHz services in cooperation with DOC is coming to an end. However, it is intended that the service will be continued on a permanent basis. As a result, these signals would be technically available to the Northern Ontario communities only by the mere provision of a television receive only (TVRO) station.

2.7.1.3 Microwave Television Transmission

Five (5) of the eight (8) Television broadcasters have extended their coverage area by using public common carrier microwave services to carry their respective signals into Northern Ontario. Private microwave carriers are making TVA available to some cabled communities.

Only CHCH-TV and CITY-TV are not at all available in Northern Ontario.

2.7.2 Remote signal delivery: 2 options

As presented in appendix 2.3.1, the rural and remote communities require to have access to a minimum of four (4) signals and a maximum of seven (7) signals from outside their respective boundaries if they are to offer a full eight (8) signal television package as proposed.

The delivery of signals picked up from points beyond the community can be evaluated by considering two (2) options, namely:

2.7.2.1 Direct delivery to each community

The signals can be delivered directly to the local headend of each community.

2.7.2.2 Indirect delivery to each community

The signals can be delivered and assembled at a central point in a district - cluster, and redistributed to individual communities in the surrounding area by way of shared use facilities.

The indirect means of delivering signals requires the grouping of communities into clusters. The direct and indirect options for signal delivery are evaluated later in the present report in order to determine the economic feasibility of these options.

2.7.3 Signal Delivery process

The provision of signals to the communities will be evaluated in light of the technical requirements for the following:

2.7.3.1 Long haul transmission

This component of the delivery chain refers to the long distance transportation of remote television signals by terrestrial microwave networks or by satellite.

2.7.3.2 Local or cluster reception and feed

This part of the delivery process refers to the local or cluster system required to receive, process and feed television signals required at the local headend for local exhibition.

2.7.3.3 Local exhibition

This element of the delivery process refers to the community system or plant capable of carrying the signals from the local headend into each residence for display.

2.7.4 Obtaining television signals for delivery

The variety of technical methods by which signals can be obtained by the communities or clusters has been categorized in the following table:

2.7.4 Cont'd

TABLE 3

Signal can be obtained from	Symbol
1. Outside community or cluster and requires long haul transmission	■
2. Adjacent cabled community and requires to be fed from that community	▲
3. Remote off-air reception inside or outside cluster and requires feed	+
4. Local off-air reception	
- some communities in cluster	●
- all communities in cluster	●-
5. Existing satellite service	
- 6/4 GHz service-CBC English and French	○
- 12/14 GHz service-OECA	⊗

2.7.5 Cost effective methods of reception and feed

The signals that are obtained as a result of existing satellite services, off-air pick-up or from an adjacent cabled community can be compared as to cost effectiveness.

2.7.5 Cont'd

Cost data detailed in the section of the report dealing with reception and feed permits the establishment of the following cost estimates:

TABLE 4

Method of reception and feed for 1 signal	Monthly cost $
1. Off-air antenna reception	195
2. Satellite TVRO	550 to 670
3. Microwave (1 hop)	1500

Includes capital amortized over 10 years at 15% and operation and maintenance costs

The cost figures enable the establishment of the intended method of television signal reception and feed for each community or cluster.

2.7.6 Intended method of obtaining the proposed television signals by the communities

The tables presented in the following pages permit to identify the intended method of obtaining each of the proposed television signals by each community grouped in clusters.

TABLE 5-1
CLASSIFICATION OF SIGNAL AVAILABILITY
FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
BARRY'S BAY CLUSTER								
1. BARRY'S BAY	●	○	⊗	▲	●–	■	■	■
2. CHALK RIVER	●	●	⊗	▲	●–	■	■	■
3. KILLALOE STATION	●	○	⊗	▲	●–	■	■	■
4. WHITNEY	○	○	⊗	▲	●–	■	■	■
5. MADAWASKA	○	○	⊗	▲	●–	■	■	■
BANCROFT CLUSTER								
1. BANCROFT	●	○	⊗	▲	●–	■	■	■
2. COE HILL	●	○	⊗	▲	●–	■	■	■
3. COMBERMERE	●	○	⊗	▲	●–	■	■	■
4. MAYNOOTH	○	○	⊗	▲	●–	■	■	■
5. QUADEVILLE	●	○	⊗	▲	●–	■	■	■
GOODERHAM CLUSTER								
1. APSLEY	●–	○	⊗	▲	●	■	■	■
2. COBOCONK	●–	○	⊗	▲	+	■	■	■
3. GOODERHAM	●–	○	⊗	▲	●	■	■	■
4. KINMOUNT	●–	○	⊗	▲	●	■	■	■
5. NORLAND	●–	○	⊗	▲	+	■	■	■
6. WILBERFORCE	●–	○	⊗	▲	●	■	■	■

TABLE 5-2

CLASSIFICATION OF SIGNAL AVAILABILITY FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
SPRUCEDALE CLUSTER								
1. BALA	●–	○	⊗	●–	▲	■	■	■
2. BAYSVILLE	●–	○	⊗	●–	▲	■	■	■
3. DORSET	●–	○	⊗	●–	▲	■	■	■
4. DWIGHT	●–	○	⊗	●–	▲	■	■	■
5. HONEY HARBOUR	●–	●	⊗	●–	▲	■	■	■
6. MACTIER	●–	○	⊗	●–	▲	■	■	■
7. MILFORD BAY	●–	○	⊗	●–	▲	■	■	■
8. NOVAR	●–	○	⊗	●–	▲	■	■	■
9. PORT CARLING	●–	○	⊗	●–	▲	■	■	■
10. PORT SYDNEY	●–	○	⊗	●–	▲	■	■	■
11. ROSSEAU	●–	○	⊗	●–	▲	■	■	■
12. SPRUCEDALE	●–	○	⊗	●–	▲	■	■	■
13. UTTERSON	●–	○	⊗	●–	▲	■	■	■
SUNDRIDGE CLUSTER								
1. BURK'S FALLS	●–	○	⊗	●–	■	■	■	■
2. EMSDALE	●–	○	⊗	●–	■	■	■	■
3. KATRINE	●–	○	⊗	●–	■	■	■	■
4. KEARNEY	●–	○	⊗	●–	■	■	■	■
5. SOUTH RIVER	●–	○	⊗	●–	■	■	■	■
6. SUNDRIDGE	●–	○	⊗	●–	■	■	■	■
7. TROUT CREEK	●–	●	⊗	●–	■	■	■	■

TABLE 5-3
CLASSIFICATION OF SIGNAL AVAILABILITY
FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITV
MATTAWA CLUSTER							
1. BONFIELD	●–	●	⊗	●–	▲	▲	■ ■
2. CALLANDER	●–	●	⊗	●–	▲	▲	■ ■
3. CORBEIL	●–	●	⊗	●–	▲	▲	■ ■
4. MATTAWA	●–	○	⊗	●–	▲	▲	■ ■
5. POWASSAN	●–	●	⊗	●–	▲	▲	■ ■
MAGNETAWAN CLUSTER							
1. ARNSTEIN	●–	●	⊗	●–	▲	■	■ ■
2. BRITT	●–	○	⊗	●–	▲	■	■ ■
3. LORING	●–	●	⊗	●–	▲	■	■ ■
4. MAGNETAWAN	●–	○	⊗	●–	▲	■	■ ■
5. MCKELLAR	●–	○	⊗	●–	▲	■	■ ■
6. NOBEL	●–	○	⊗	●–	▲	■	■ ■
7. POINTE AU BARIL	●–	○	⊗	●–	▲	■	■ ■

TABLE 5-4

CLASSIFICATION OF SIGNAL AVAILABILITY FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
ST-CHARLES CLUSTER								
1. ALBAN	●–	●	●	●–	▲	▲	■	■
2. CRYSTAL FALLS	●–	●	⊗	●–	▲	▲	■	■
3. FIELD	●–	●	⊗	●–	▲	▲	■	■
4. HAGAR	●–	●	●	●–	▲	▲	■	■
5. MARKSTAY	●–	●	●	●–	▲	▲	■	■
6. NOELVILLE	●–	●	●	●–	▲	▲	■	■
7. RIVER VALLEY	●–	●	⊗	●–	▲	▲	■	■
8. SKEAD	●–	○	●	●–	▲	▲	■	■
9. ST-CHARLES	●–	●	●	●–	▲	▲	■	■
10. VERNER	●–	●	⊗	●–	▲	▲	■	■
11. WAHNAPITAE	●–	●	●	●–	▲	▲	■	■
12. WARREN	●–	●	●	●–	▲	▲	■	■
WEBBWOOD CLUSTER								
1. CARTIER	●–	●	●	●–	▲	▲	■	■
2. KILLARNEY	●–	○	⊗	●–	▲	▲	■	■
3. MASSEY	●–	●	⊗	●–	▲	▲	■	■
4. NAIR CENTRE	●–	●	●	●–	▲	▲	■	■
5. WEBBWOOD	●–	○	⊗	●–	▲	▲	■	■
6. WHITE FISH FALLS	●–	●	●	●–	▲	▲	■	■

TABLE 5-5

CLASSIFICATION OF SIGNAL AVAILABILITY FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
LITTLE CURRENT CLUSTER							
1. LITTLE CURRENT	●	○	⊗	●–	■	■	■ ■
2. MANITOWANING	○	○	⊗	●–	■	■	■ ■
3. MINDEMOYA	○	○	⊗	●–	■	■	■ ■
4. WIKWEMIKONG	○	○	⊗	●–	■	■	■ ■
SPANISH CLUSTER							
1. IRON BRIDGE	●–	●–	⊗	●–	▲	▲	■ ■
2. SPANISH	●–	●–	⊗	●–	▲	▲	■ ■
3. SPRAGGE	●–	●–	⊗	●–	▲	▲	■ ■
4. THESSALON	●–	●–	⊗	●–	▲	▲	■ ■
ECHO BAY CLUSTER							
1. BATCHAWANA BAY	●–	○	●	●–	■	■	■ ■
2. BRUCE MINES	●–	○	⊗	●–	■	■	■ ■
3. DESBARATS	●–	○	⊗	●–	■	■	■ ■
4. ECHO BAY	●–	●	●	●–	■	■	■ ■
5. HILTON BEACH	●–	○	⊗	●–	■	■	■ ■
6. RICHARD LANDING	●–	○	⊗	●–	■	■	■ ■
7. SEARCHMOUNT	●–	○	●	●–	■	■	■ ■

TABLE 5-6
CLASSIFICATION OF SIGNAL AVAILABILITY
FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
COBALT CLUSTER								
1. COBALT	●	○	⊗	●–	▲	●	■	■
2. LATCHFORD	●	○	⊗	●–	▲	+	■	■
3. TEMAGAMI	○	○	⊗	●–	▲	+	■	■
FOLEYET CLUSTER								
1. FOLEYET	●–	○	⊗	●–	■	■	■	■
2. GOGAMA	●–	○	⊗	●–	■	■	■	■
KING KIRKLAND CLUSTER								
1. EARLTON	●–	○	⊗	●–	▲	●	■	■
2. ELK LAKE	●–	○	⊗	●–	▲	+	■	■
3. ENGLEHART	●–	○	⊗	●–	▲	●	■	■
4. KEARNS	●–	○	⊗	●–	▲	●	■	■
5. KING KIRKLAND	●–	○	⊗	●–	▲	●	■	■
6. LARDER LAKE	●–	○	⊗	●–	▲	●	■	■
7. MATACHEWAN	●–	○	⊗	●–	▲	+	■	■
8. VIRGINIATOWN	●–	○	⊗	●–	▲	●	■	■

TABLE 5-7

CLASSIFICATION OF SIGNAL AVAILABILITY FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
RAMORE CLUSTER							
1. HOLTYRE	◐	○	⊗	◐	▲	◐	■ ■
2. MATHESON	◐	●	⊗	◐	▲	◐	■ ■
3. RAMORE	◐	○	⊗	◐	▲	◐	■ ■
4. VAL GAGNE	◐	●	⊗	◐	▲	◐	■ ■
MICHIPICOTEN RIVER CLUSTER							
1. DUBREUILVILLE	◐	○	⊗	▲	■	■	■ ■
2. MICHIPICOTEN RIVER	◐	●	⊗	▲	■	■	■ ■
MOONBEAM CLUSTER							
1. FAUQUIER	◐	◐	⊗	◐	▲	▲	■ ■
2. MOONBEAM	◐	◐	⊗	◐	▲	▲	■ ■
3. OPASATIKA	◐	◐	⊗	◐	▲	▲	■ ■
4. VAL RITA	◐	◐	⊗	◐	▲	▲	■ ■
CALSTOCK CLUSTER							
1. CALSTOCK	◐	◐	⊗	▲	▲	▲	■ ■
MOOSONEE CLUSTER							
1. MOOSONEE	◐	○	⊗	■	■	■	■ ■

TABLE 5-8
CLASSIFICATION OF SIGNAL AVAILABILITY
FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
LONGLAC CLUSTER								
1. CARAMAT	●–	○	⊗	■	■	■	■	■
2. LONGLAC	●–	○	⊗	■	■	■	■	■
3. NAKINA	●–	○	⊗	■	■	■	■	■
KAKABEKA FALLS CLUSTER								
1. KAKABEKA FALLS	●–	●–	●–	●–	■	■	■	■
HUDSON CLUSTER								
1. DINORWIC	●–	○	⊗	▲	■	■	■	■
2. HUDSON	●–	○	⊗	▲	■	■	■	■
3. VERMILLION BAY	●–	○	⊗	▲	■	■	■	■
4. WABIGOON	●–	○	⊗	▲	■	■	■	■
EAR FALLS CLUSTER								
1. BALMERTOWN	●–	○	⊗	▲	■	■	■	■
2. COCHENOUR	●–	○	⊗	▲	■	■	■	■
3. EAR FALLS	●–	○	⊗	▲	■	■	■	■
4. RED LAKE	●–	○	⊗	▲	■	■	■	■

TABLE 5-9

CLASSIFICATION OF SIGNAL AVAILABILITY FOR EACH CLUSTER AND COMMUNITY

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
REDDIT CLUSTER							
1. MINAKI	●–	●–	⊗	▲	■	■	■ ■
2. REDDIT	●–	●–	⊗	▲	■	■	■ ■
3. SIOUX NARROWS	●–	●–	⊗	▲	■	■	■ ■
STRATTON CLUSTER							
1. BARWICK	●–	○	⊗	■	■	■	■ ■
2. EMO	●–	○	⊗	■	■	■	■ ■
3. RAINY RIVER	●–	○	⊗	■	■	■	■ ■
4. STRATTON	●–	○	⊗	■	■	■	■ ■
HERON BAY CLUSTER	●–	○	⊗	▲	■	■	■ ■
1. HERON BAY							
ARMSTRONG CLUSTER							
1. ARMSTRONG	●–	○	⊗	■	■	■	■ ■
PICKLE LAKE/							
CENTRAL PATRICIA CLUSTER							
1. PICKLE LAKE/	●–	○	⊗	■	■	■	■ ■
CENTRAL PATRICIA							

3.0 LONG HAUL TRANSMISSION

The Tables 5.1 to 5.9 indicate that each community or cluster has a requirement for Canadian Television signals which must be obtained from outside the cluster area. The purpose of this section of the report is to present the various alternatives of transporting the signals over long distances and to determine the most cost effective alternative.

Two (2) signals are not available at any of the communities or clusters, namely: CITY-TV, CHCH-TV. Three (3) other signals are unavailable in varying degrees, namely: CTV, Global, TVA. Although the CBC English and French as well as OECA signals are not always available off-air, they are technically available on the basis of existing satellite service. Therefore, these latter signals will not be treated as signals requiring long haul transmission.

The signals already being carried by satellites are considered, for the purposes of the present study, available for community or cluster pick-up using a satellite earth station (TVRO). The transmission costs are already borne by each tax paying citizen of Canada as regards CBC signals and by each Ontario tax paying resident for the OECA signal. As a result, only the cost for the television receive earth station is considered in our cost evaluation since it is the only incremental cost that would be necessary to make these signals available to all communities that do not have access to them by off-air direct reception.

For the technically unavailable signals, there are at least two (2) alternatives of extending television services to distant communities and clusters. From the technology available today, we have identified terrestrial microwave networks and satellites as the alternative ways of providing the five (5) missing signals.

3.0 LONG HAUL TRANSMISSION (cont'd)

These alternatives are discussed in this section. The cost of obtaining the required services from public common carriers are given in figures and tables. The most cost effective solution for each signal is identified. Hypothetical transmission costs per residence are developed on the basis of possible markets for each signal.

3.1 Signal requirements

The following tables present a summary of the television signals which would have to be obtained from outside the cluster area.

3.1.1 Community and cluster long haul transmission requirements

TABLE 6

Number of signals to be obtained from outside	Number of clusters	Number of communities	Percentage of communities	
			%	cum.
1	0	0	0	0
2	9	47	37	37
3	5	36	28	65
4	11	35	27	92
5	5	10	8	100

All communities require a minimum of 2 outside signals. A total of 65% of the communities require at least 3 outside signals and 35% of the communities require 4 and 5 outside signals.

3.1.2 Identification of signals requiring long haul transmission

TABLE 7

Signal	Number of clusters	Number of communities	Percentage of communities	
			%	rank
CTV	5	10	8	4
Global	15	45	35	3
TVA	20	81	63	2
CHCH-TV	29	128	100	1
CITY-TV	29	128	100	1

The signals required by over 50% of the communities are: TVA, CHCH-TV and CITY-TV. Approximately one third of the communities require the Global signal. Only 8% of the communities require the CTV signal from outside the immediate vicinity of their respective clusters.

3.2 Alternatives

Two (2) alternative ways of transporting each of the five (5) television signals over long distances to rural and remote communities are considered. These are the following:

3.2.1 Terrestrial microwave

3.2.2 Satellite

Since the requirements vary from signal to signal, each will be examined separately. The most cost effective alternative will be determined for each signal.

3.2 Cont'd

Throughout this analysis it is assumed that both alternatives can be implemented within the same timeframe and that the required regulatory approvals would be forthcoming. However, in actual fact, this is not the case as regards the satellite alternative where the satellite carriage timetable extends into the mid-80's and beyond.

3.2.1 Terrestrial microwave

Transmission of the signals by microwave can be accomplished by public or private common carriers. This is presently the case in Northern Ontario.

3.2.1.1 Existing services

3.2.1.1.1 Public common carriers

Bell Canada and CNCP have developed microwave routes which transmit television signals in Northern Ontario. Appendix 3.1.1 presents each carrier's network as well as the signals carried.

3.2.1.1.2 Private microwave carriers

Several private microwave networks have been established by broadcasters and cable television operators. Appendix 3.1.2 presents the existing networks. The private carriers serving cabled communities in Northern Ontario carry the TVA and Global signals.

3.2.1.1.3 Ontario Northland Transportation Commission (ONTC)

The microwave networks operated by this governmental agency runs parallel to the railway line terminating at Moosonee. Appendix 3.1.3 presents the existing network.

3.2.1.2 Required services

On the basis of the community signal requirements and the existing microwave routing, the additional routes and number of microwave hops were established. The addition of new microwave routes were minimized by considering the addition of video services along existing microwave routes, regardless of the common carrier. In those areas where common carrier routes were inadequate, new microwave routes were identified.

The information provided by the carriers and MTC was used to detail routes and the required number of microwave hops. In the case of new routes, these were estimated on the basis of the shortest distance between the origination and destination points and a maximum distance of 80 Km per hop.

3.2.1.2 Cont'd

The following table presents a summary of the number of new microwave hops required for each signal, (on both existing and new routes).

TABLE 8

Signal	Number of microwave hops
CTV	23
Global	56
TVA	66
CITY-TV	102
CHCH-TV	102
TOTAL:	349

3.2.1.3 Cost of services

Two (2) costing approaches can be considered to evaluate microwave services; namely:

3.2.1.3.1 Public common carrier services

These carriers are prepared to offer terrestrial microwave services on the basis of a 5 or 10 year service contract. The carrier is responsible to meet DOC quality and reliability standards called for in carrying television signals for delivery to rural and remote communities.

3.2.1.3.2 Private common carrier services

In the unserved areas defined, private firms would have to be formed and major investments undertaken to offer the required microwave services to the interested communities.

Since the purpose of the costing is to compare terrestrial microwave costs with satellite costs, the first approach was used to develop a budgetary estimate. It does not include electronic equipment or reception infrastructure at the final delivery point (covered in Section 4, Reception and Feed).

3.2.1.3.3 Estimated service costs

A budgetary estimate for microwave services was developed with the assistance of Bell Canada. A budgetary estimate of $1,500.00 per signal per hop per month was used for the present study. This estimate represents a service cost covering electronic equipment, support infrastructures, and installation for all of the network hops. This estimate is also an average cost for existing and new microwave sites.

3.2.1.3.3 Cont'd

The following table presents a summary of the annual microwave costs for each signal:

TABLE 9

Signal	Annual service cost - $
CTV	414,000
Global	1,008,000
TVA	1,188,000
CITY-TV	1,836,000
CHCH-TV	1,836,000
TOTAL:	6,282,000

3.2.2 Satellite

Transmission of Canadian Television signals by satellite is a more recent alternative. Telesat Canada, owned by the Federal government and the principal Canadian Telecommunications carriers, operates domestic communications satellites. As a telecommunications common carrier, it is regulated by the Canadian Television and Telecommunications Commission (CRTC).

3.2.2.1 Telesat satellite services

Telesat carries long distance message, voice and broadcast traffic using Anik-A series and Anik-B series satellites.

The satellites operate in both the 6/4 and 14/12 GHz bandwidths. As for television transmission services, CBC English and French network signals are carried on Anik-B in the 6/4 bandwidth and OECA (and TVFQ) are carried on the same satellite in the 14/12 GHz bandwidth. The Department of Communications leases the 14/12 GHz capacity of Anik-B for telecommunications experiments.

3.2.2.2 Satellite technical and cost characteristics

The principal advantage of the 14/12 GHz band for satellite use is that it is not shared with terrestrial radiocommunications services. This advantage can therefore be used to increase satellite power (at an increased cost). As a result smaller and less costly earth stations can be used anywhere within the primary and secondary coverage area.

The Anik 6/4 GHz satellites use only one beam covering the whole of Canada. An advantage is that only one satellite channel is required for programs to be viewed simultaneously in all parts of the country. Considering the six and a half time zones this feature has its drawbacks when delivery of regular programming is considered.

3.2.2.2 Cont'd

The Anik-A series operating in the 6/4 GHz band is approaching the end of its operational life. The 6/4 GHz channels on Anik-B are now considered by Telesat as fully booked (CBC English and French services). The 14/12 GHz channels on Anik-B are leased by DOC for experimental purposes, and two (2) are used for TVFQ and OECA regular transmission. These satellites have, at present, limited commercial prospects.

3.2.2.3 Anik-C and Anik-D planned services

3.2.2.3.1 Anik-C

New satellite services are planned with the advent of the Anik-C geostationary series starting in 1982. The projected Anik-C series is planned to operate in the 14/12 GHz band with four (4) regional spot-beams covering the south of the country from east to west. The regional spot-beam feature of Anik-C would permit the flexible utilization of one (1), two (2), three (3) or four (4) beams in combination to ensure national coverage, part Canada coverage or only regional coverage.

Appendix 3.2.2 presents the planned Anik-C transmit patterns or footprints. The figure illustrates that one of the spot-beams is planned to cover most of Ontario.

3.2.2.3.1 Cont'd

It is assumed in this study, that Anik-C would be the transmission satellite with the capacity to carry the five (5) television signals. It is planned to operate twelve (12) transponders with four (4) additional transponders for backup. For any one region or beam, four (4) transponders would be "visible" from locations within the transmit pattern. A maximum of eight (8) television signals could be transmitted to a region. The transmit power would be the major factor in determining the size of the required earth stations.

3.2.2.3.2 Anik-D

New satellite services are also projected in the 6/4 GHz band. The two (2) planned Anik-D satellites would meet all 6/4 GHz requirements to the end of the 1980's. Anik-D 1 is expected to be operational in late 1982.

It is assumed that Anik-D would also be an alternative transmission link to carry the five (5) signals. It is planned to carry up to 20 television signals. The transmit pattern would include all of the Southern parts of Canada.

3.2.2.4 Cost of services

A budgetary estimate for satellite services was developed with the assistance of Telesat. A budgetary estimate of $1,000,000 per television signal per year was used for the present study. This estimate represents a service cost which includes the feed from the signal source to satellite uplink station, the uplink station and the satellite. The same budgetary estimate applies to both the 6/4 GHz and 14/12 GHz service. The full satellite budgetary cost was developed on the basis of a non-preemptable unprotected service for service between 0900 hours and 0100 hours. The unprotected service was assumed to be a sufficient condition for a five (5) signal television "block" where four (4) signals are considered optional services. Within the block, it is assumed that the basic signal could always be made available.

The following table presents a summary of the annual satellite service costs for each signal:

TABLE 10

Signal	Annual service cost - $
CTV	1,000,000
Global	1,000,000
TVA	1,000,000
CITY-TV	1,000,000
CHCH-TV	1,000,000
TOTAL:	5,000,000

3.2.3 Choice of alternatives

The costs presented for the alternative transmission methods can be compared to determine the most cost effective overall solution for Northern Ontario.

The following table presents the least cost transmission method for each of the five (5) signals and the budgetary cost estimate that would have to be incurred:

TABLE 11

Signal	Preferred solution		Least annual cost estimate $
	Microwave	Satellite	
CTV	X		414,000
Global		X	1,000,000
TVA		X	1,000,000
CITY-TV		X	1,000,000
CHCH-TV		X	1,000,000
TOTAL:			4,414,000

It is important to recall that the alternatives are not necessarily equally available. The microwave solution for CTV only considers the Northern Ontario requirements. Since most existing Southern Ontario communities, cabled and non cabled, presently receive a CTV signal, it is unlikely that the microwave solution would be changed. However, the study of community CTV signal requirements accross rural and remote Canada would undoubtedly lead to a satellite preferred solution.

3.3 Potential markets for the television services

The satellite transmission solution has one important implication in terms of coverage. It is that the satellite carriage of four (4) of the five (5) signals would make these signals available to all Ontario communities in the case of the 14/12 GHz carriage and to all Canadian communities in the case of 6/4 GHz carriage. This is important to consider in evaluating the market and the cost of service to rural and remote residents.

3.3.1 CTV microwave transmission

The incremental microwave services that have been evaluated for the communities and clusters requiring the CTV signal is a small market which has limited potential for growth. The following table presents a summary of the market served:

TABLE 12

Signal	Cluster	Communities	Potential residences - number -
CTV	Moosonee	Moosonee	299
	Longlac	Caramat	136
		Longlac	875
		Nakina	302
	Stratton	Barwick	102
		Emo	390
		Rainy River	443
		Stratton	113
	Armstrong	Armstrong	196
	Pickle Lake/ Central Patricia	Pickle Lake/ Central Patricia	216
	TOTAL:		3,072

3.3.2 Global, TVA, CITY-TV, and CHCH-TV satellite transmission

The market for these signals is potentially much greater that the limited Northern Ontario rural and remote communities market. The following tables present a summary of the potential 1980 market profile for each signal:

TABLE 13

NUMBER OF RESIDENCES WITHOUT REFERENCE SIGNAL

Signal	Study communities	Other Ontario (1) cabled communities	Total Ontario cabled and study communities	Canada (2) cabled communities excluding Ontario (3)	Total Canada cabled and study communities
Global	11,795	114,690	126,485	3,735,000	3,861,485
TVA	21,019	2,230,553	2,251,572	2,135,000	4,386,572
CITY-TV	35,878	1,002,433	1,038,311	3,735,000	4,773,311
CHCH-TV	35,878	658,079	693,957	3,735,000	4,428,957

(1) Source: Mathews CATV (see Appendix 2.3)

(2) Source: CRTC Fact Digest 1979 and Statistics Canada BC-0-4-80E

(3) Does not include Quebec for TVA; numbers should be relatively small.

3.3.3 Market penetration

The availability of the five (5) signals by microwave and satellite would not be of interest to all of the potential residents or their respective exhibition operators.

The market for new and additional Canadian Television services must take account of existing market penetration information. CRTC and Statistics Canada data were examined to establish market penetration assumptions. Appendix 5.1.6 provides data for various Canadian cable markets particularly Northern Ontario. The following table presents a summary of the market profile adopted for each signal:

TABLE 14

EXPECTED MARKET PENETRATION

Signal	Study communities		Other Ontario cabled communities		Total Ontario cabled and study communities	Canada cabled communities excluding Ontario		Total Canada cabled and study communities
	Penetration (1) %	Number of residences	Penetration (1) %	Number of residences		Penetration (1) %	Number of residences	
CTV	80	2,458	-	-	-	-	-	-
Global	80	9,436	75	86,018	95,454	70	2,614,500	2,709,954
TVA	80	16,815	75	1,672,915	1,689,730	70	1,494,500(2)	3,184,230
CITY-TV	80	28,702	75	751,825	780,527	70	2,614,500	3,395,027
CHCH-TV	80	28,702	75	493,559	522,261	70	2,614,500	3,136,761

(1) Based on CRTC statistics.

(2) Excluding Quebec.

3.4 Estimated residential long haul transmission costs

Based on the various costs and market penetration assumptions, the following table presents the estimated annual and monthly transmission costs per residence for microwave, 6/4 GHz and 14/12 GHz band satellite services.

TABLE 15

Signal	ONTARIO COVERAGE		CANADA COVERAGE	
	14/12 GHz satellite service		6/4 GHz satellite service	
	Annual cost per residence $	Monthly cost per residence $	Annual cost per residence $	Monthly cost per residence $
CTV (1)	168.49	14.04	(2)	(2)
Global	10.48	.87	.37	.03
TVA	.59	.05	.31	.03
CITY-TV	1.28	.11	.24	.02
CHCH-TV	1.91	.16	.32	.03

(1) Microwave cost

(2) CTV requirements across Canada would have to be evaluated to consider satellite alternative.

3.4 Cont'd

The CTV microwave costs per residence were calculated on the assumption that each residence of the 10 communities would share equally in the microwave transmission costs for this signal. The following table presents an alternative method of cost allocation whereby the transmission costs are directly apportioned to the community served by the required microwave link.

DIRECT MICROWAVE COSTS PER RESIDENCE

TABLE 16

Signal	Cluster	Residences 80% penetration	Microwave link cost - $	Annual cost per residence	Monthly cost per residence
CTV	Moosonee	239	90,000	376.57	31.38
	Longlac	1,050	90,000	85.71	7.14
	Stratton	838	18,000	21.48	1.79
	Armstrong	157	102,757 (1)	654.50	54.54
	Pickle Lake/ Cen. Patricia	173	113,243 (1)	654.58	54.55
TOTAL		2,457	414,000	168.50	14.04

(1) 12 hops allocated on basis of number of residences.

3.4 Cont'd

This alternative method of cost allocation illustrates that some communities would certainly be better off on a go-it-alone basis. Conversely, the costs for the other communities would be prohibitive.

4.0 RECEPTION AND FEED

Each community has a requirement to receive eight (8) Canadian Television signals for local exhibition. Tables 5.1 to 5.9 present the expected method of signal access at each community or cluster taking into account existing signal availability.

The proposed long haul transmission solutions, examined in section 3, would modify the initial method of access exposed in tables 5.1 to 5.9, to satisfy the requirements for signals requiring long haul transmission, (outside cluster signals) in the following way:

- CTV: microwave exclusively to 5 clusters;
- Global, TVA, CITY-TV, CHCH-TV: satellite to all

The purpose of this section of the report is to examine the various ways of receiving and feeding all the signals to each community exhibition system, and to determine the most cost effective way.

Three (3) signals are considered available to all communities and clusters by means of direct broadcast reception where possible or satellite earth station reception, namely: CBC English and French networks and OECA.

One (1) signal is considered available to most communities and clusters by means of direct broadcast reception or by means of one microwave link from the nearest cabled community, namely: CTV network or stations. As described above, communities of five (5) clusters would obtain the CTV signal by being fed from long haul microwave networks.

4.0 RECEPTION AND FEED (cont'd)

The four (4) remaining signals are considered available to all communities and clusters by means of direct broadcast reception where possible or, as proposed in section 3, would be accessible by means of a satellite earth station, namely: Global, TVA, CITY-TV, and CHCH-TV.

The various methods of reception and feed are evaluated on the basis of two alternative options, namely:

Option 1: Each community establishes individual facilities;
Option 2: Communities in a cluster share use of common facilities;

These options are discussed in this section, specifically in 4.2.2. The costs of receiving and feeding the eight (8) signals are given in figures and tables. The most cost effective solutions are identified on a community or cluster basis. The preferred solutions are evaluated further by modifying key variables. Cost improvements are identified. Estimated distribution costs are developed on the basis of the markets formed by the 128 communities and the existing cabled communities in Northern Ontario.

4.1 Method of signal reception and feed

The following tables present a revised summary, for each option, of the methods of reception and feed for the eight (8) Canadian television signals on the basis of the preferred long haul transmission solutions and the availability of signals.

4.1.1 Community and cluster reception and feed

The following table presents the overall requirements for obtaining the eight (8) television signals.

TABLE 17

Number of signals to be obtained	Option 1		Option 2
	Number of communities	% of total communities	Number of clusters
A. OFF-AIR			
1	29	22	10
2	51	40	11
3	34	27	3
4	14	11	5
TOTAL:	128	100	29
B. MICROWAVE			
0	87	68	15
1	41	32	14
TOTAL:	128	100	29
C. SATELLITE			
1	-		-
2	-		-
3	-		-
4	15	12	5
5	48	37	8
6	61	48	15
7	4	3	1
TOTAL:	128	100	29

4.1.1 Community and cluster reception and feed requirements (cont'd)

All communities and clusters require a minimum of four (4) satellite signals. Fully 50% of the communities require six (6) or seven (7) satellite signals. Microwave delivery is required by 32% of the communities. Off-air broadcast reception of 2 signals is feasible for 40% of the communities.

4.1.2 Signal reception and feed method

The following table presents the general requirements for the different means of access for each of the eight (8) signals.

TABLE 18

SIGNAL	OPTION 1						OPTION 2		
	OFF-AIR BROADCAST		MICROWAVE		SATELLITE		OFF-AIR BROADCAST	MICROWAVE	SATELLITE
	NUMBER OF COMMUNITIES	% OF TOTAL COMMUNITIES	NUMBER OF COMMUNITIES	% OF TOTAL COMMUNITIES	NUMBER OF COMMUNITIES	% OF TOTAL COMMUNITIES	NUMBER OF CLUSTERS	NUMBER OF CLUSTERS	NUMBER OF CLUSTERS
CBC English	121	95	-	-	7	5	27	-	2
CBC French	41	32	-	-	87	68	9	-	20
OECA	15	12	-	-	113	88	4	-	25
CTV	87	68	41	32	-	-	15	14	-
Global	14	11	-	-	114	89	3	-	26
TVA	11	9	-	-	117	91	3	-	26
CITY-TV	-	-	-	-	128	100	-	-	29
CHCH-TV	-	-	-	-	128	100	-	-	29

4.1.2 Signal reception and feed method (cont'd)

A total of 95% and 68% of the communities can obtain the CBC English and CTV signals by off-air pick-up respectively. 100% of the communities would have to obtain CITY and CHCH by satellite, while 91%, 89% and 88% would have to obtain TVA, Global and OECA by satellite respectively.

4.2 Development of options

The configuration and design of facilities to provide access to eight (8) television signals at 128 communities for the lowest possible cost are described in this section.

4.2.1 Design criteria for signal quality and reliability

The quality and reliability factors for television signals to be delivered by the television and telecommunications systems and networks relevant to this study are listed in the Department of Communication's Broadcast Procedures (BP 1 to 24) and Radio Standards Procedure (RSP 100 to 116). Each undertaking for the provision of television services must conform with quality levels and standards. However, quality and reliability standards for a multi-link transmission, reception and exhibition chain are not available to guide the present study.

The reception and feed undertaking would have to permit the CATV or rebroadcast systems to meet their respective levels of quality and reliability in comformity with BP 23 specifications (see section dealing with exhibition). On that basis, we have established the following objectives for the reception and feed link:

4.2.1.1 44 dB S/N for

4.2.1.2 99.7% of the time

This would permit the delivery of top quality signals to the community local exhibition system. The above quality levels are reasonable and are standards to which the reception and feed facilities should conform. We believe that reducing quality levels in designing the reception and feed facilities would only marginally decrease the costs. The proposed quality levels leave open the possibility for further design refinements as implementation projects are undertaken.

Other factors that influence the design of the facility installations are expected, namely:

4.2.1.3 Use equipment already on the market;

4.2.1.4 Take delivery of microwave signals at cluster center point when cluster is made up of 2 or more communities;

4.2.1.5 Use one (1) microwave hop for CTV signal obtained in a cluster for delivery to communities or to cluster center point;

4.2.1.6 Power would be readily available at all facility sites;

4.2.1.7 Access to sites would not be a problem;

4.2.1.8 Terrain was examined using 1: 50,000 scale maps to verify propagation characteristics.

4.2.2 Options

A schematic illustration of the two (2) options to receive and feed off-air broadcast, microwave and satellite signals is illustrated in appendix 4.1; the list of equipment considered for each option and the installation requirements appear in appendix 4.2.

The basic options for signal reception and feed are the following:

4.2.2.1 Option 1

Each community establishes individual facilities. This option consists of the establishment for each community of the facilities to receive, process and feed the community's local exhibition system the eight (8) signals accessible by direct broadcast reception, microwave feed, and satellite earth station reception.

The facilities, located in or close to each community, would include a local headend, an antenna structure and a building. The required satellite earth stations would be installed for 4 GHz and/or 12 GHz reception adjacent to the building. The antenna structure would be adapted in those communities requiring the CTV microwave feed; the height of the structure would be determined by line of sight conditions for each link. The dimensions of the building were established on the basis of the number of racks, support material required (including air conditioning system) and wiring. No space was provided for a work area, spare parts or alternative power.

4.2.2.1 Option 1 (cont'd)

This option was assumed to be possible to all communities since no access problems or terrain difficulties were identified. Appropriate sites for facilities appeared to exist in and around communities which would ensure good reception conditions and easy maintenance of site and facilities.

4.2.2.2 Option 2

Communities in a cluster share use of common facilities.

The option consists of the establishment, at a cluster center point (for clusters of more than 1 community), of shared use facilities to receive, process and retransmit to each community's local exhibition system the eight (8) signals. These would be obtained at the cluster center point by direct broadcast reception, microwave feed and satellite earth station reception. Each center point installation would become a shared use headend from which the eight (8) signals would be retransmitted to each local community system by the use of a Very High Capacity Microwave (VHCM) system.

The facilities, located at a cluster center point usually several kilometres from the communities, would include a prefabricated type shelter with an antenna structure located beside the building.

4.2.2.2 Option 2 (cont'd)

The antenna structure height and strength requirements for mounting the broadcast reception antennas, the microwave reception antenna and the individual VHCM transmit antennas, were adapted to each cluster requirement. The required satellite earth stations would be installed for 4 GHz and/or 12 GHz reception adjacent to the building. The building would house the headend electronic equipment for the broadcast, microwave and satellite feeds.

The dimensions of the building were established on the basis of the number of racks, a limited work space and support material required (including heating and air conditioning) and wiring. No space is provided for spare parts or alternate power.

The facilities considered also include, for each community sharing the use of the central facility, a reception tower and antenna. No building is required since the reception equipment can be attached directely to the tower. The siting of the reception tower is assumed to be in or close to the community's local exhibition installation or plant.

4.2.2.2 Option 2 (cont'd)

Each community cluster formation was examined to determine the applicability of high-or low-VHCM transmitter power. For the transmission of eight (8) signals to each community, the low-power VHCM transmitter was selected when the optimal community grouping was circumscribed within a 32 Km radius of the grouping center point. The high-power VHCM transmitter was selected in the case of a 42.3 km coverage radius from the cluster center point. Appendix 4.1.3 presents the 32 km clusters and appendix 4.1.4 presents the 42.3 km clusters.

The height of the towers and the antenna elevations applicable to the 23 clusters where the VHCM option is examined were established on the basis of line of sight analysis.

The installation and the maintenance of the facilities would be more difficult than for option 1 since the sites would be remote, creating possible access problems. Every effort would have to be made to choose sites where access and power supply problems would be minimized. It should be pointed out, that only one headend per cluster would have to be installed and maintained.

4.3 Costing of the reception and feed options

The cost of the proposed reception and feed options were estimated on the basis of the facility requirements for each individual community and cluster. The individual cluster cost estimates take into account the following cost elements.

4.3.1 Assumptions

Cost estimates for each community or cluster were developed on the following basis:

4.3.1.1 All facilities for either option are treated as capital expenditure projects;

4.3.1.2 Required CTV microwave services are costed on the basis of an estimated monthly service charge;
The receive equipment and structure are treated separately as capital cost elements;

4.3.1.3 Supplier pricing for equipment and systems quoted in mid-1980;

4.3.1.4 Electrical power available at the site;

4.3.1.5 Easy access to site;

4.3.1.6 No land to purchase or lease;

4.3.1.7 No provision for contingency;

4.3.1.8 Facilities requirements were detailed and costed in two (2) steps, namely:
- facilities for outside signals are costed first;
- then, incremental facilities for additionnal signals are costed.

4.3.1.9 Capital costs are amortized monthly over a 10 year period at an annual interest rate of 15%, compounded monthly.

4.3.1.10 All facility sites require operating and maintenance costs to sustain installations.

4.3.2 Capital cost elements

Appendix 4.2 lists in detail the cost elements for each reception and feed component, namely: local and regional headends, 4 GHz and 12 GHz satellite earth stations, and low-and-high-power VHCM systems.

The cost components include the electronic equipment as well as the associated infrastructures including the civil, electrical and mechanical works.

Also included in the appendix are the engineering, installation and transportation costs. These estimates would have to be adjusted to take into account local particularities.

The establishment of microwave and/or VHCM towers permits the multi-purpose use of those structures. It could be used to mount off-air pick-up antennas; VHCM towers could be used to receive the microwave feed. The costs reflect these colocating possibilities.

4.3.3 Incremental capital cost

The varying community and cluster circumstances required that capital costs be built up on a per signal basis.

Appendix 4.2 presents the initial base cost, i.e. for the first signal, and the incremental cost for each additional signal. The reception and feed components, namely: regional and local headends, 4 GHz and 12 GHz satellite earth stations and low-and high-power VHCM systems, are presented separately.

The initial base cost for the first signal includes the basic electronic equipment, all of the infrastructures including civil, electrical and mechanical works as well as engineering, installation and transportation. The incremental cost includes the additional electronic equipment and supporting accessories.

The capital cost calculations were divided into three (3) parts, namely, the cost to establish facilities to receive and feed:

4.3.3.1 Outside cluster signals

4.3.3.2 Inside cluster signals

4.3.3.2.1 Signals not presently available to all communities

4.3.3.2.2 Signals presently available to all communities by off-air pick-up or satellite 4 GHz reception.

The incremental capital cost for the VHCM facilities in appendix 4.5.4 establishes the cost of adding another cluster community to the initial list of communities which might share the use of the common facilities.

4.3.4 Service Cost Elements

The CTV signal was defined as technically available in the clusters either by off-air pick-up or by microwave feed from existing cabled communities in the cluster.

The common carrier service charge of $1,500 per month per hop was utilized to calculate the cost of microwave feeds. The building of private microwave links instead of leasing common carrier services is an alternative which would have to be evaluated in a separate study.

4.3.5 Operating and Maintenance Elements

The recurring costs of operating and maintaining each reception and feed component were estimated on the basis of the direct costs for heat, light and power, communication and transportation, labour and spare parts for general and repair maintenance.

Appendix 4.2.7 presents the operating and maintenance costs for the two (2) headend models and the two (2) satellite earth station models. The VHCM operating and maintenance costs were established on the basis of supplier information. These costs represent 3.5% and 4.0% of capital costs excluding towers, for high-and low-power VHCM respectively.

4.3.6 Total monthly costs

For comparison purposes all capital, service and operating and maintenance costs were summarized on a monthly basis. Capital costs were amortized over 10 years at 15% annual interest rate, compounded monthly.

4.4 Comparative analysis of options

In the following sub-sections, the options are compared in the following manner:

First, the capital and service costs for establishing the various reception and feed facilities and services for each community are evaluated (option 1). These costs are summarized and presented by cluster and by signal category in appendix 4.3.1 page 1. The operation and maintenance, the equivalent capital costs and service costs are separately summarized and presented by cluster in appendix 4.3.1 page 2. The total monthly cost for option 1 is also presented in appendix 4.3.1 page 2.

Second, the capital and service costs for establishing shared used reception and feed facilities and services for each cluster (option 2) are evaluated. The capital, services and operating and maintenance costs for option 2 are presented in appendix 4.3.2. The total monthly cost for this option is presented in appendix 4.3.2 page 2.

Third, the total monthly costs are compared to identify the most cost effective solutions.

Fourth, the effect of modifying the long haul transmission solution or the satellite earth station costs are discussed.

Fifth, cost improvements are identified.

4.4.1 Option 1 - Each community establishes facilities

The following table presents the cost summary for option 1. Its general implementation would require an initial capital commitment of over $12 million and a long term microwave cost commitment of $684,000 per year. The total annual cost of the option would be approximately $4.06 million.

TABLE 19

OPTION 1 - COST SUMMARY

CLUSTERS	TOTAL CAPITAL COST $	TOTAL CAPITAL MONTHLY EQUIVALENT COST - $	TOTAL MONTHLY MICROWAVE SERVICE COST - $	DISTRIBUTION OPERATING AND MAINTENANCE MONTHLY COST $	TOTAL MONTHLY COST
BARRY BAY	484,050	7,533	7,500	3,800	18,833
BANCROFT	500,700	7,792	7,500	4,000	19,292
GOODERHAM	604,900	9,413	9,000	4,800	23,213
SPRUCEDALE	1,258,950	19,591	-	10,200	29,791
SUNDRIDGE	667,850	10,393	-	5,400	15,793
MATTAWA	406,475	6,325	-	3,200	9,525
MAGNETAWAN	646,375	10,059	-	5,200	15,259
ST-CHARLES	906,325	14,104	-	7,400	21,504
WEBBWOOD	490,175	7,628	-	4,000	11,628
LITTLE CURRENT	408,375	6,355	-	3,200	9,555
SPANISH	308,000	4,793	-	2,400	7,193
ECHOBAY	668,275	10,399	-	5,400	15,799
COBALT	301,875	4,698	-	2,400	7,098
FOLEYET	196,950	3,065	-	1,600	4,665
KING KIRKLAND	806,950	12,557	-	6,400	18,957
RAMORE	355,350	5,530	-	2,800	8,330
MICHIPICOTEN RIVER	186,475	2,902	3,000	1,400	7,302
MOONBEAM	331,600	5,160	-	2,400	7,560
CALSTOCK	84,475	1,315	1,500	600	3,415
MOOSONEE	110,000	1,712	-	800	2,512
LONGLAC	312,300	4,860	4,500	2,400	11,760
KAKABEKA FALLS	72,075	1,122	-	600	1,722
HUDSON	440,000	6,847	6,000	3,200	16,047
EAR FALLS	440,000	6,847	6,000	3,200	16,047
REDDIT	264,825	4,121	4,500	1,800	10,421
STRATTON	438,800	6,828	6,000	3,200	16,028
HERON BAY	104,100	1,620	1,500	800	3,920
ARMSTRONG	104,100	1,620	-	800	2,420
PICKLE LAKE	104,100	1,620	-	800	2,420
TOTAL	12,004,425	186,809	57,000	94,200	338,009

4.4.2 Option 2 - Communities in cluster share use of common facilities

The following table presents the cost summary for option 2. The general implementation of this option would involve an initial capital commitment of $14.0 million and a long term microwave cost commitment of $162,000 per year. The total annual cost of the option would be approximately $3.4 million.

TABLE 20

OPTION 2 - COST SUMMARY

CLUSTERS	TOTAL CAPITAL COST $	TOTAL CAPITAL MONTHLY EQUIVALENT COST - $	TOTAL MONTHLY MICROWAVE SERVICE COST - $	DISTRIBUTION OPERATING AND MAINTENANCE MONTHLY COST $	TOTAL MONTHLY COST
BARRY BAY	603,662	9,394	1,500	2,054	12,948
BANCROFT	544,394	8,472	1,500	2,011	11,983
GOODERHAM	606,762	9,442	1,500	2,168	13,110
SPRUCEDALE	992,984	15,452	-	2,825	18,277
SUNDRIDGE	558,962	8,698	-	2,074	10,772
MATTAWA	519,188	8,079	-	1,967	10,046
MAGNETAWAN	698,606	10,871	-	2,207	13,078
ST-CHARLES	891,397	13,871	-	2,439	16,310
WEBBWOOD	591,103	9,198	-	1,858	11,056
LITTLE CURRENT	426,798	6,642	-	1,809	8,451
SPANISH	552,213	8,593	-	1,750	10,343
ECHOBAY	710,520	11,057	-	2,076	13,133
COBALT	381,323	5,934	-	1,622	7,556
FOLEYET	498,566	7,758	-	1,789	9,547
KING KIRKLAND	970,690	15,105	-	2,459	17,564
RAMORE	471,099	7,331	-	1,703	9,034
MICHIPICOTEN RIVER	402,263	6,260	1,500	1,631	9,391
MOONBEAM	475,567	7,401	-	1,701	9,102
CALSTOCK	*84,475	*1,315	*1,500	*600	*3,415
MOOSONEE	*110,000	*1,712	* -	*800	*2,512
LONGLAC	477,117	7,425	-	1,754	9,179
KAKABEKA FALLS	*72,075	*1,122	* -	*600	*1,722
HUDSON	593,768	9,240	1,500	1,970	12,710
EAR FALLS	519,388	8,082	1,500	1,926	11,508
REDDIT	469,758	7,310	1,500	1,669	10,479
STRATTON	458,598	7,138	-	1,750	8,888
HERON BAY	*104,100	*1,620	*1,500	*800	*3,920
ARMSTRONG	*104,100	*1,620	* -	*800	*2,420
PICKLE LAKE	*104,100	*1,620	* -	*800	*2,420
TOTAL	13,993,676	217,762	13,500	49,612	280,874

* Clusters of 1 community included for comparison purposes

4.4.3 Choice of options

The costs presented in the two (2) previous tables can be compared to determine the most cost effective option. This is defined as the least cost when comparing the total monthly costs.

The following table presents the least cost option for each cluster.

TABLE 21

CLUSTERS	LEAST COST OPTION		LEAST COST OPTION		
	OPTION 1 INDIVIDUAL COMMUNITY FACILITIES	OPTION 2 COMMUNITIES SHARE USE COMMON FACILITIES	TOTAL CAPITAL COST $	TOTAL MONTHLY MICROWAVE SERVICE COST $	TOTAL MONTHLY COST $
BARRY BAY		X	603,662	1,500	12,948
BANCROFT		X	544,394	1,500	11,983
GOODERHAM		X	606,762	1,500	13,110
SPRUCEDALE		X	992,984	-	18,277
SUNDRIDGE		X	558,962	-	10,772
MATTAWA	X		406,475	-	9,525
MAGNETAWAN		X	698,606	-	13,078
ST-CHARLES		X	891,397	-	16,310
WEBBWOOD		X	591,103	-	11,056
LITTLE CURRENT		X	426,798	-	8,451
SPANISH	X		308,000	-	7,193
ECHOBAY		X	710,520	-	13,133
COBALT	X		301,875	-	7,098
FOLEYET	X		196,950	-	4,665
KING KIRKLAND		X	970,690	-	17,564
RAMORE	X		355,350	-	8,330
MICHIPICOTEN RIVER	X		186,475	3,000	7,302
MOONBEAM	X		331,600	-	7,560
CALSTOCK	X (1)		84,475	1,500	3,415
MOOSONEE	X (1)		110,000	-	2,512
LONGLAC		X	477,117	-	9,179
KAKABEKA FALLS	X (1)		72,075	-	1,722
HUDSON		X	593,768	1,500	12,710
EAR FALLS		X	519,388	1,500	11,508
REDDIT	X (2)		264,825	4,500	10,421
STRATTON		X	458,698	-	8,888
HERON BAY	X (1)		104,100	1,500	3,920
ARMSTRONG	X (1)		104,100	-	2,420
PICKLE LAKE	X (1)		104,100	-	2,420
TOTAL		X(3)	12,575,249	18,000	267,470

(1) One (1) community clusters - (2) Variance between option 1 and 2 is only $58 per month
(3) Variance between options is $57,135 per month.

4.4.3 Cont'd

The overall cost comparison indicates that the general use of option 2 is less costly than option 1 by the amount of $57,135 per month or $688,620 per year. Option 2, however, would require an initial investment of approximately $2,000,000 more than option 1 due to VHCM facilities.

To determine an optimal least cost solution it is necessary to compare options on a cluster by cluster basis. As indicated, option 1 is the least cost distribution solution for 33 communities (grouped into 14 clusters). Option 2 is the least cost solution for (the 96 communities grouped into) 15 clusters. The financial outcome of combining least cost solutions is that the initial capital cost total of $12.6 million is $571,000 higher than option 1. However, the total monthly cost is reduced to a level which is still lower than option 2 by $13,404 per month or $160,000 per year.

Two (2) key variables which determine the least cost option have been identified, namely: the number of communities per cluster and the method of delivery. The following table presents these variables and identifies the least cost option trade-off areas.

TABLE 22

OPTION/AND CRITICAL METHOD OF DELIVERY	NUMBER OF COMMUNITIES PER CLUSTER					TOTAL CLUSTERS
	⩽ 2	3	4	5	⩾6	
	NUMBER OF CLUSTERS					
Option 1	8	2	3	1	-	14
Microwave - CTV		1	-	-		
Off-air pick-up: 3 signals or more		1	3	1		
Option 2	-	1	4	2	8	15
Microwave - CTV		1	3	2		
Off-air pick-up: 3 signals or more		-	-	-		

4.4.3 Cont'd

The table indicates that option 1 is most viable for clusters of 2 or less communities. On the other hand, option 2 is the least cost option when 6 or more communities are grouped into clusters to share common facilities. The trade-off, which is between 3 and 5 communties, is also determined by the delivery variables, namely: microwave feed requirements and the number of available off-air broadcast signals.

4.4.3 Cont'd

When microwave feed is required, option 2 becomes the more viable option for clusters of 4 communities or more and in one case for 3 communities or more.

When microwave delivery is not required, option 1 becomes the more viable option for the individual communities if three (3) or more signals can be picked up off-air. This is the case for clusters of 3, 4 and 5 communities.

The addition therefore of communities, under specific signal delivery circumstances, would modify the least cost option to be retained in the direction of option 2.

4.4.4 Impact of modifying assumptions

The cost estimates presented in the previous sub-section corresponded to 1980 supplier prices and to a predominantly satellite transmission mode. In this sub-section, these two (2) major variables are modified to verify the cost implications for options 1 and 2. In particular, the reduction of satellite earth station costs and the use of microwave transmission are examined separately.

4.4.4.1 TVRO cost reduction

4.4.4.1.1 Future cost scenario

The cost of installing TVRO equipement was based on data developed to satisfy the requirements of Quebec cable television operators for the satellite transmission of TVFQ. Configurations were developed using good quality equipment to obtain a level of signal quality compatible with DOC standards. The resulting costs can be considered as high in comparison with projected future costs for TVRO's. It is entirely possible that significant cost improvements will be forthcoming on the basis of technological innovation and significant production runs by manufacturers. These cost improvements are predicted by industry specialists in Canada and from abroad. Appendix 4.4.1 page 1 illustrates a cost scenario which might apply in the mid-1980's. It is neither an optimistic or pessimistic scenario. The base 12 GHz TVRO is estimated to cost $5,000 for a community and $7,000 for a cluster. The base 4 GHz TVRO is evaluated to cost $8,000 for a community and $9,000 for a cluster.

4.4.4.1.2 Method of reception and feed

The method of reception and feed is the same as previously defined, namely CTV is obtained by microwave feed, and the other signals are obtained either by off-air pick-up or satellite earth station reception.

4.4.4.1.3 Costing of options

Appendices 4.4.1, pages 2 to 5, detail the initial capital costs, the operating and maintenance costs and the microwave service costs for both options.

The following table summarizes the investment and total monthly cost. Option 2 is the least cost option for six (6) clusters involving 27 communities only. In all six (6) cases, there is a requirement to distribute the CTV signal by microwave feed.

The table indicates that option 1 is the least cost option both as regards total monthly cost and initial capital investment.

4.4.4.1.4 Comparison with the initial cost optimization of options 1 and 2

The impact of a reduction in the cost of satellite earth stations is twofold: the general shift toward option 1 where each community establishes its own facilities; the reduction in initial capital investment from $12.6 million to $7.1 million and in the total monthly cost from $267,500 to $191,500.

TABLE 23

CLUSTERS	COST OF OPTIONS				LEAST COST TOTAL MONTHLY COST OPTION	
	OPTION 1		OPTION 2			
	TOTAL CAPITAL COST $	TOTAL MONTHLY COST $	TOTAL CAPITAL COST $	TOTAL MONTHLY COST $	OPTION 1	OPTION 2
BARRY BAY	239,750	13,701	556,862	11,930		X
BANCROFT	247,000	13,894	497,594	10,964		X
GOODERHAM	296,500	16,674	559,962	12,092		X
SPRUCEDALE	563,250	15,315	941,384	17,184	X	
SUNDRIDGE	299,750	8,156	507,362	9,679	X	
MATTAWA	189,875	5,185	467,588	8,953	X	
MAGNETAWAN	292,375	7,960	647,006	11,985	X	
ST-CHARLES	444,625	12,159	857,697	15,616	X	
WEBBWOOD	233,375	6,372	557,403	10,362	X	
LITTLE CURRENT	175,875	4,777	370,498	7,284	X	
SPANISH	146,000	3,992	513,713	9,574	X	
ECHOBAY	299,875	8,156	674,720	12,406	X	
COBALT	131,875	3,582	327,723	6,432	X	
FOLEYET	87,750	2,386	446,966	8,454	X	
KING KIRKLAND	351,750	9,554	917,990	16,454	X	
RAMORE	160,750	4,382	431,499	8,248	X	
MICHIPICOTEN RIVER	91,375	5,362	350,663	8,298	X	
MOONBEAM	146,000	3,992	431,167	8,241	X	
CALSTOCK	41,875	2,582	41,875*	2,582*	X	
MOOSONEE	49,500	1,280	49,500*	1,280*	X	
LONGLAC	148,500	8,341	425,517	8,086		X
KAKABEKA FALLS	36,375	996	36,375*	996*	X	
HUDSON	198,000	11,121	536,268	11,525	X	
EAR FALLS	198,000	11,121	461,888	10,324		X
REDDIT	125,625	7,745	425,358	9,618	X	
STRATTON	198,000	11,121	401,198	7,703		X
HERON BAY	49,500	2,780	49,500*	2,780*	X	
ARMSTRONG	49,500	1,280	49,500*	1,280*	X	
PICKLE LAKE	49,500	1,280	49,500*	1,280*	X	
TOTAL	5,542,125	205,246	12,584,276	251,610	X	

4.4.4.2 Microwave vs satellite long haul transmission

4.4.4.2.1 Method of long haul transmission

The initial evaluation was based on new television satellite services for Global, TVA, CITY-TV and CHCH-TV. As has been stated, the satellite means of transmission of these signals is for sometime in the future. The use of microwave transmission could make these available within a one (1) to two (2) year period. The microwave transmission of CTV as well as Global, TVA, CITY-TV and CHCH-TV signals is now examined. It is based on the assumption that the delivery will be made at the cluster center points.

4.4.4.2.2 Costing of options

Appendices 4.4.2, pages 1 to 4 detail the initial capital costs, the operating and maintenance costs and the microwave service costs for both reception and feed options.

The following table presents the cost summary for both reception and feed options 1 and 2. The table also identifies the least cost option for each cluster.

TABLE 24

CLUSTERS	COST OF OPTIONS				LEAST COST TOTAL MONTHLY COST/ OPTION	
	OPTION 1		OPTION 2			
	TOTAL CAPITAL COST $	TOTAL MONTHLY COST $	TOTAL CAPITAL COST $	TOTAL MONTHLY COST $	OPTION 1	OPTION 2
BARRY BAY	407,550	39,892	588,362	12,660		X
BANCROFT	424,200	40,351	529,094	11,694		X
GOODERHAM	502,500	51,320	591,462	12,822		X
SPRUCEDALE	1,095,150	104,592	972,384	19,407		X
SUNDRIDGE	571,650	49,946	538,362	10,402		X
MATTAWA	343,475	38,295	498,588	12,675		X
MAGNETAWAN	558,175	55,536	678,006	14,208		X
ST-CHARLES	566,775	86,020	849,197	18,604		X
WEBBWOOD	335,775	41,325	548,903	13,350		X
LITTLE CURRENT	357,975	32,571	406,198	8,080		X
SPANISH	257,600	30,209	532,063	12,979		X
ECHOBAY	502,975	54,277	666,220	12,393		X
COBALT	259,375	19,786	366,023	8,768		X
FOLEYET	171,750	28,173	477,966	9,177		X
KING KIRKLAND	717,950	56,171	955,390	18,776		X
RAMORE	326,150	25,675	455,799	10,246		X
MICHIPICOTEN RIVER	145,275	18,561	381,662	9,020		X
MOONBEAM	281,200	29,976	454,967	11,731		X
CALSTOCK	63,875	3,044	63,875*	3,044*	X	
MOOSONEE	83,500	2,049	83,500*	2,409*	X	
LONGLAC	244,500	21,055	456,517	8,808		X
KAKABEKA FALLS	37,875	939	37,875*	939*	X	
HUDSON	357,600	38,565	573,168	12,339		X
EAR FALLS	357,600	38,565	498,788	11,138		X
REDDIT	203,025	27,309	449,158	10,109		X
STRATTON	357,600	31,065	438,098	8,517		X
HERON BAY	83,500	3,549	83,500*	3,549	X	
ARMSTRONG	83,500	2,049	83,500*	2,049	X	
PICKLE LAKE	89,400	2,141	89,400*	2,141	X	
TOTAL	9,787,475	937,006	13,348,025	291,674		X

* One (1) community clusters included for overall comparison purposes.

4.4.4.2.2 Cont'd

The table indicates that option 2 is the least cost option on an overall basis since the total monthly cost is $290,000 compared to $1,000,000. This latter figure includes a microwave reception and feed service cost of $765,000 per month or $9.2 million per year.

Option 1 is indicated as the least cost reception and feed option for the six (6) clusters with only one (1) community.

4.4.4.2.3 Comparison with the initial optimization of options 1 and 2

The impact of microwave transmission on the cost of reception and feed is twofold: the complete shift toward option 2 for all clusters of 2 or more communities; the increase in the initial capital investment from $12.6 million to $13.2 million and in the total monthly cost from $267,500 to $290,000.

4.4.5 Possibilities of cost reductions

The reception and feed costs presented were based on two (2) key factors: method of signal delivery and use of existing equipment normally available off the shelf. The costs were established on the basis of the various set of conditions for each cluster and each community.

The configuration developed for headends, satellite earth stations, VHCM's and microwave receive facilities involved the required amount of equipment selected from the median cost category to ensure conformity with DOC standards. The design approach was to ensure that signal quality met these standards under the most difficult conditions. In this respect, the costs can be considered as neither minimum nor maximum.

Limited savings could be achieved in specific cases where certain design parameters can be optimized or where less costly equipment might be satisfactory. This might be the case for headends and satellite earth stations rather than for VHCM's. One way of achieving cost savings would be to use antennas for off-air pick-up of broadcast signals available beyond contour B limits whenever feasible. This would certainly lower costs for both option 1 and 2 and tend to shift the least cost option for the communities and clusters toward option 1. It has already been mentionned that clusters and communities with three (3) or more off-air signals tend to favor option 1 when the number of communities is limited to 3, 4 or 5.

Certain reductions to option 2 capital costs can be envisaged under certain circumstances, namely:

4.4.5.1 High power VHCM

The incremental capital cost reduction as a result of eliminating the transmission of one (1) signal is $20,484. The elimination would be possible if off-air pick-up can be substituted.

4.4.5.2 Availability of off-air signals to all communities

Off-air broadcast signals reception in individual communities can be considered whether the community is within or beyond the contour B limits.

4.4.5.3 Local broadcast receive antenna

The incremental addition of a broadcast receive antenna to the VHCM reception tower and associated electronic equipment is approximately $4,000.

The resulting cost reduction to option 2 would therefore be in the order of $8,000 for a cluster of 3 communities with a high power VHCM. It would be less than $500 in the case of a cluster with 5 communities.

4.5 Summary of technical and cost considerations

In this section of the study, we developed two (2) cost options for receiving and feeding eight (8) television signals to small communities in rural and remote Northern Ontario. The options were costed out and evaluated from both the technical and economic points of view. It is important to underline specific key points in relation to the two (2) options. These are the following:

4.5.1 Satellite vs microwave long haul transmission

It was demonstrated that the microwave long haul transmission of the five (5) television signals not presently technically available to certain communities or clusters was the most costly method of reception and feed to the local exhibition systems in comparison with the satellite method of reception and feed. Furthermore, the least cost option was option 2, for clusters of two (2) or more communities (table 24).

The satellite long haul transmission of up to seven (7) signals (with CTV transmitted by microwave) was demonstrated to be less costly to receive and feed than terrestrial microwave delivered signals (table 23 VS table 24). Smaller monthly cost differentials between options 1 and 2 are indicated although option 1 is the least cost option.

The microwave feed of the CTV signal within the cluster areas was calculated to cost $18,000 per month for the least cost feed option. The microwave long haul transmission annual cost of $414,000 and the cluster microwave feed costs of $216,000 is less than the $1,000,000 for satellite transmission. On this basis only, the decision to use the satellite for the long haul transmission of the CTV signal would have to take into consideration other needs than those of Northern Ontario communities.

4.5.2 Availability of foreign signals

The extension of television services would inevitably bring with it a request for US network programming or stations. Consistent with present CRTC policy, cable operators (exhibitors) might eventually wish to exhibit up to three (3) US commercial stations and one (1) non-commercial station. At present, the authorization of microwave carriage of US signals, received near the border, over long distances into the interior makes these available to many Northern Ontario communities. The US signals are considered to be essential features of the cable television services.

The limited Canadian satellite capacity for carrying US signals in the next few years as well as legal and regulatory implications involved in the reception of US signals from US satellites make it likely that microwave carriage will remain the method of transmission for US signals for many years. However the CRTC has issued a notice that it would consider a request for satellite transmission of US signals on the same basis as for microwave.

The extension of present microwave networks carrying US signals in Northern Ontario would increase the number of signals for distribution from eight (8) to as many as twelve (12). The cost effect on option 1 and 2 would be to further enhance the viability of option 2. The incremental capital cost of adding an extra signal to the VHCM system would be $6,875 for a low power VHCM and $20,484 for a high power VHCM in the case of a VHCM feeding communities. It would be extremely costly to provide each community with its own standard microwave link for up to 4 signals.

4.5.3 Addition of communities

It was demonstrated that the economic viability of option 2 improved as the number of communities in a cluster increased assuming present day satellite earth station costs. The increase in the number of communities within a cluster would tend, therefore, to enhance the viability of option 2.

The addition of communities would be possible if the original criteria of communities with 100 residences or more and a density of 25 residences or more per road mile was modified or if existing cable communities intended to share the use of the common facilities. In this latter case, several factors might attract the participation of existing cable operators as explained below.

4.5.4 Sharing use of common facilities with existing cable operators

Appendix 4.5.2 describes the Canadian television services offered by Northern Ontario cable operators to their respective subscribers. Sixteen (16) out of thirty four (34) cable operators provide five (5) or six (6) of the eight (8) Canadian television signals. The remainder carry 4 signals or less. The availability of eight (8) signals and the existence of cluster facilities would certainly be of interest to many cable operators. The following key factors would be of interest to them.

4.5.4.1 Improve quality of signals;

4.5.4.2 Increase number of television services and revenues;

4.5.4.3 Obtain cost savings by the integration of facilities and support infrastructures;

4.5.4.4 Make possible the addition of regional and other services which might not otherwise be made available.

4.5.4.5 Reduce regional and cluster disparities in television services.

4.5.5 Reduction in satellite earth station costs

As demonstrated, the "satellization" of television services would have a significant cost impact in favour of option 1.

Further technological and service developments are expected in the next few years which would make satellite services more widespread and accessible. The rate of increase in the number of popular television services available on satellite and the rate of decrease in the cost of satellite earth stations will determine the economic viability of option 1 in relation to option 2.

It can also be noted that the advent of high powered broadcast satellites would enable the reduction in the size of TVRO's. Such a development would make certain television services directly available to the home thereby by-passing community exhibition plants or installations, specially in rural areas.

4.6 Potential market for reception and feed services

In this section of the report, we have defined the reception and feed of television signals to be limited to the receiving, processing and delivery of signals in a cluster or a community for exhibition by a community system. To improve television services at the most reasonable cost, the market area must be maximized.

The shared use of common facilities as achieved in option 2 has one (1) important advantage in terms of increasing market size. It is that Very High Capacity Microwave systems can be extended to serve additional communities, whether cabled or not, for incrementally limited costs.

The availability of an eight (8) signal Canadian Television package would undoubtedly attract interest on the part of existing cabled communities and communities of less than 100 residences. We include the cabled communities as part of the market area that could be served, while leaving the latter communities for consideration in a subsequent study.

4.6.1 Cluster markets

The largest market area which the proposed reception and feed services can serve is defined by the community residences within a cluster.

The following table defines the 29 cluster areas in terms of their respective cabled and non-cabled communities of 100 residences or more.

TABLE 25

CLUSTER TELEVISION MARKETS

CLUSTER	CLUSTER RESIDENCES NUMBER	CABLED COMMUNITIES RESIDENCES NUMBER (1)	TOTAL RESIDENCES NUMBER	TOTAL RESIDENCES @ 80% PENETRATION NUMBER
BARRY BAY	2,201	1,723	3,924	3,139
BANCROFT	1,789	220	2,009	1,607
GOODERHAM	1,476	630	2,106	1,685
SPRUCEDALE	2,797	5,813	8,610	6,888
SUNDRIDGE	2,611	-	2,611	2,089
MATTAWA	2,268	14,758	17,026	13,621
MAGNETAWAN	961	2,200	3,161	2,529
ST-CHARLES	2,732	45,316	48,048	38,437
WEBBWOOD	1,519	1,600	3,119	2,495
LITTLE CURRENT	1,443	265	1,708	1,366
SPANISH	1,261	4,800	6,061	4,849
ECHOBAY	1,257	22,520	23,777	19,022
COBALT	1,322	3,150	4,472	3,578
FOLEYET	431	-	431	345
KING KIRKLAND	2,750	4,040	6,790	5,432
RAMORE	1,040	23,000	24,040	19,232
MICHIPICOTEN RIVER	411	1,500	1,911	1,529
MOONBEAM	766	3,700	4,466	3,573
CALSTOCK	201	1,805	2,006	1,605
MOOSONEE	299	-	299	239
LONGLAC	1,313	900	2,213	1,770
KAKABEKA FALLS	218	33,530	33,748	26,998
HUDSON	714	2,260	2,974	2,379
EAR FALLS	2,029	-	2,029	1,623
REDDIT	470	5,600	6,070	4,856
STRATTON	1,048	3,100	4,148	3,318
HERON BAY	139	4,268	4,407	3,526
ARMSTRONG	196	-	196	157
PICKLE LAKE	216	-	216	173
TOTAL (29)	35,878	186,698	222,576	178,060
	16.1%	83.9%	100%	

(1) Residences in communities with existing cable services.

4.6.1 Cluster markets (cont'd)

Appendix 4.5.2 lists the cabled communities including the choices of Canadian television services offered and table 25 indicates the number of potential subscribers for each cabled community.

The total number of residences for which the television services could be made available by means of a VHCM system is 222,576. This total includes 35,878 (16%) study community residences and 186,698 (84%) cabled community residences.

It is worth noting that the average study cluster size is 1,237 residences. In the case of study and cabled communities the average cluster size is 7,675 residences or 6.2 times more.

4.6.2 Community markets

The proposed distribution services can also be provided to serve individual communities.

The following table presents the 128 individual communities of Northern Ontario with the number of residences for each.

TABLE 26

STUDY COMMUNITY MARKETS

CLUSTER/COMMUNITIES (number)	COMMUNITY RESIDENCES 100% PENETR. NUMBER	COMMUNITY RESIDENCES 80% PENETR. NUMBER
BARRY BAY		
Madawaska, Barry Bay,	135, 1,010	108, 808
Chalk River, Killaloe Stn,	425, 306	340, 245
Whitney (5)	325	260
BANCROFT		
Bancroft, Coe Hill,	1,220, 185	976, 148,
Combermere, Maynooth,	126, 158,	101, 126
Quadeville (5)	100	80
GOODERHAM		
Apsley, Coboconk,	532, 310	426, 248
Gooderham, Kinmount,	157, 187,	126, 149
Norland, Wilberforce (6)	125, 165	100, 132
SPRUCEDALE		
Bala, Baysville, Dorset	527,242,205	422,194,164
Dwight, Honey Harbour,	188, 155,	150, 124
MacTier, Milford Bay,	344, 150,	275, 120
Novar, Port Carling,	131, 259,	105, 207
Port Sydney, Rosseau,	147, 180,	118, 144
Sprucedale, Utterson (13)	160, 109	128, 87
SUNDRIDGE		
Burk's Falls, Emsdale	608, 176	486, 141
Katrine, Kearney	110, 253	87, 205
South River, Sundridge	629, 570	503, 456
Trout Creek (7)	265	211

CLUSTER/COMMUNITIES	CLUSTER RESIDENCES 100% PENETR. NUMBER	COMMUNITY RESIDENCES 80% PENETR. NUMBER
MATTAWA		
Bonfield, Callander,	157, 573	125, 458
Corbeil, Mattawa,	118, 925	95, 740
Powassan (5)	495	396
MAGNETAWAN		
Arnstein, Britt, Loring	110,110,112	88,88,89
Magnetawan, McKellar,	133, 172	107, 138
Nobel, Pointe au Baril (7)	203' 121	162, 97
ST-CHARLES		
Alban, Crystal'Falls,	280, 150	224, 120
Field, Hagar, Markstay,	168,144,255	134,115,204
Noelville, River Valley,	315, 104,	252, 83,
Skead, St-Charles, Verner,	165,186,351,	133,149,281
Wahnapitae, Warren (12)	354, 260	283, 208
WEBBWOOD		
Cartier, Killarney	237, 125	189, 100
Massey, Nairn Center,	609, 161	487, 130
Webbwood, White Fish (6)	209, 178	167, 142
LITTLE CURRENT		
Little Current,	646,	517,
Manitowaning, Mindemoya,	366, 202,	293, 161,
Wikwemikong (4)	229	183
SPANISH		
Iron Bridge, Spanish	280, 347,	224, 277
Spragge, Thessalon (4)	122, 512	98, 410

CLUSTER/COMMUNITIES (number)	COMMUNITY RESIDENCES 100% PENETR. NUMBER	COMMUNITY RESIDENCES 80% PENETR. NUMBER	CLUSTER COMMUNITIES	CLUSTER RESIDENCES 100% PENETR. NUMBER	CLUSTER RESIDENCES 80% PENETR. NUMBER
ECHOBAY			MOOSONEE		
Batchawana Bay, Bruce Mines	126, 236,	101, 189,	Moosonee (1)	299	239
Desbarats, Echobay,	158, 270,	126, 216,			
Hilton Beach, Richards Landing, Searchmount (7)	144, 158, 165	115, 126, 132	LONGLAC (3)		
			Caramat, Longlac, Nakina	136,875,302	109,700,241
COBALT			KAKABEKA FALLS		
Cobalt, Latchford	806, 159,	645, 127,	Kakabeka Falls(1)	218	174
Temagami (3)	357	286			
			HUDSON (4)		
FOLEYET			Dinowwic, Hudson,	120, 140,	96, 112
Foleyet, Gogama (2)	186, 245	149, 196	Vermillion Bay, Wabigoon	276, 178	221, 142
KING KIRKLAND			EAR FALLS		
Earlton, Elk Lake,	406, 250,	325, 200,	Balmertown, Cochenour,	326, 174	261, 139,
Englehart, Kearns,	896, 139,	717, 111,	Ear Falls, Red Lake (4)	634, 895	507, 716
King Kirkland, Larder Lake,	125, 444,	100, 355,			
Matachewan, Virginiatown(8)	156, 334	126, 267	REDDIT		
			Minaki, Reddit	131, 129,	105, 103
RAMORE			Sioux Narrows (3)	210	168
Holtyre, Matheson, Ramore,	134,488,240	107,390,192			
Val Gagne (4)	178	143	STRATTON		
			Barwick, Emo, Rainy River,	102,390,443	81,312,354
MICHIPICOTEN RIVER			Stratton (4)	113	90
Dubreuilville,	311,	249,			
Michipicoten River (2)	100	80	HERON BAY		
			Heron Bay (1)	139	111
MOONBEAM					
Fauquier, Moonbeam,	197, 270	158, 216	ARMSTRONG		
Opasatika, Val Rita (4)	136, 163	109, 130	Armstrong (1)	196	157
CALSTOCK			PICKLE LAKE		
Calstock (1)	201	161	Pickle Lake (1)	216	173
			TOTAL RESIDENCES:	35,878	28,702

4.6.2 Community markets (cont'd)

The total market to be served if each community provides its own distribution facilities is 35,878 residences or 280 residences per community. The average number of residences per community is 4 times smaller than the average number of residences per cluster.

4.6.3 Market penetration

The availability of television services at the cluster or community level would not be of interest to all the potential residents or their exhibitor operators.

The potential markets were adjusted to take account of existing market penetration for cable services in Northern Ontario and the possible impact on penetration if the eight (8) signal television choice were exhibited. It was assumed that 80% penetration of the various markets was possible, assuming subscription rates to be acceptable by the local population.

The penetration figures for each cluster and community market are indicated in table 25 and 26. At 80% penetration, the total cluster market is 178,060 residences whereas the individual community markets total only 28,702 residences.

4.7 Estimated residential reception and feed costs

The least cost option presented in table 21 and the least cost option presented in table 23 were retained for further cost analysis. The purpose of this subsection is to determine the range of reception and feed costs per residence which could reasonably be envisaged over the next few years.

4.7.1. Revising costs to account for cable markets.

Tables 21 and 23 identify those clusters which would benefit from the installation of cluster delivery facilities, principally a VHCM system.

These same clusters could accomodate additional cabled communities by adding a VHCM link at relatively limited capital costs. These have been estimated to be $30,000 per cabled community as shown in appendix 4.5.4.

The capital cost of adding a new community without existing cable services would be more costly since we have assumed that existing cable operators dispose of a tower and equipment. If these costs were much more than $30,000, a cable operator might consider satellite reception for the missing signal to be more advantageous. The operating and maintenance costs are assumed to remain the same. This is due to the reduction in the headend costs which would come about if the operator relied on the common facilities rather than on its own facilities. These costs savings would offset the new maintenance costs.

Table 27 presents the revised costs for these clusters which share the use of common facilities and which might be joined by cabled communities.

TABLE 27

REVISED MONTHLY COSTS - CLUSTER MARKETS WITH CABLE COMMUNITY PARTICIPATION

CLUSTER	NUMBER OF CABLED COMMUNITIES	CLUSTERS SHARING COMMON FACILITIES - 1980 COSTS -		CLUSTERS SHARE COMMON FACILITIES - REDUCED TVRO COSTS -	
		COST OF ADDING CABLED COMMUNITY	REVISED MONTHLY COST	COST OF ADDING CABLED COMMUNITY	REVISED MONTHLY COST
BARRY'S BAY	1	30,000	13,415	30,000	12,397
BANCROFT	1	30,000	12,450	30,000	11,431
GOODERHAM	2	60,000	14,044	60,000	13,026
SPRUCEDALE	3	90,000	19,678	(1)	-
SUNDRIDGE	-	-	10,772	(1)	-
MATTAWA	1	(1)	(1)	(1)	-
MAGNETAWAN	1	30,000	13,545	(1)	-
ST-CHARLES	2	60,000	17,244	(1)	-
WEBBWOOD	1	30,000	11,523	(1)	-
LITTLE CURRENT	1	30,000	8,918	(1)	-
SPANISH	2	(1)	(1)	(1)	-
ECHOBAY	1	30,000	13,600	(1)	-
COBALT	1	(1)	(1)	(1)	-
FOLEYET	-	(1)	(1)	(1)	-
KING KIRKLAND	2	60,000	18,498	(1)	-
RAMORE	3	(1)	(1)	(1)	-
MICHIPICOTEN RIVER	1	(1)	(1)	(1)	-
MOONBEAM	2	(1)	(1)	(1)	-
CALSTOCK	2	(1)	(1)	(1)	-
MOOSONEE	-	(1)	(1)	(1)	-
LONGLAC	1	30,000	9,646	30,000	8,553
KAKABEKA FALLS	1	(1)	(1)	(1)	-
HUDSON	1	30,000	13,177	(1)	-
EAR FALLS	-	-	11,508	-	10,324
REDDIT	1	(1)	(1)	(1)	-
STRATTON	1	30,000	9,355	30,000	8,170
HERON BAY	2	(1)	(1)	(1)	-
ARMSTRONG	-	(1)	(1)	(1)	-
PICKLE LAKE	-	(1)	(1)	(1)	-
TOTAL	34	540,000	197,373	180,000	63,901

(1) Least cost option is facilities for each individual community
See table 21 or 23.

4.7.2 Reception and feed costs per residence

The reception and feed cost evaluation has been limited to only two (2) alternatives in order to provide some indication as to the range of costs per residence which the distribution of eight (8) Canadian television signals might entail. The cost per residence for these alternatives are now presented on the basis of including the cabled communities whenever technically and economically feasible and of an 80% market penetration. A more detailed approximation would require the development of a simulation model so as to calculate the impact of modifying some of the key variables.

4.7.2.1 Alternative 1 - Least cost options at 1980 costs

Tables 21, 25, 26 and 27 were utilized to establish the cost per residence for the least cost option presented in table 21. The costs were based on 1980 market costs.

The table on the following page presents the costs per residence for both cluster markets where study communities and existing cabled communities share the use of common facilities and individual community markets where each community sets up its own facilities.

TABLE 28

RECEPTION AND FEED COST PER RESIDENCE

OPTIMIZED OPTIONS AT TODAYS COSTS FOR 80% PENETRATION

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST (*) $	TOTAL MARKET RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
CLUSTER MARKETS OF:			
BARRY'S BAY	13,415	3,139	4.27
BANCROFT	12,450	1,607	7.75
GOODERHAM	14,044	1,685	8.33
SPRUCEDALE	19,678	6,888	2.86
SUNDRIDGE	10,772	2,089	5.15
MAGNETAWAN	13,545	2,529	5.36
ST-CHARLES	17,244	38,437	0.45
WEBBWOOD	11,523	2,495	4.62
LITTLE CURRENT	8,918	1,366	6.53
ECHOBAY	13,600	19,022	0.71
KING KIRKLAND	18,498	5,432	3.41
LONGLAC	9,646	1,770	5.45
HUDSON	13,177	2,379	5.54
EAR FALLS	11,508	1,623	7.04
STRATTON	9,355	3,318	2.82
COMMUNITY MARKETS OF:			
(1) BONFIELD	1,905	125	15.24
CALLANDER	1,905	458	4.16
CORBEIL	1,905	95	20.05
MATTAWA	1,905	740	2.57
POWASSAN	1,905	396	4.81
(2) IRON BRIDGE	1,798	224	8.03
SPANISH	1,798	277	6.49
SPRAGGE	1,798	98	18.35
THESSALON	1,798	410	4.38
(3) COBALT	2,371	645	3.68
LATCHFORD	2,371	127	18.67
TEMAGAMI	2,371	286	8.29
(4) FOLEYET	2,332	149	15.65
GOGAMA	2,332	196	11.90

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST $	TOTAL RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
COMMUNITY MARKETS OF:			
(5) HOLTYRE	2,082	107	19.46
METHESON	2,082	390	5.34
RAMORE	2,082	192	10.84
VAL GAGNE	2,082	143	14.56
(6) DUBREUILVILLE	3,651	249	14.66
MICHIPICOTEN R.	3,651	80	45.64
(7) FAUQUIER	1,890	158	11.96
MOONBEAM	1,890	216	8.75
OPASATIKA	1,890	109	17.34
VAL RITA	1,890	130	14.54
(8) CALSTOCK	3,415	161	21.21
(9) MOOSONEE	2,512	239	10.51
(10) KAKABEKA FALLS	1,722	174	9.90
(11) MINAKI	3,474	105	33.09
REDDIT	3,474	103	33.73
SIOUX NARROWS	3,474	168	20.68
(12) HERON BAY	3,920	111	35.33
(13) ARMSTRONG	2,420	157	15.41
(14) PICKLE LAKE	2,420	173	13.99

(*) Refer table 27 for clusters and table 21 for communities total

		Residences
** Total number of cluster communities:	95	21,311
Total number of communities:	33	7,391
Total:	128	28,702
*** Total number of cabled communities in clusters: (Table 27)	18	72,468

4.7.2.1 Cont'd

The reception and feed cost per residence can be summarized in the following table.

TABLE 29
COST - MARKET RELATIONSHIP

CLUSTER/ COMMUNITY / COST CATEGORIES	CLUSTER MARKETS PENETRATION 80%			INDIVIDUAL COMMUNITY MARKETS PENETRATION 80%			
	<2,000 res.	2,001 to 5,000 res.	>5,001 res.	<150 res.	151 to 275 res.	276 to 400 res.	>401 res.
< 2.00	-	-	2	-	-	-	-
2.01 to 5.00	-	3	2	-	-	1	4
5.01 to 8.00	4	3	-	-	-	2	-
8.01 to 11.0	1	-	-	-	5	1	-
11.01 to 15.00	-	-	-	3	4	-	-
>15.01	-	-	-	10	3	-	-
TOTAL:	5	6	4	13	12	4	4

Tables 28 and 29 indicate that there exists a wide range of reception and feed costs per residence and that these are very sensitive to the market size. It also demonstrates that choosing the least cost arrangement of facilities and maximizing the markets has not necessarily made for low reception and feed costs. On the contrary, there are 32 communities, 26 individual community markets and 6 communities in the Gooderham cluster market, whose reception and feed cost per residence is greater than $8.01 per month.

4.7.2.2 Alternative 2 - Least cost options with TVRO reduced costs

Table 23, 25, 26 and 27 were utilized to establish the cost per residence for the least cost option presented in table 23. The costs were based on 1980 markets costs for all facilities except for TVRO's which were modified to reflect near term cost reductions.

The table on the following page presents the costs per residence for both cluster markets where study communities and existing cabled communities share the use of common facilities and individual community sets up its own facilities.

The reception and feed cost per residence can be summarized in the following table.

TABLE 30-1
RECEPTION AND FEED COST PER RESIDENCE
OPTIMIZED OPTIONS AT FUTURE TVRO COSTS FOR 80% PENETRATION

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST $	TOTAL MARKET RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
CLUSTER MARKETS OF:			
BARRY'S BAY	12,397	3,139	3.95
BANCROFT	11,431	1,607	7.11
GOODERHAM	13,026	1,685	7.73
LONGLAC	8,553	1,770	4.83
STRATTON	8,170	3,318	2.46
EAR FALLS	10,324	1,623	6.36
COMMUNITY MARKETS OF:			
(1) BALA	1,178	422	2.79
BAYSVILLE	1,178	194	6.07
DORSET	1,178	164	7.18
DWIGHT	1,178	150	7.85
HONEY HARBOUR	1,178	124	9.50
MACTIER	1,178	275	4.28
MILFORD BAY	1,178	120	9.82
NOVAR	1,178	105	11.22
PORT CARLING	1,178	207	5.69
PORT SYDNEY	1,178	118	9.98
ROSSEAU	1,178	144	8.18
SPRUCEDALE	1,178	128	9.20
UTTERSON	1,178	87	13.54
(2) BURK'S FALLS	1,165	486	2.39
EMSDALE	1,165	141	8.26
KATRINE	1,165	87	13.39
KEARNEY	1,165	205	5.68
SOUTH RIVER	1,165	503	2.32
SUNDRIDGE	1,165	456	2.55
TROUT CREEK	1,165	211	5.52
(3) BONFIELD	1,037	125	8.29
CALLANDER	1,037	458	2.26
CORBEIL	1,037	95	10.92
MATTAWA	1,037	740	1.40
POWASSAN	1,037	396	2.62

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST $	TOTAL RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
COMMUNITY MARKETS OF:			
(4) ARNSTEIN	1,137	88	12.92
BRITT	1,137	88	12.92
LORING	1,137	89	12.77
MAGNETAWAN	1,137	107	10.63
MCKELLAR	1,137	138	8.24
NOBEL	1,137	162	7.02
PTE AU BARIL	1,137	97	11.72
(5) ALBAN	1,013	224	4.52
CRYSTAL FALLS	1,013	120	8.44
FIELD	1,013	134	7.56
HOGAN	1,013	115	8.81
MARKSTAY	1,013	204	4.97
NOELVILLE	1,013	252	4.02
RIVER VALLEY	1,013	83	12.20
SKEAD	1,013	133	7.62
ST-CHARLES	1,013	149	6.80
VERNER	1,013	281	3.60
WAHNAPITAE	1,013	283	3.58
WARREN	1,013	208	4.87
(6) CARTIER	1,062	189	5.62
KILLARNEY	1,062	100	10.62
MASSEY	1,062	487	2.18
NAIRN CENTER	1,062	130	8.17
WEBBWOOD	1,062	167	6.36
WHITE FISH	1,062	142	7.48
(7) LITTLE CURRENT	1,192	517	2.31
MANITOWANING	1,192	293	4.07
MINDEMOYA	1,192	161	7.40
WIKWEMIKONG	1,192	183	6.51
(8) IRON BRIDGE	998	224	4.46
SPANISH	998	277	3.60
SPRAGGE	998	98	10.18
THESSALON	998	410	2.43

TABLE 30-2

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST $	TOTAL MARKET RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
COMMUNITY MARKETS OF:			
(9) BATCHAWAN BAY	1,165	101	11.53
BRUCE MINES	1,165	189	6.16
DESBARATS	1,165	126	9.25
ECHOBAY	1,165	216	5.39
HILTON BEACH	1,165	115	10.13
RICHARDS LANDING	1,165	126	9.25
SEARCHMOUNT	1,165	132	8.83
(10) COBALT	1,194	645	1.85
LATCHFORD	1,194	127	9.40
TEMAGAMI	1,194	286	4.17
(11) FOLEYET	1,191	149	7.99
GOGAMA	1,191	196	6.08
(12) EARLTON	1,194	325	3.67
ELK LAKE	1,194	200	5.97
ENGLEHART	1,194	717	1.67
KEARNS	1,194	111	10.76
KING KIRKLAND	1,194	99	12.06
LARDER LAKE	1,194	355	3.36
MATACHEWAN	1,194	126	9.48
VIRGINIATOWN	1,194	267	4.47
(13) HOLTYRE	1,096	107	10.24
MATHESON	1,096	390	2.81
RAMORE	1,096	192	5.71
VAL GAGNE	1,096	143	7.66

CLUSTER/COMMUNITIES	TOTAL MONTHLY COST $	TOTAL RESIDENCES 80% PENETRATION NUMBER	COST PER RESIDENCE $
COMMUNITY MARKETS OF:			
(14) DUBREUILVILLE	2,681	249	10.76
MICHIPICOTEN R.	2,681	80	33.51
(15) FAUQUIER	998	158	6.32
MOONBEAM	998	216	4.62
OPASATIKA	998	109	9.16
VAL RITA	998	130	7.68
(16) CALSTOCK	2,605	161	16.18
(17) MOOSENEE	1,280	239	5.36
(18) KAKABEKA FALLS	996	174	5.72
(19) DINORWIC	2,558	96	26.65
HUDSON	2,558	112	22.84
VERMILLION BAY	2,558	221	11.57
WABIGOON	2,558	142	18.01
(20) MINAKI	2,605	105	24.81
REDDIT	2,605	103	25.29
SIOUX NARROWS	2,605	168	15.51
(21) HERON BAY	2,804	111	25.26
(22) ARMSTRONG	1,280	157	8.15
(23) PICKLE LAKE	1,280	173	7.40

		Residences
* Total number of cluster communities:	27	7,885
Total number of communities:	101	20,817
Total:	128	28,702
** Total number of cabled communities in clusters:	6	5,257

TABLE 31

COST - MARKET RELATIONSHIP

CLUSTER/ COMMUNITY / COST CATEGORIES	CLUSTER MARKETS PENETRATION 80%			INDIVIDUAL COMMUNUTY MARKETS PENETRATION 80%			
	<2,000 res.	2,001 to 5,000 res.	>5,001 res.	<150 res.	151 to 275 res.	276 to 400 res.	>401 res.
<2.00	-	-	-	-	-	-	3
2.01 to 5.00	1	2	-	-	8	9	8
5.01 to 8.00	3	-	-	6	21	-	-
8.01 to 11.00	-	-	-	26	0	-	-
11.01 to 15.00	-	-	-	10	1	-	-
>15.01	-	-	-	7	2	-	-
TOTAL	4	2	-	49	32	9	11

Tables 30 and 31 also indicate a wide range of reception and feed costs per residence and sensitivity to market size. It also appears to show that the reduction of TVRO costs has improved the reception and feed cost per residence when comparing tables 29 and 31, particularly for the individual community markets. However, that is not the case for many communities who are no longer sharing the use of common facilities with existing cabled communities. As a result, 46 communities have a reception and feed cost per residence of $8.01 per month or more.

5.0 EXHIBITION

The third component of the delivery process concerns the local exhibition. Each community has a requirement to establish the community system or plant which will ultimately deliver the eight (8) Canadian television signals to each residence for display. At this point of the study, the major obstacles have been overcome for we consider the signals to be available to each community. We may now examine the problem of developing the most cost effective method of local exhibition.

The availability of eight (8) signals to each community by means of satellite, broadcast or microwave permits the examination of three (3) exhibition technical options, namely:

- local cable television plant;
- local rebroadcasting station;
- direct broadcast satellite home reception.

These options are discussed in this section. The local cable television plant option was studied in some depth at the outset of the study since it was felt to be most practical and economically viable. Nonetheless, all options are examined on a technical and cost effectiveness basis in order to identify the least cost exhibition option which will locally deliver the signals to each residence. Technical details and considerations are presented in figures and tables attached as appendices. The least cost options are analyzed further on a community by community basis to develop an exhibition cost per residence on the basis of an 80% market penetration.

5.1 Quality and reliability requirements

The quality and reliability factors for television signals subject to the long haul transmission, reception and feed and local exhibition chain under consideration is an important and complex matter which we have already mentioned in sub-section 4.2.1. It is no doubt a problem which should receive greater attention in the future.

5.1 Cont'd

The quality and reliability factors for signals to be delivered by cable television systems are listed in the Department of Communications BP-23 and they are as follows:

GRADE	QUALITY	SNR
Grade 1	Top quality	Not less than 40 dB
Grade 2	Good quality	Not less than 35 dB
Grade 3	Acceptable quality	Not less than 27 dB
Grade 4	Marginal quality	Less than 27 dB

For signals transmitted over long distances, the reliability of the above signal qualities should be 99%. For this study we have adopted grade 1 quality for the cable television option. Reducing the quality can be considered at the system design stage when long haul transmission and reception and feed design criteria would be more firm. In any event, reducing the quality levels would only marginally decrease the overall costs.

In the case of a rebroadcast station to transmit eight (8) television signals, the quality and reliability factors adopted are those contained in a feasibility study titled "Television Extension Northern Ontario" prepared by DGB Consultants in June 1978 for the Ontario Ministry of Transportation and Communications. It is recommended that the quality should be 35 dB S/N ratio at a level of reliability of 99.9%. This quality would be somewhat less than the cable television quality and reliability factors.

The direct-to-home satellite receive quality and reliability factors is not considered in this study since direct broadcast satellite services are not expected for some years to come. Our concern is the possible home antenna cost should this service exist within the next 10 years.

5.2 Technical options evaluation

5.2.1 Local cable television distribution

This sub-section examines the cable television distribution option available to each of the identified communities. The objective of the evaluation is to determine cable system requirements and the corresponding capital and operating and maintenance costs. The costs are then summarized in order to establish the cost per residence for eventual comparison with the other technical options.

5.2.1.1 Community density patterns and establishment of reference communities

The capital cost of a community cable plant is primarily a function of residential density as expressed by the number of residences per mile of cable plant. The adopted methodology first considers typical community density patterns, then categorizes the communities according to the patterns and processes to the selection of reference communities for further cable plant analysis.

The density patterns were determined after examining aerial photographs and municipal plans.

Appendix 5.1.1 presents the definition for the six (6) community density patterns adopted for the cable evaluation and corresponding to the rural and remote Northern Ontario communities layouts.

5.2.1.1 Cont'd

The table on the following page presents the density patterns and chosen reference communities.

5.2.1.2 System design parameters and cable plant layout

Appendix 5.1.3 details the cable system design parameters consistent with the signal quality and reliability objectives.

Using municipal plans, a cable plant layout was designed for each of the six (6) reference communities. Appendix 5.1.2 presents the cable plant layouts showing trunk and distribution coaxial cable, active and passive equipment, power supply and headend location.

TABLE 32

REPRESENTATIVE DENSITY PATTERNS AND COMMUNITIES

Model	Pattern	Reference community	Residences number
1	Linear	Echobay	270
2	Linear with development	Emo	390
3	Spread development	Plantagenet	283
4	Semi-dense	Mattice	233
5	Dense	Mattawa	925
6	Dispersed	Caramat	136

Note: Plantagenet and Mattice, although excluded from the revised study area, were retained to represent the spread and semi-dense patterns.

5.2.1.3 Costing of models

The capital and operating and maintenance costs were estimated using the following assumptions:

1) The eight (8) signals are fed to each cable system starting at the first trunk amplifier. Headend considerations are excluded since these have been dealt with in the reception and feed section:

2) The installation of 100% of the cable drops to serve all of the community residences;

5.2.1.3 Cont'd

3) The capital costs include the material costs, transportation costs, the aerial installation of cable and equipment, and the engineering costs. Transportation costs and engineering costs have been assumed to be approximately 2% and 10% respectively of the material cost;

4) No provision has been made for contingency costs;

5) The initial capital costs required to build the cable distribution system are amortized into equivalent monthly costs on the basis of a 10 year loan at 15% per annum compounded for end of month payments;

6) The operating and maintenance costs (O&M), have been evaluated to represent approximately 25% of the capital cost for small rural type systems.

This percentage was established on the basis of actual operating statistics collected by the CRTC for cable operators in the study area. Key operating statistics are provided in appendix 5.1.6.

Appendix 5.1.4 presents the detailed capital cost calculations for each reference community representing a density pattern.

The table on the following page summarizes the capital and operating and maintenance costs for each reference community.

TABLE 33

SUMMARY OF CABLE TELEVISION ESTIMATED COSTS

BY COMMUNITY DENSITY PATTERN

DENSITY PATTERN	TOTAL CAPITAL COST FOR CABLE PLANT $	ANNUAL O&M COSTS $	EQUIVALENT MONTHLY CAPITAL COST $	MONTHLY O&M COST $	TOTAL MONTHLY COST $	MONTHLY COST PER RESIDENCE $	PLANT CAPITAL COST PER RESIDENCE $
Linear	46,355	11,589	721	966	1,687	6.25	172
Linear with development	68,015	17,004	1,058	1,417	2,475	6.35	174
Spread development	88,328	22,082	1,375	1,840	3,215	11.37	312
Semi-dense	37,846	9,462	589	789	1,378	5.91	162
Dense	148,096	37,024	2,305	3,085	5,390	5.84	160
Dispersed	41,317	10,330	643	861	1,504	11.07	304

5.2.1.4 Capital cost of cable television option

The derived cable plant capital cost per residence was used to estimate the total capital cost of establishing cable television systems in all of the communities. The table on the following page summarizes capital and operating and maintenance costs for each density pattern.

The total capital cost commitment to cable the 128 communities is estimated to be $6.3 million. The subsequent operating and maintenance costs are in the order of $1.6 million per year.

5.2.1.5 Cost per residence

Table 33 presents the monthly cost per residence on the basis of spreading the monthly capital equivalent and plant operating and maintenance costs over all the residences of each reference community. This permits the establishment of a cost per residence for the communities comprising the present study.

It should be noted that the costs are limited to those which are directly related to the exhibition plant. No consideration has been given to other cable operation costs such as programming, selling and administration overhead for billing. Our cost per residence is therefore understated in relation to full cable television services.

The cost per subscriber should also be adjusted to account for the fact that the cable service is never bought by all of the potential subscribers. We have adopted a penetration hypothesis of 80% (appendix 5.1.6). Table 35 summarizes the cost per residence as a result of an 80% penetration hypothesis.

TABLE 34

TOTAL CABLE PLANT COSTS -
ALL COMMUNITIES

DENSITY PATTERN	NO. OF COMMUNITIES	NO. OF RESIDENCES	CABLE PLANT CAPITAL COST $	ANNUAL OPERATING AND MAINTENANCE COSTS - $
Linear	28	4,583	788,276	197,069
Linear with development	16	3,828	666,072	166,518
Spread	15	2,500	780,000	195,000
Semi-dense	45	10,377	1,681,074	420,268
Dense	21	14,109	2,257,440	564,360
Dispersed	3	481	146,224	36,556
TOTAL	128	35,878	6,319,086	1,579,771

TABLE 35

COST PER RESIDENCE - 80% CABLE SERVICE PENETRATION

DENSITY PATTERN	NUMBER OF RESIDENCES REFERENCE COMMUNITY	TOTAL MONTHLY COST - $	MONTHLY COST PER RESIDENCE $
Linear	216	1,687	7.81
Linear with development	312	2,475	7.93
Spread development	226	3,215	14.22
Semi-dense	186	1,378	7.40
Dense	740	5,390	7.28
Dispersed	109	1,504	13.79

5.2.2 Rebroadcasting

Another possible local exhibition medium alternative is multichannel local rebroadcasting whereby off-air signals are picked-up by a home antenna.

For this topic we have referred to a recent study prepared for the Department of Communications Canada by DGB Consultants Inc. titled RURAL CANADA - MODELS OF MULTICHANNEL REBROADCASTING STATIONS and dated september 1979.

This sub-section examines the possible application of the rebroadcasting option for the Northern Ontario communities included in the present study.

5.2.2.1 Models and cost of rebroadcasting stations

The DGB study developed four basic models of rebroadcasting stations that should be capable of providing good quality television service to almost every rural and remote community. The models developed were the following:

Model no. 1: Pole mounted model
Model no. 2: Standard shelter model
Model no. 3: Specialized shelter model
Model no. 4: Existing housing model

5.2.2.1 Cont'd

Appendix 5.2.1 presents an illustration of the 4 rebroadcast station models.

The operation was considered for the VHF band and the UHF band.

The table on the following page presents the coverage and cost which each model and frequency application would entail as presented in the DGB study. Appendix 5.2.2 presents additional cost estimates for the existing housing model (model 4).

TABLE 36

REBROADCASTING STATIONS-CAPITAL COSTS					
Description of models	Basic coverage	4 TV channels+2 FM		8 TV channels+2 FM	
		VHF	UHF	VHF	UHF
Model no. 1	2 mi.	$ 61,000	$ 88,000	N/A	N/A
	4 mi.	$ 74,000		N/A	N/A
Model no. 2	8 mi.	$179,000	$298,000	$296,000	$534,000
	14 mi.	$253,000	$389,000	$426,000	$677,000
Model no. 3	2 mi.	$ 59,000	$ 87,000	N/A	N/A
Model no. 4	2 mi.	$ 50,000	$ 78,000	$ 76,000	$132,000
YEARLY OPERATING AND MAINTENANCE COSTS					
Model no. 1	2 mi.	$ 4,050	$ 4,050	N/A	N/A
	4 mi.	$ 4,150	-	N/A	N/A
Model no. 2	8 mi.	$ 9,100	$ 12,400	$ 12,600	$ 20,100
	14 mi.	$ 11,500	$ 14,500	$ 16,300	$ 24,000
Model no. 3	2 mi.	$ 2,450	$ 2,450	N/A	N/A
Model no. 4	2 mi.	$ 2,450	$ 2,450	$ 2,900	$ 2,900

5.2.2.2 Selection of rebroadcasting station models

In order to determine the feasibility of local rebroadcasting stations as a means of exhibition, we examined DGB's models using the following criteria:

- feasibility of transmitting up to eight (8) television signals;
- general terrain and topography characteristics;
- interference;
- cost relative to the cable transmission option.

Models 1 and 3 have no application in the present study since there is a requirement to rebroadcast up to eight (8) channels.

Model 2 is described by DGB as applicable to communities which conform to the linear, linear with development, spread and dispersed density patterns as long as the power was between 10 and 250 watts. With a coverage of 8 or 14 miles, this model provides more coverage than is necessary for the vast majority of communities dealt with. The capital and operating costs are such that this model becomes an expensive option in comparison with cable plant.

Model 4 permitting a 2 mile coverage would represent a technically feasible and cost effective option, except for one further consideration. The risks of interference would undoubtedly be a real problem if the VHF frequency model was retained. We have selected the UHF model 4 as an alternative option to cable television. The stated capital cost of the model adapted for the transmission of eight (8) signals is $123,000 (see appendix 5.2.2).

5.2.2.3 Reception antenna

One of the design assumptions used by the consultant was a "Grade "B" Contour Coverage. This would require the installation of an exterior reception antenna for each residence.

The need for this antenna is also strengthened by the very nature of multi channel transmission (which would otherwise cause a very poor reception with ordinary interior reception antenna designed for single channel reception). A summary estimate of a commercial type reception antenna would include the following:

Antenna Color VHF 20 elements:	$50.00
Tripod	20.00
Post 10 ft	10.00
Twin lead 100 ft	10.00
Grounding	8.00
Material total:	98.00
Provincial sales tax 7%:	6.86
GRAND TOTAL:	$104.86

This does not include installation by an electrician or contractor. The operating and maintenance costs for such an installation is considered nil.

5.2.2.4 Station operating and maintenance

The operating and maintenance costs of $2,900 per year indicated in DGB's study appear to be too low to cover all of the station costs. We estimate the annual cost to be the following:

Space and access rental - $150/month	$1,800.00
Insurance:	500.00
Monitoring and taking calls - $20/week:	1,040.00
Maintenance and spare parts and other O&M:	2,800.00
Total operating and maintenance:	$6,140.00

5.2.2.5 Total cost summary

The table on the following page establishes capital and operating and maintenance costs for various sizes of communities.

TABLE 37

COST ESTIMATE FOR REBROADCASTING UNDERTAKINGS

NUMBER OF RESIDENCES PER COMMUNITY	TOTAL STATION CAPITAL COST $	TOTAL HOME ANTENNA CAPITAL COST $	ANNUAL O & M COSTS $	MONTHLY COST PER RESIDENCE $ (1)
200	123,000	21,000	6,140	13.76
300	123,000	31,500	6,140	9.72
400	123,000	42,000	6,140	7.70
500	123,000	52,500	6,140	6.49
600	123,000	63,000	6,140	5.68
700	123,000	73,500	6,140	5.10

(1) The monthly cost per residence was derived by amortizing monthly the station and home antenna capital cost over 10 years at 15% interest compounded monthly and then adding the monthly O & M costs obtained by dividing the annual O & M cost by 12.

The home antenna is considered a capital cost component in order to sustain the cost comparison between a rebroadcasting undertaking and a cable television undertaking.

5.2.2.5 Cont'd

The table indicates falling cost per residence as the number of residences increases for a rebroadcast station with a coverage of 2 miles. The monthly cost per residence was utilized to establish the rebroadcast cost curve in appendix 5.2.3.

The total capital cost to establish rebroadcasting stations in all 128 communities would total $19.5 million and the operating and maintenance cost would approximate $786,000 per year. Although the capital cost is more than twice the cost of establishing cable television facilities, the operating and maintenance costs are half those of cable television.

5.2.2.6 Cable plant vs rebroadcast station cost comparison

The least cost option for local exhibition when comparing cable television costs and rebroadcast station costs can be identified using appendix 5.2.3. The following table summarizes the results of the comparison:

TABLE 38

REBROADCASTING LEAST COST OPTION

	MAXIMUM NUMBER OF RESIDENCES PER COMMUNITY	BREAK-EVEN COST PER RESIDENCE NUMBER OF RESIDENCES	REBROADCAST LEAST COST OPTION NUMBER OF COMMUNITIES
Linear	315	515	-
Linear with development	532	525	2
Spread	259	260	-
Semi-dense	366	575	-
Dense	1,220	575	12
Dispersed development	216	275	-
TOTAL:			14

The cost per residence for the fourteen (14) communities whose least cost exhibition option would be the establishment of a rebroadcast station is as follows:

TABLE 39

REBROADCASTING LEAST COST OPTION - COST PER RESIDENCE

DENSITY PATTERN	COMMUNITY	NUMBER OF RESIDENCES	MONTHLY COST PER RESIDENCE
Linear with development	Apsley	532	6.19
	Bala	527	6.23
Dense	Bancroft	1,220	3.62
	Barry's Bay	1,010	4.04
	Burks Falls	608	5.62
	Cobalt	806	4.64
	Ear Falls	634	5.46
	Englehart	896	4.34
	Little Current	646	5.39
	Longlac	875	4.41
	Massey	609	5.62
	Red Lake	895	4.34
	South River	629	5.49
	Mattawa	925	4.26

5.2.2.7 Rebroadcasting station vs cable plant

Multi-channel rebroadcasting stations can be a feasible alternative for exhibition purposes particularly when the number of signals are limited and when the residence density pattern is low or dispersed in more than one nucleus. They feature simple installation, operation and maintenance limited to one location, a reduced number of trouble sources, and ready access.

Rebroadcast stations are considered of limited applications due to transmitting antenna positioning constraints as a result of radiation pattern irregularities. The home reception quality is influenced by interference due to reflection phenomena, seasonal atmospheric effects and topography. Furthermore, their expansion capacity is limited in terms of the number of channels that can feasibly be transmitted.

Rebroadcasting station undertakings have an additional drawback concerning the method of implementing the service. In the case of cable television undertakings the operator can easily control the access to the service and as a result bill the subscribers for this service. A rebroadcasting undertaking would have to be implemented on a different basis, for example, as a municipal service, in order that the operator recoup his investment.

5.2.2.8 Service penetration

The retention of the rebroadcast option for communities characterized by a linear with development pattern or a dense pattern would not necessarily lead to 100% penetration of television service since a service is rarely bought by all potential subscribers. As in the case for cable television, we have adopted a penetration hypothesis of 80%. The following table presents the cost per residence for the two (2) density patterns assuming 80% penetration.

TABLE 40

REBROADCASTING SERVICE COST PER RESIDENCE AT 80% PENETRATION

DENSITY PATTERN	COMMUNITY	NUMBER OF RESIDENCES 80% PENETR.	MONTHLY COST PER RESIDENCE
Linear with development	Apsley	426	7.33
	Bala	422	7.38
	Sub-total:	848	
Dense	Bancroft	976	4.12
	Barry's Bay	808	4.64
	Burks Falls	486	6.62
	Cobalt	645	5.40
	Ear Falls	507	6.42
	Englehart	717	5.02
	Little Current	517	6.33
	Longlac	700	5.10
	Massey	485	6.63
	Red Lake	716	5.02
	South River	503	6.46
	Mattawa	740	4.95
	Sub-total:	7,800	

5.2.3 Direct broadcast satellite

The study has demonstrated the importance of satellite transmission for making the eight (8) television signals available to the identified communities or clusters of Northern Ontario. The development of satellite television service over the next few years could make the direct satellite to home reception a feasible exhibition option.

Past Canada-US experiments using the high power Hermes satellite and more recent experimentation by the Department of Communications in the 12 GHz band using the Anik-B satellite have tested the feasibility of direct to home satellite broadcasting. The success of the experiments as well as others carried out by the Japanese and the Europeans, have demonstrated the feasibility of home terminals to directly receive broadcast signals from satellites. It should however be noted that direct to home satellite broadcasting is not expected to come on stream in the near future. What now exists, and is planned for further development, is the restricted use of satellite for fixed television signal transmission whereby the ground reception is limited to authorized organizations.

This sub-section briefly examines this third exhibition option since longer term implications are important. The direct home reception of broadcast satellite signals could lead to specific rural and remote community applications which would eliminate the need for cable television or rebroadcast station options as well as the local reception and feed component of the communication process.

5.2.3.1 Factors to be considered

There are important technical and non-technical factors which will come to play in this new development, namely:

- Broadcast vs fixed-service
  As mentioned, some replacement of ground broadcast stations by direct broadcast satellite transmitters for direct to home reception could take some time to develop, both for technical and non-technical reasons. At the present time, satellite television services are restricted to fixed or point to point service whereby reception of television signals must be approved by the owner of the signal and the CRTC.

- Satellite power
  The satellite transmission power has a definite impact on the size and cost of the earth station reception dish. To reduce the cost of home reception dishes, satellites using higher power will have to be used. However, the cost of transmission will undoubtedly increase.

- Picture quality
  The home satellite receive station equipments will have to be further developed to ensure ease of installation and good picture quality in order to improve the consumer price for those who would not have access to cable television services or rebroadcast stations. Good picture quality is an important consideration in the further development of the electronics of a small and cheaper home terminal.

5.2.3.1 Cont'd

- Satellite long haul transmission bandwidth
  It is expected that direct home satellite reception will be feasible only in the 12 GHz band. This would imply that all television signals that were considered to be transmitted on the 6/4 GHz band satellite for the long haul transmission accross Canada would also have to be transmitted by DBS, at extra cost.

- Use of multiple satellites
  The use of more than one (1) satellite could also necessitate the use of more than one (1) type of home terminal to receive good quality signals.

5.2.3.2 Preliminary home terminal hypothesis for cost evaluation

We have briefly reviewed the promising new development in this field. In particular we have identified two (2) home terminal cost hypotheses for Direct Broadcast Satellite (DBS) based on the expert opinion of DOC officials working in this field and confirmed through various industry experts.

First, it is estimated that a 1.3 meter dish and a 12 dB/°K G/T receiver and channel selector would cost approximately $2,000 in the next 2 or 3 years.

5.2.3.2 Cont'd

Second, industry and government sources anticipate that further technological developments and new markets created by DBS's will lead to a 60 cm dish and a 5.8 dB/°K G/T receiver that would cost approximately $500 within 10 years.

These two (2) hypotheses have been retained for further cost evaluation. It is essential that prospective technical developments be considered in evaluating the most cost effective methods of improving television services in rural and remote communities.

5.2.3.3 Preliminary cost evaluation per residence

On the basis of the two (2) identified capital cost hypotheses, we have calculated the cost per residence of purchasing home terminals. We have ignored the installation costs as well as the operating and maintenance costs. The table on the following page presents the cost estimate for one (1) home terminal per residence for communities of various sizes.

TABLE 41

DBS HOME TERMINAL COST ESTIMATE - VARIOUS COMMUNITY SIZES

NUMBER OF COMMUNITY RESIDENCES	TOTAL CAPITAL COST		EQUIVALENT MONTHLY CAPITAL COST		MONTHLY COST PER RESIDENCE	
	$2,000/unit	$500/unit	$2,000/unit	$500/unit	$2,000/unit	$500/unit
100	200,000	50,000	3,112	778	31.12	7.78
300	600,000	150,000	9,336	2,334	31.12	7.78
500	1,000,000	250,000	15,561	3,890	31.12	7.78

The total capital cost of establishing one (1) $2,000 per unit or $500 per unit home terminals in each of the residences included in the 128 identified communities would be $71.8 million and $17.9 million respectively.

5.2.3.4 Comparison with other exhibition options

The use of only one (1) home terminal must be considered insufficient to receive the full complement of eight (8) television signals in the home, at least until the full implementation of DBS's at some much later date. On this basis, the minimum requirement for two (2) terminals would make the $2,000 unit a prohibitive consumer investment whereas the $500 unit would be of economic interest to communities since it would permit the elimination of the reception and feed component of the communication process. At $15.56 per residence per month, two (2) home terminals would be the most cost effective solution, assuming that the cost of transmission did not change, which is not the case.

5.2.3.5 Potential long term impact of a $500 terminal

The eventual impact of using one (1) home terminal for providing television services to the identified Northern Ontario communities would be substantial assuming high power DBS services for the full eight (8) television signals. On the basis of choosing the least cost technical options, 105 of the 128 communities would eventually choose the satellite home terminal option.

As already noted, such impacts are predicated on important contingencies which will require several years to work out. In the meantime, a significant number of Canadians and Ontarians are insisting on improved television services in the short term. The study does not pursue any further the high power Direct Broadcast Satellite or the possible Anik-C or other direct to home satellite reception since these would appear to require the use of several home terminals to obtain the eight (8) television signals.

5.3 Estimated local exhibition costs per residence

Three (3) local exhibition options were evaluated. The cable television and rebroadcasting station options offer near term local exhibition solutions, providing eight (8) television signals to the 128 communities, assuming the implementation of long haul transmission and local or cluster reception and feed. The satellite home terminal option is not a practically feasible option since it would require more than one terminal to accomodate the projected satellites. The contingencies leading to DBS's would however make home terminals a viable option in the long term.

5.3.1 Least cost per residence exhibition arrangement

The table on the following page presents the least cost per residence for cable television or rebroadcast station services for each community on the basis of an 80% market penetration for the eight (8) television service.

The table indicates that the local exhibition cost for the 18 spread development and dispersed type communities is almost twice and, in some cases, three times the cost per residence for communities characterized by a more dense development pattern.

TABLE 42

LOCAL EXHIBITION COST PER RESIDENCE
80% PENETRATION

COMMUNITY DENSITY PATTERN	CABLE TELEVISION		REBROADCAST STATION	
	NUMBER OF COMMUNITIES	MONTHLY COST PER RESIDENCE $	NUMBER OF COMMUNITIES	MONTHLY COST PER RESIDENCE $
Linear	28	7.81	-	-
Linear with development	14	7.93	-	-
Aspley	-	-	1	7.33
Bala	-	-	1	7.38
Spread development	15	14.22	-	-
Semi-dense	45	7.40	-	-
Dense	9	7.28	-	-
Bancroft	-	-	1	4.12
Barry's Bay	-	-	1	4.64
Burks Falls	-	-	1	6.62
Cobalt	-	-	1	5.40
Ear Falls	-	-	1	6.42
Englehart	-	-	1	5.02
Little Current	-	-	1	6.33
Longlac	-	-	1	5.10
Massey	-	-	1	6.63
Red Lake	-	-	1	5.02
South River	-	-	1	6.46
Mattawa	-	-	1	4.95
Dispersed	3	13.79	-	-
TOTAL	114		14	

5.3.2 Improvements and advantages to cable television services

The cost per residence for cable television services appear high in some cases in comparison with industry yardsticks. This is essentially due to the low overall density pattern of rural and remote communities and the low number of residences for a fixed plant investment.

The effect of modifying the signal quality parameters would not significantly reduce the cost per residence. For example, the use of lower quality equipment, the quantity purchase of equipment, or the greater spacing of amplifiers might reduce the capital investment by 15 to 20%. However, the operating and maintenance costs would not be reduced below the absolute total already calculated. On the contrary, these may rise.

Although new residences could receive the rebroadcast station at no extra cost, the implementation of cable television services has many advantages. The broadcast infrastructure of cable can accomodate other television services and new communication uses such as Telidon at very little extra costs. As these services expand elsewhere in Canada and Ontario, the 128 rural and remote residents of Ontario will also want to have access to these services.

6.0 COST AND TECHNICAL INTEGRATION OF COMMUNICATION SYSTEM

The study to date has evaluated separately technical and cost factors, options and alternatives for each essential element making up the integrated communication system capable of satisfying the defined television needs of rural and remote communities in Northern Ontario.

We now present a cost and technical integration of the long haul transmission, cluster or community reception and feed and local exhibition elements of this communication system. The principal technical options and cost alternatives for each element are retained for consideration as well as the optimized solutions which have been derived and presented in the three (3) technical sections of the report.

The communication system has been broken down into its essential elements to facilitate the analysis. It is however important to stress that it is the successful meshing together of these elements which will ultimately produce the level of service defined in the most cost effective manner. The proposed integration describes the technical applications and the corresponding costs at both the element level as well as at the communication system level. It should be obvious by now that no one single technical solution will improve the level of television services for all rural and remote communities.

The integration concerns the 128 communities of Northern Ontario in such a way that only those technical options which solve a pressing problem, at a corresponding cost per residence, are retained.

6.0 COST AND TECHNICAL INTEGRATION OF COMMUNICATION SYSTEM (cont'd)

Three (3) tables which summarize the technical and cost factors for each element are presented. Taken together they permit the full integration of the elements.

6.1 Integration factors

The following factors were utilized in whole or in part to present each element in the overall integration scheme:

6.1.1 Base alternatives

Cost alternatives are initially identified since these may condition the basis for calculating both total costs as well as costs per residence.

6.1.2 Mode

Establishes the technical means which has been identified to have its application in the context of this study.

6.1.3 Option

Presents the technical options which has been demonstrated to be applicable.

6.1.4 Market coverage

Describes the broad market area for which the option, if retained, could reach if integrated with the other elements.

6.1.5 Signals / signal reception

Identifies various groups of signals when the option concerns less than the full eight (8) signals / the method of signal reception.

6.1.6 Number of communities

The applicable number of communities

6.1.7 Expected market

The number of residences in the market coverage area on the basis of 80% market penetration.

6.1.8 Capital investment

The total equipment and associated civil, electrical and other works including installation, engineering and transportation.

6.1.9 Operating and maintenance costs

The total costs of operating and maintaining the facilities for which a capital investment is proposed.

6.1.10 Service costs

The total cost of leasing terrestrial microwave or satellite services from a public common carrier.

6.1.11 Monthly cost / residence

The summation of all costs including the equivalent capital cost, the service costs and the operating costs divided by the expected number of residences as defined by the market coverage.

6.1.12 Study clusters or communities

The listing of the clusters, the clusters and communities, or the communities for which a corresponding monthly cost per residence has been identified.

6.2 Method of calculation

The data presented in the integration tables were obtained by referring to tables and appendices which contain the required information in whole or in part. References are provided to track the data to its source. For specific cases, the data was extracted from the reference tables and computed separately. Only the derived least cost solutions are presented.

6.3 Integration tables

The tables on the following pages present the technical and cost summary for each element. All three (3) tables must be taken together to identify the particular elements to make up a viable communication system. The following communication systems are identified:

6.3.1 Satellite 12 GHz long haul transmission, cluster or community reception and feed at 1980 equipment and services costs, and cable and rebroadcast local exhibition.

6.3.2 Satellite 12 GHz long haul transmission, cluster or community reception and feed at expected mid 1980's TVRO costs, and cable and rebroadcast local exhibition.

6.3.3 Satellite 4 GHz long haul transmission, cluster or community reception and feed at 1980 equipment and service costs, and cable and rebroadcast local exhibition.

6.3.4 Satellite 4 GHz long haul transmission, cluster or community reception and feed at expected mid 1980's TVRO costs, and cable and rebroadcast local exhibition.

TABLE 43

SUMMARY: LONG HAUL TRANSMISSION - 8 SIGNALS

COSTS SUPPORTED EXCLUSIVELY BY COMMUNITY USERS							COSTS SUPPORTED BY SIGNAL PROVIDER		
TERRESTRIAL MICROWAVE	SATELLITE						SATELLITE		BASE ALTERNATIVES
	12 GHz			4 GHz			12 GHz	4 GHz	MODE
STUDY SPECIFIC CLUSTERS CTV	ONTARIO			CANADA			ONTARIO	CANADA	OPTION
	CHCH CITY TVA	CHCH CITY GLOBAL	CHCH CITY GLOBAL TVA	CHCH CITY TVA	CHCH CITY GLOBAL	CHCH CITY GLOBAL TVA	OECA	CBC-E CBC-F	MARKET COVERAGE
2,458	2,992,518	1,398,242	3,087,977	9,716,017	9,241,742	12,425,972	N/A	N/A	SIGNALS
-	-	-	-	-	-	-	-	-	EXPECTED MARKET : CUMULATIVE SIGNAL - RESIDENCES (TABLES 14 , 16)
414,000	3,000,000	3,000,000	4,000,000	3,000,000	3,000,000	4,000,000	-	-	CAPITAL INVESTMENT - $
-	-	-	-	-	-	-	-	-	ANNUAL SERVICE COSTS - $ (TABLE 11)
RANGE 1.79 TO 54.55 AVERAGE 14.04	.32	1.14	1.19	0.08	0.08	0.11	-	-	OPERATING & MAINTENANCE COSTS - $
									MONTHLY COST / RESIDENCE - $ (TABLES 15 , 16)
MOOSENEE LONGLAC STRATTON ARMSTRONG PICKLE LAKE	BARRY'S BAY BANCROFT GOODERHAM	COBALT KING KIRKLAND RAMORE	ALL OTHERS (23)	BARRY'S BAY BANCROFT GOODERHAM	COBALT KING KIRKLAND RAMORE	ALL OTHERS (23)	N/A	N/A	STUDY CLUSTERS

(1) Relative market size is demonstrated by adding up the number of residences for each signal contained in the identified signal package. The cumulative total can not be utilized to compute directly the monthly cost/residence.

TABLE 44
SUMMARY: OPTIMIZED LOCAL OR CLUSTER RECEPTION AND FEED - 8 SIGNALS

1980 COST FOR TVRO'S						EXPECTED MID 1980'S COST FOR TVRO'S						
LOCAL BROADCAST RECEPTION, TVRO		SHARED USE OF BROADCAST RECEPTION, TVRO AND VHCM				LOCAL BROADCAST RECEPTION, TVRO		SHARED USE OF BROADCAST RECEPTION, TVRO AND VHCM				BASE ALTERNATIVES
ONE (1) COMMUNITY		CLUSTER		CLUSTER WITH CABLED COMMUNITIES		ONE (1) COMMUNITY		CLUSTER		CLUSTER WITH CABLED COMMUNITIES		OPTION
OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	OFF-AIR LONG HAUL MICROWAVE SATELLITE	CLUSTER MICROWAVE CTV	MARKET COVERAGE
												SIGNAL RECEPTION
33	* 7	95	24	113	24	101	*15	27	24	33	30	NUMBER OF COMMUNITIES (TABLE 28, 30; 21, 26)
7,391	-	21,311	-	93,779	-	20,817	-	7,885	-	13,142	-	EXPECTED MARKET - RESIDENCES (TABLE 28, 30)
2,930,400	-	9,644,849	-	10,184,849	-	4,214,375	-	2,903,021	-	3,083,021	-	CAPITAL INVESTMENT - $ (TABLE 21, 23, 27)
-	10,500	-	7,500	-	7,500	-	16,500	-	6,000	-	6,000	SERVICE COSTS / MONTH - $ (TABLE 21' APPENDIX 4.3.2.2)
22,400	-	31,380	-	31,380	-	48,310	-	9,923	-	9,923	-	OPERATING AND MAINTENANCE/MONTH (APPENDIX 4.3.1.2, 4.3.2.2, 4.4.1.3)
RANGE 2.57 TO 45.64 MATTAWA MICHIPICOTEN AVERAGE 10.62		RANGE 5.16 TO 22.26 SUNDRIDGE HUDSON AVERAGE 8.87		RANGE 0.45 TO 8.33 ST-CHARLES GOODERHAM AVERAGE 2.10		RANGE 1.40 TO 33.51 MATTAWA MICHIPICOTEN AVERAGE 6.26		RANGE 6.35 TO 10.24 BARRY'S BAY GOODERHAM AVERAGE 7.74		RANGE 2.46 TO 7.73 STRATTON GOODERHAM AVERAGE 4.87		MONTHLY COST / RESIDENCE - $ (TABLE 30, 28)
BONFIELD CALLANDER CORBEIL MATTAWA POWASSAN IRON BRIDGE SPANISH SPRAGGE THESSALON COBALT LATCHFORD TEMAGAMI FOLEYET GOGAMA HOLTYRE MATHESON RAMORE VAL GAGNE	DUBREUILVILLE MICHIPICOTEN R. FAUQUIER MOONBEAM OPASATIKA VAL RITA CALSTOCK MOOSONEE KAKABEKA FALLS MINAKI REDDIT SIOUX NARROWS HERON BAY ARMSTRONG PICKLE LAKE	BARRY'S BAY (5) BANCROFT (5) GOODERHAM (6) SPRUCEDALE (13) SUNDRIDGE (7) MAGNETAWAN (5) ST-CHARLES (12) WEBBWOOD (6) LITTLE CURRENT (4) ECHOBAY (7) KING KIRKLAND (8) LONGLAC (3) HUDSON (4) EAR FALLS (4) STRATTON (4)	(+1) (+1) (+2) (+3) - (+1) (+2) (+1) (+1) (+1) (+2) (+1) (+1) - (+1)	SAME, PLUS: BALA BAYSVILLE DORSET DWIGHT HONEY HARBOUR MACTIER MILFORD BAY NOVAR PORT CARLING PORT SYDNEY ROSSEAU SPRUCEDALE UTTERSON BURK'S FALLS EMSDALE KATRINE KEARNEY SOUTH RIVER SUNDRIDGE TROUT CREEK ARNSTEIN BRITT LORING MAGNETAWAN MCKELLAR NOBEL POINTE AU BARIL ALBAN DINORWIC HUDSON VERMILLION BAY WABIGOON	CRYSTAL FALLS FIELD HOGAN MARKSTAY NOELVILLE RIVER VALLEY SKEAD ST-CHARLES VERNER WAHNAPITAE CARTIER KILLARNEY MASSEY NAIRN CENTER WEBBWOOD WHITE FISH LITTLE CURRENT MANITOWANING MINDEMOYA WIKWEMIKONG BATCHAWANA BAY BRUCE MINES DESBARATS ECHOBAY MILTON BEACH RICHARDS LANDING SEARCHMOUNT EARLTON ELK LAKE ENGLEHART KEARNS KING KIRKLAND LARDER LAKE MATACHEWAN VIRGINIATOWN	BARRY'S BAY (5) BANCROFT (5) GOODERHAM (6) LONGLAC (3) STRATTON (4) EAR FALLS (4) ( ) NUMBER OF COMMUNITIES IN CLUSTER	(+1) (+1) (+2) (+1) (+1) - ( ) NUMBER OF CABLED COMMUNITIES	CLUSTER / COMMUNITIES ( ) NUMBER OF COMMUNITIES IN CLUSTER

* INCLUDED IN OFF-AIR, SATELLITE AND LONG HAUL MICROWAVE TOTAL

TABLE 45

SUMMARY: OPTIMIZED LOCAL EXHIBITION - 8 SIGNALS

CATV						REBROADCAST		
LOCAL COMMUNITY - CABLE						LOCAL COMMUNITY-2 MILE RADIUS		MARKET COVERAGE
DENSITY PATTERNS						BREAK - EVEN RESIDENCES		DETERMINANT COST VARIABLE
LINEAR	LINEAR WITH DEVELOPMENT	SPREAD	SEMI-DENSE	DENSE	DISPERSED	LINEAR WITH DEVELOPMENT > 525 RESIDENCES	DENSE > 575 RESIDENCES	
28	14	15	45	9	3	2	12	NUMBER OF COMMUNITIES (TABLE 34)
3,666	2,214	2,000	8,302	3,487	385	848	7,800	EXPECTED MARKET - RESIDENCES (TABLE 40)
788,276	481,806	780,000	1,681,074	759,840	146,224	335,040	2,295,000	CAPITAL INVESTMENT - $ (TABLE 37) CALCULATIONS, 33, 34)
197,069	120,452	195,000	420,268	189,960	36,556	12280	73680	OPERATING AND MAINTENANCE ANNUAL COSTS- $
7.81	7.93	14.22	7.40	7.28	13.79	RANGE 7.33 TO 7.38 AVERAGE 7.35	RANGE 4.12 TO 6.63 AVERAGE 5.36	MONTHLY COST / RESIDENCE - $ (TABLE 42)

ALBAN BATCHAWANA BAY BRITT COE HILL COMBERMERE CORBEIL DORSET EMSDALE HAGAR HERON BAY KATRINE KEARNEY LORING MADAWASKA MAYNOOTH MINDEMOYA NOBEL NOELVILLE QUADEVILLE RIVER VALLEY SEARCHMOUNT SPRAGGE SPRUCEDALE STRATTON UTTERSON VAL GAGNE WILBERFORCE ECHO BAY	ARMSTRONG BARWICK BRUCE MINES CRYSTAL FALLS DESBARATS DINORWIRC HOLTYRE MACTIER NORLAND NOVAR VERMILLION BAY WHITE FISH WIKWEMIKONG EMO	FIELD GOODERHAM HONEY HARBOUR KINMOUNT MILFORD BAY MINAKI PORT CARLING ROSSEAU SIOUX NARROWS SKEAD ARNSTEIN DWIGHT MCKELLAR POINTE AU BARIL PORT SYDNEY	ALL OTHERS (45)	CALLANDER CHALK RIVER EARLTON LARDER LAKE MATHESON POWASSAN RAINY RIVER SUNDRIDGE THESSALON	CARAMAT CENTRAL PATRICIA-PICKLE LAKE REDDIT	APSLEY BALA	BANCROFT BARRY'S BAY BURKS FALLS COBALT EAR FALLS ENGLEHART LITTLE CURRENT LONGLAC MASSEY RED LAKE SOUTH RIVER MATTAWA	COMMUNITIES

7.0 RESULTS AND CONCLUSIONS

The work carried out in the course of this study has shown the potential application of several technical options to be technically and economically feasible and necessary for the provision of an eight (8) Canadian television signal package to rural and remote communities of Northern Ontario.

The integration of the elements making up the communication system appears to be economically attractive for some communities but not all communities, depending on signal availability, remoteness, type of community layout and low number of residences. The cost per residence could be as low as $13.00 or $14.00 per month but higher than $25.00 per month.

Satellite transmission should be the preferred long haul transmission method to improving Canadian television services in rural and remote Northern Ontario. The CTV signal, required by only 9 communities, was the only signal where the terrestrial microwave method was less costly.

However, this would not be the case if the Canadian market requirement for this signal was taken into account.

Satellite transmission could be established to cover Ontario alone using Anik 12 GHz transmission or to cover Canada using Anik 4 GHz transmission. The former has the advantage of specializing the signal "package" to meet Ontario resident needs; the latter has the advantage of potentially costing ten (10) times less if the costs were to be supported by community users.

7.0 RESULTS AND CONCLUSIONS (cont'd)

The introduction of satellite transmission and the continued fall in satellite earth station costs would appear to favour the establishment by each community of receive and feed facilities. This trend would have to be verified in light of possible increases in the number of communities needing improved television services and of the need to also provide popular foreign signals which might only be made available on a microwave basis. These factors would tend to make the shared use of common receive and feed facilities more attractive.

Local community cable television plants were demonstrated to be an economical and attractive solution to exhibit the eight (8) television signals in the majority of communities. There are small-size community types where rebroadcast stations would be economically attractive. This latter solution would appear to have technical and economic limitations beyond the provision of 8 signals and beyond a coverage of 4 miles when compared with the cable television option.

The cost estimated for each element was based on typical conditions and 1980 market costs. It would be possible that some of the basic capital and service costs could be reduced on the basis of further investigation in the following areas:

. Optimization of satellite transmission costs as a result of "package" transmission;

. Back-haul requirements and engineering:

. Detail design of reception and feed facilities and exhibition cable plant or rebroadcast station when applied to specific communities or clusters;

7.0 RESULTS AND CONCLUSIONS (cont'd)

. Development of low cost equipment "package" for rural and remote community television services;

. Establishment with DOC of overall multi-link telecommunication system quality levels and standards, not presently available;

The study also raises other issues which should be the subject of further investigation, namely:

. Establishment of implementation responsibilities;

. Encouraging the participation of local and regional entrepreneurs in the television service improvement process;

. Adding local and regional television content to the Canadian television package;

. Possible future television service developments;

. Establishing the appropriate costs to be supported by rural and remote communities for the improved services;

. Integrating the requirements for foreign television signals as part of meeting the overall television needs of rural and remote communities.

8.0 RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations can be formulated to pursue the development of policies which will have the effect of improving Canadian television services in Northern Ontario rural and remote communities.

1) A market study taking into account not only the costs developed in this study but also the added entrepreneurs costs to initiate and operate the various service elements making up the communication system should be conducted to establish the full economic impact including the market acceptability of tariff rates to community users;

2) An analysis of the implementation requirements with a view to obtain the full cooperation of each industry associated with the improvement of television services in Northern Ontario and elsewhere and including local and regional cable operators, broadcast undertakings, common carriers, government departments and municipal governments.

   One particular aspect of such an analysis would relate to the possible organization structures at local, cluster, provincial and national levels which would have operating and maintenance responsibilities for all parts of the communication system;

3) The development by governments of technical and economic models of the television communication system with a view to speeding up and increasing the depth of the analysis of impacts due to new technology developments. It is suggested that a modeling tool and its subsequent use, by simulating technical or cost changes would assist industry and government policy makers to adapt more rapidly to changing technology, thereby accelerating television service improvements to the rural and remote communities;

8.0 RECOMMENDATIONS (cont'd)

4) The analysis of Department of communications quality and reliability factors in order to develop norms and standards which could be applied when considering a full communication system involving the tandeming of long haul transmission systems with receive and feed systems and with local exhibition systems. Such an analysis would perhaps ensure that the television needs of rural and remote communities could be met in the most economical way possible as a result of optimizing certain quality and reliability factors;

5) The two (2) governments should continue research studies which would lead to design guidelines and standard specifications for certain system and equipment components associated with receive and feed technology and local exhibition technology. This approach could lead to quantity purchasing of equipment as well as reduced engineering costs.

PART 3

DETAILED TECHNICAL AND COST APPENDICES

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TO
SECTION 2 - INTRODUCTION

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2.3 Signal Availability

2.3.1 List of Television signals in each community

2.3.2 Cable television services in Ontario-selected signals

ORIGINAL LIST OF ONTARIO COMMUNITIES

(500 RESIDENCES OR MORE)

	MUNICIPALITY	1979 POPULATION	1979 HOUSEHOLDS	POPULATION 1991
N.W	MICHIPICOTEN HARBOUR	4788	1686	5230
	HUDSON	583	163	550
	RAINY RIVER	1036	451	950
N.E.	BRUCE MINES	584	237	500
	BURK'S FALLS	868	391	750
	COBALT	1817	574	2100
	ENGLEHART	1706	636	2100
	LATCHFORD	432	162	400
	LITTLE CURRENT	1536	561	750
	MASSEY	1328	434	1600
	MATTAWA	2644	875	2750
	POWASSAN	1209	374	1220
	SOUTH RIVER	1118	429	1100
	SUNDRIDGE	740	330	600
	THESSALON	696	266	700
	TROUT CREEK	656	203	625
	WEBBWOOD	525	185	430
	EARLTON	1500		1690
	ELK LAKE	639		580
	FAUQUIER	926		750
	FIELD	850	220	875
	FOLEYET	800	125	630
	GOGAMA	700	170	525
	HAGAR	1100	296	1835
	LARDER LAKE	1267	470	1100
	IRON BRIDGE	813	475	750
	MOOSEBEAM	1460	272	1030
	OPASATIKA	800	140	600
	SPANISH	2065		1230
	TEMAGAMI	1295	671	1015
EAST	ALEXANDRIA	3341	1172	
	ALFRED	1079	351	
	ATHENS	954	359	
	BARCROFT	2287	869	
	BARRY'S BAY	1269	479	
	BATH	1004	388	
	BEACH BURG	670	267	
	BLOOMFIELD	729	279	
	BRAESIDE	489	161	
	CARDINAL	1742	708	
	CASSELMAN	1692	465	
	CHALK RIVER	1001	335	
	CHESTERVILLE	1413	524	
	EGANVILLE	1292	496	
	IROQUOIS	1201	449	
	KILLALOE STN	716	278	
	LANARK	754	283	
	LANCASTER	642	221	
	MARMORA	1301	535	
	MAXVILLE	836	282	
	MERRICKVILLE	986	382	
	MORRISBURG	2319	874	
	NEWBURGH	605	200	
	PLANTAGENET	950	283	
	ST-ISIDORE DE PRESCOTT	742	239	
	STIRLING	1571	601	
	TWEED	1593	642	
	VANKLEEK HILL	1685	628	
	WELLINGTON	1090	501	
	WESTPORT	674	293	
	WINCHESTER	1886	702	
CENTRAL	BEETON	1674	566	1900
	BOBCAYGEON	1584	798	1600
	BRIGHTON	3184	1302	3700
	CLIFFORD	605	255	985
	COLBORNE	1790	701	2315
	COLDWATER	774	329	1400
	COOKSTOWN	836	340	1000
	CREEMORE	1104	395	1200
	DRAYTON	768	297	1385
	ELMVALE	1162	465	1270
	ERIN	5767	1815	3355
	FENELON FALLS	1656	862	1910
	GRAND VALLEY	1219	402	1535
	HASTINGS	929	447	1000
	HAVELOCK	1293	530	1650
	LAKEFIELD	2296	836	2250
	MILLBROOK	922	349	900
	NIAGARA-ON-THE-LAKE	12307	4225	12500
	NORWOOD	1307	514	1945
	OMEMEE	813	352	1035
	SHELBURNE	2899	1070	3900
	TOTTENHAM	2926	846	4000
	WASAGA BEACH	4609	4921	6000
	WOODVILLE	570	225	780
SOUTH	SPRINGFIELD	515	181	
	ST-CLAIR BEACH	2664	642	
	TARA	695	279	
	TECUMSEH	5990	1800	
	TEESWATER	1008	404	
	THAMESVILLE	1006	379	
	THEDFORD	691	271	
	TORNBURY	1424	702	
	TILBURY	4348	1421	
	TIVERTON	792	269	
	WATFORD	1433	535	
	WEST LORNE	1283	536	
	WHEATLEY	1600	556	
	WIARTON	2132	829	
	WYOMING	1554	541	
	ZURICH	775	296	

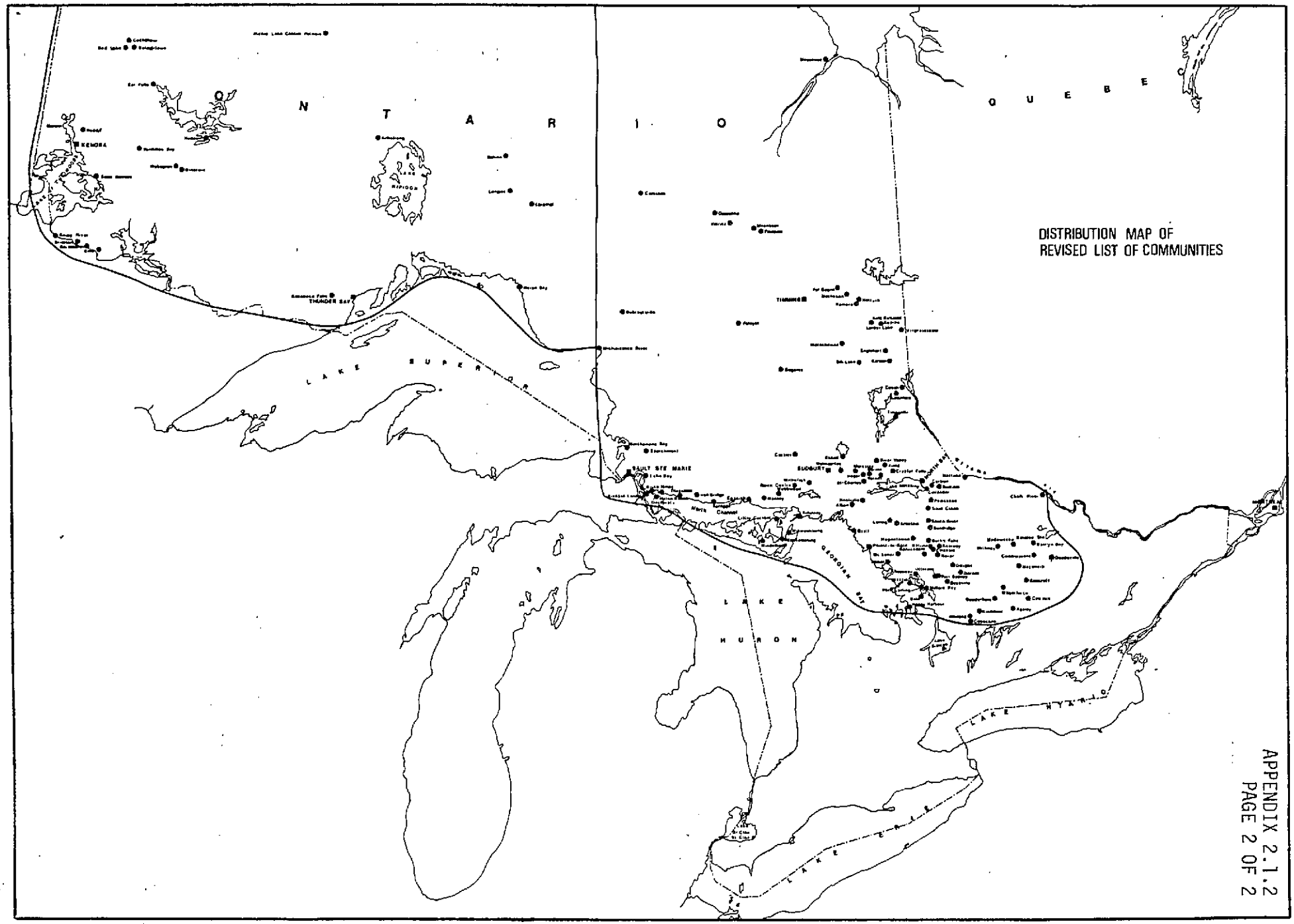
REVISED LIST OF NORTHERN ONTARIO COMMUNITIES

(100 RESIDENCES OR MORE)

COMMUNITIES	1979 RESIDENCES	PROJECTED POPULATION* 1991
ALBAN	280	425
APSLEY	532	340
ARNSTEIN	110	340
ARMSTRONG	196	700
BALA	527	621
BALMERTOWN	326	1350
BANCROFT	1220	2610
BARRY'S BAY	1010	1970
BARWICK	102	65
BATCHAWANA BAY	126	960
BAYSVILLE	242	653
BONFIELD	157	1200
BRITT	110	770
BRUCE MINES	236	610
BURK'S FALLS	608	800
CALLANDER	573	1430
CALSTOCK	201	140
CARAMAT	136	380
CARTIER	237	690
CENTRAL PATRICIA - P.L	216	300
CHALK RIVER	425	1845
COBALT	806	2155
COBOCONK	310	411
COCHENOUR	174	280
COE HILL	185	310
COMBERMERE	126	255
CORBEIL	118	620
CRYSTALL FALLS	150	120
DESBARATS	158	480
DINORWIRC	120	320
DORSET	205	203
DUBREUILVILLE	311	850
DWIGHT	188	347
EAR FALLS	634	3300
EARLTON	406	1810
ECHO BAY	270	1160
ELK LAKE	250	580
EMO	390	880
EMSDALE	176	510
ENGLEHART	896	2140
FAUQUIER	197	600
FIELD	168	700
FOLEYET	186	690
GOGAMA	245	615
GOODERHAM	157	525
HAGAR	144	325
HERON BAY	139	150
HILTON BEACH	144	395
HOLTYRE	134	400
HONEY HARBOUR	155	231
HUDSON STATION	140	590
IRON BRIDGE	280	750
KAKABEKA FALLS	218	400
KATRINE	110	470
KEARNEY	253	250
KEARNS	139	550
KILLALOE STN	306	1105
KILLARNEY	125	400
KING KIRKLAND	125	400
KINMOUNT	187	273
LARDER LAKE	444	1100
LATCHFORD	159	490
LITTLE CURRENT	646	1510
LONGLAC P.O. & STATION	875	2750

COMMUNITIES	1979 RESIDENCES	PROJECTED POPULATION* 1991
LORING	112	215
MACTIER	344	843
MADAWASKA	135	350
MAGNETAWAN	133	250
MANITOWANING	366	510
MASSEY	609	1600
MARKSTAY	255	515
MATACHEWAN	156	590
MATHESON	488	1230
MATTAWA	925	2750
MAYNOOTH	158	220
MC KELLAR	172	480
MICHIPICOTEN RIVER	100	230
MILFORD BAY	150	625
MINAKI	131	320
MINDEMOYA	202	830
MOONBEAM	270	1030
MOOSONEE	299	1675
NAIRN CENTRE	161	635
NAKINA	302	1200
NOBEL	203	630
NOELVILLE	315	875
NORLAND	125	279
NOVAR	131	580
OPASATIKA	136	650
POINTE-AU-BARIL STN	121	285
PORT CARLING	259	883
PORT SYDNEY	147	900
POWASSAN	495	1450
QUADEVILLE	100	105
RAINY RIVER	443	1100
RAMORE	240	540
REDDIT	129	210
RED LAKE	895	2220
RICHARD LANDING	158	695
RIVER VALLEY	104	295
ROSSEAU	180	230
SEARCHMONT	165	550
SIOUX NARROWS	210	450
SKEAD	165	380
SOUTH RIVER	629	1220
SPANISH	347	955
SPRAGGE	122	150
SPRUCEDALE	160	270
ST-CHARLES	186	465
STRATTON	113	145
SUNDRIGE	570	600
TEMAGAMI	357	1770
THESSALON	512	1700
TROUT CREEK	265	750
UTTERSON	109	850
VAL GAGNE	178	700
VAL RITA	163	760
VERMILLION BAY	276	720
VERNER	351	1050
VIRGINIATOWN	334	985
WABIGOON	178	355
WAHNAPITAE	354	1500
WARREN	260	710
WEBWOOD	209	430
WHITE FISH	178	195
WIKWEMIKONG	229	300
WILBERFORCE	165	961
WITHNEY	325	
TOTAL	35878	97545

MUNICIPAL ASSESSMENT BRANCH, ONTARIO MINISTRY OF TREASURY AND ECONOMICS


ONTARIO
QUEBEC
DISTRICT OF KENORA
DISTRICT OF THUNDER BAY
DISTRICT OF SUDBURY
DISTRICT OF ALGOMA
DISTRICT OF NIPISSING
DISTRICT OF PARRY SOUND
DISTRICT OF MANITOULIN
DISTRICT OF TIMISKAMING
KENORA
THUNDER BAY
SUDBURY
SAULT STE MARIE
TIMMINS
LAKE SUPERIOR
LAKE HURON
GEORGIAN BAY
LAKE ERIE
LAKE ONTARIO
DISTRIBUTION MAP OF
REVISED LIST OF COMMUNITIES

APPENDIX 2.2.1
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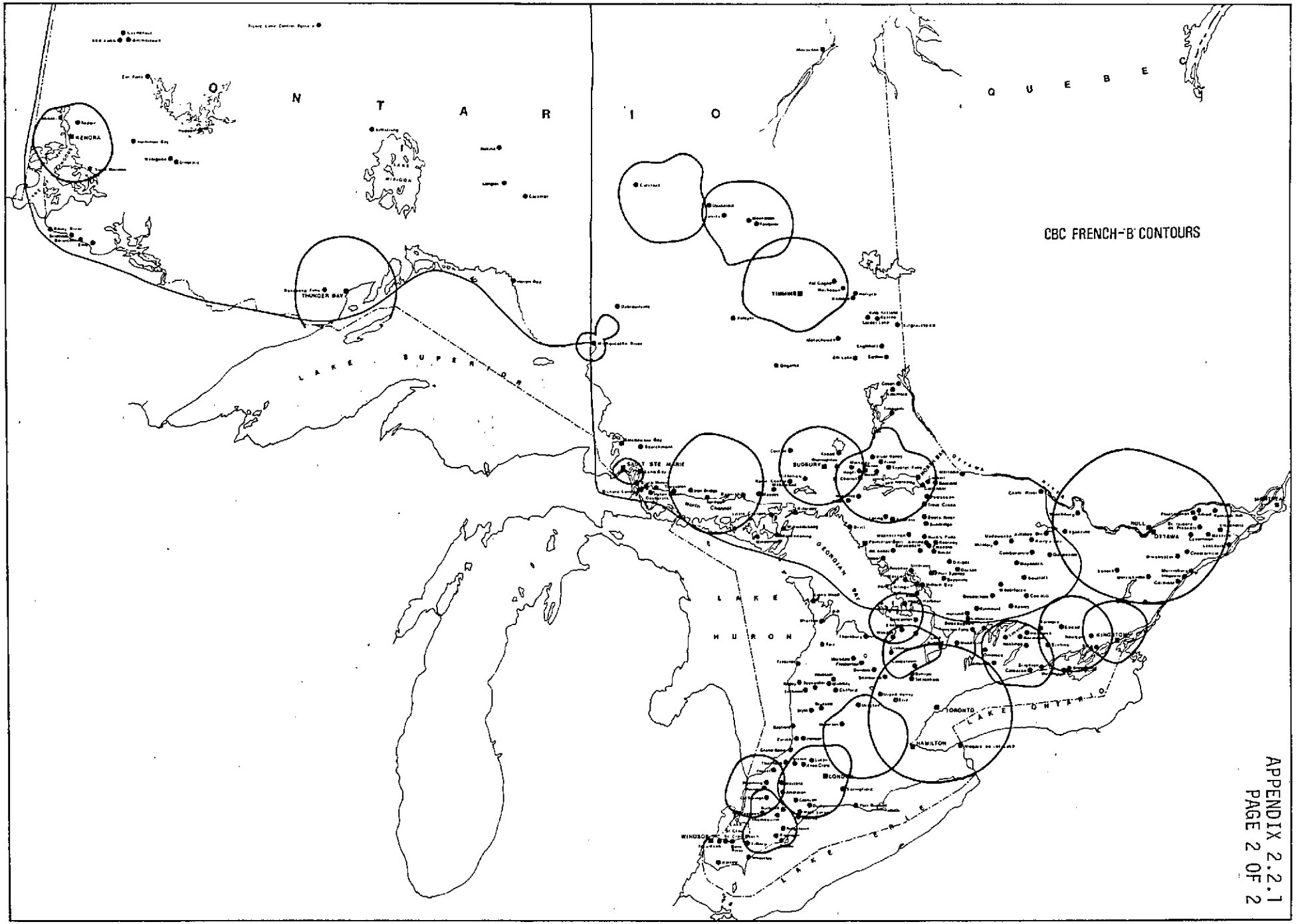

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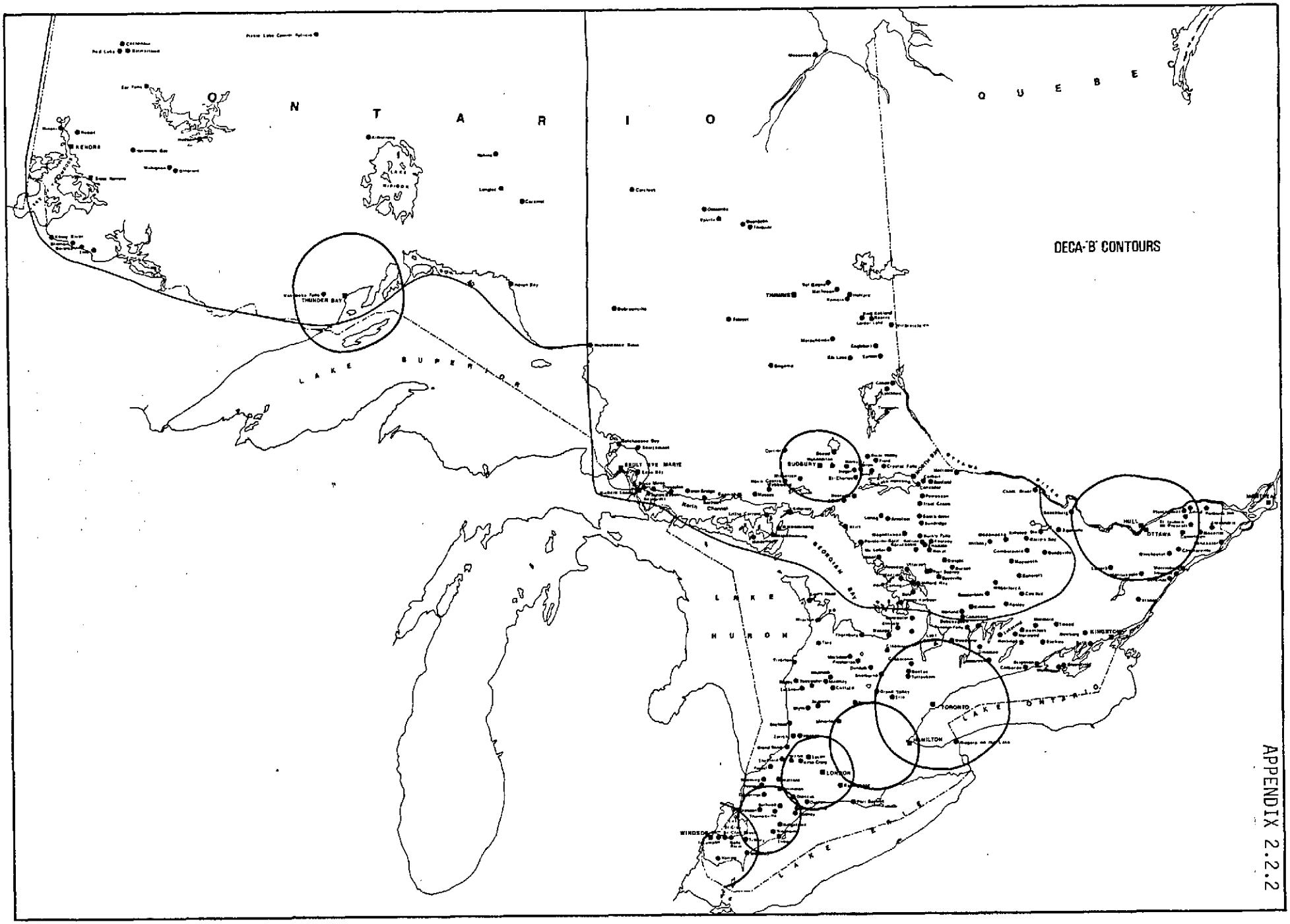
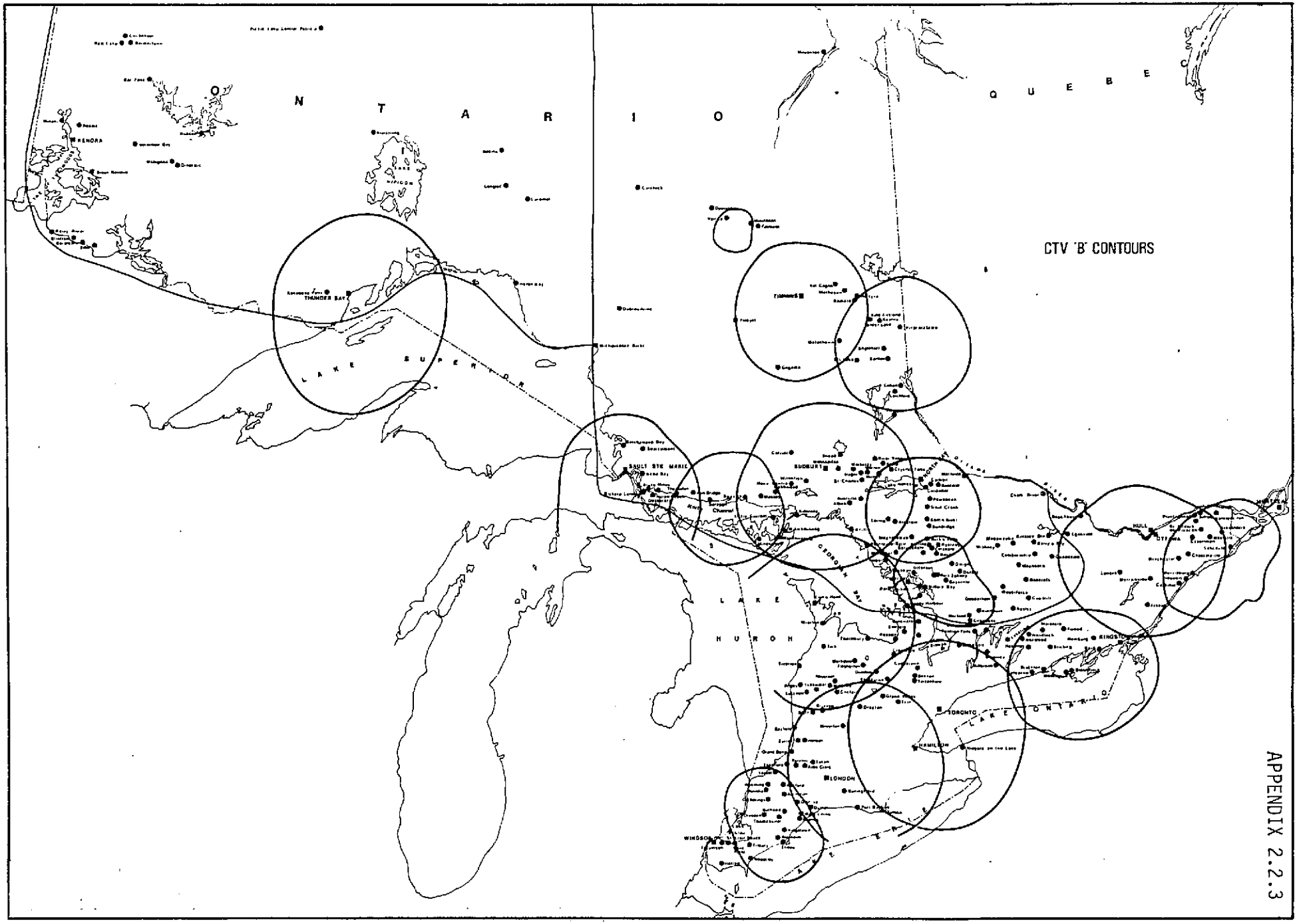


APPENDIX 2.2.2



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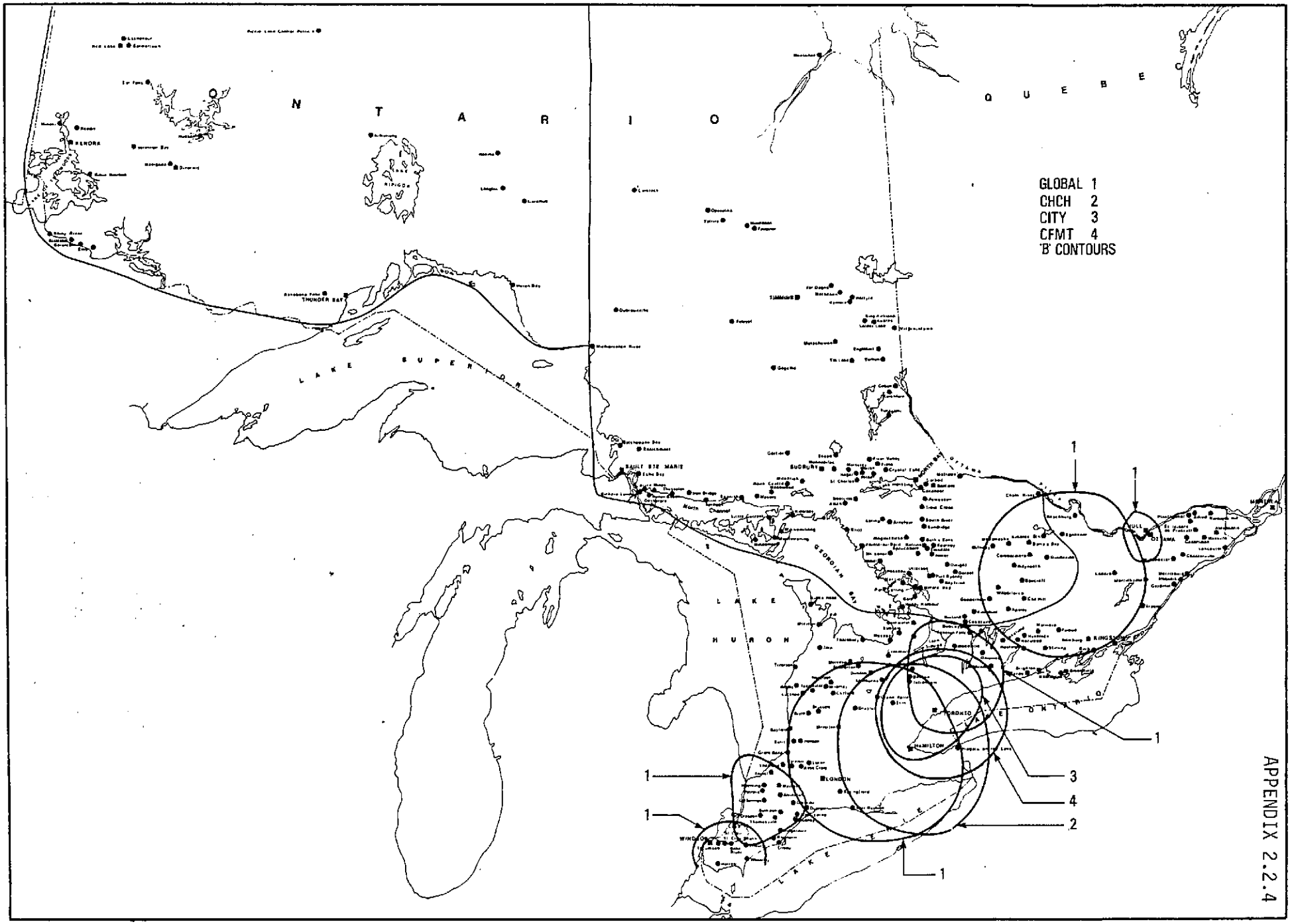

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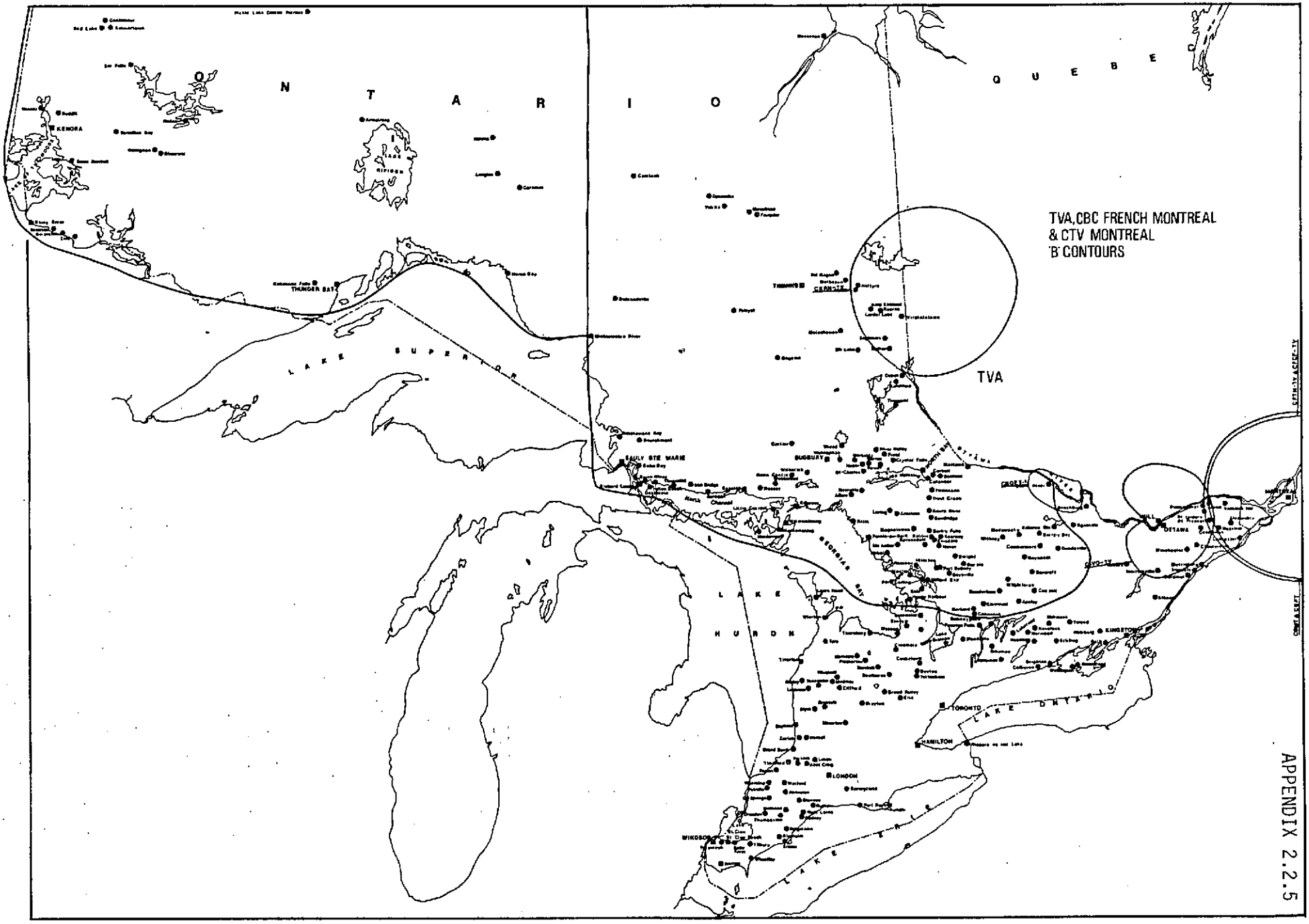

APPENDIX 2.2.5

LIST OF TELEVISION SIGNALS IN EACH COMMUNITY

COMMUNITIES \ STATIONS	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				EHCH	CITY
ALBAN	●	●	●	●				
APSLEY	●				●			
ARNSTEIN	●	●		●				
ARMSTRONG	●							
BALA	●			●				
BALMERTOWN	●							
BANCROFT	●				●			
BARRY'S BAY	●				●			
BARWICK	●							
BATCHAWANA BAY	●		●	●				
BAYSVILLE	●			●				
BONFIELD	●	●		●				
BRITT	●			●				
BRUCE MINES	●			●				
BURK'S FALLS	●			●				
CALLANDER	●	●		●				
CALSTOCK		●						
CARAMAT	●							
CARTIER	●	●	●	●				
CENTRAL PATRICIA	●							
CHALK RIVER	●	●			●			
COBALT	●			●		●		
COBOCONK	●							
COCHENOUR	●							
COE HILL	●				●			
COMBERMERE	●				●			
CORBEIL	●	●		●				
CRYSTALL FALLS	●	●		●				
DESBARATS	●			●				
DINORWIRC	●							
DORSET	●			●				
DUBREUILVILLE	●							
DWIGHT	●			●				
EAR FALLS	●							
EARLTON	●			●		●		
ECHO BAY	●	●	●	●				
ELK LAKE	●			●				
EMO	●							
EMSDALE	●			●				
ENGLEHART	●			●		●		
FAUQUIER	●	●		●				
FIELD	●	●		●				
FOLEYET	●			●				
GOGAMA	●			●				
GOODERHAM	●				●			
HAGAR	●	●	●	●				
HERON BAY	●							
HILTON BEACH	●			●				
HOLTYRE	●			●		●		
HONEY HARBOUR	●	●		●				
HUDSON	●							
IRON BRIDGE	●	●		●				
KAKABEKA FALLS	●	●	●	●				
KATRINE	●			●				
KEARNEY	●			●				
KEARNS	●			●		●		
KILLALOE STN	●				●			
KILLARNEY	●			●				
KING KIRKLAND	●			●		●		
KINMOUNT	●				●			

CRITERIA: "B" CONTOURS

LIST OF TELEVISION SIGNALS IN EACH COMMUNITY (CONT'D)

COMMUNITIES \ STATIONS	BASIC TV SERVICE				OPTIONAL			
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE	
	CBC-E	CBC-F	OECA				CHCH	CITY
LARDER LAKE	●			●		●		
LATCHFORD	●			●				
LITTLE CURRENT	●			●				
LONGLAC	●							
LORING	●	●		●				
MACTIER	●			●				
MADAWASKA					●			
MAGNETAWAN	●			●				
MANITOWANING				●				
MASSEY	●	●		●				
MARKSTAY	●	●	●	●				
MATACHEWAN	●			●				
MATHESON	●	●		●		●		
MATTAWA	●			●				
MAYNOOTH					●			
MC KELLAR	●			●				
MICHIPICOTEN RIVER	●	●						
MILFORD BAY	●			●				
MINAKI	●	●						
MINDEMOYA				●				
MOONBEAM	●	●		●				
MOOSONEE	●							
NAIRN CENTRE	●	●	●	●				
NAKINA	●							
NOBEL	●			●				
NOELVILLE	●	●	●	●				
NORLAND	●							
NOVAR	●			●				
OPASATIKA	●	●		●				
POINTE-AU-BARIL STN	●			●				
PORT CARLING	●			●				
PORT SIDNEY	●			●				
POWASSAN	●	●		●				
QUADEVILLE	●				●			
RAINY RIVER	●							
RAMORE	●			●		●		
REDDIT	●	●						
REDLAKE	●							
RICHARD LANDING	●			●				
RIVER VALLEY	●	●		●				
ROSSEAU	●			●				
SEARCHMONT	●		●	●				
SIOUX NARROWS	●	●						
SKEAD	●		●	●				
SOUTH RIVER	●			●				
SPANISH	●	●		●				
SPRAGGE	●	●		●				
SPRUCEDALE	●			●				
ST-CHARLES	●	●	●	●				
STRATTON	●							
SUNDRIDGE	●			●				
TEMAGAMI				●				
THESSALON	●	●		●				
TROUT CREEK	●	●		●				
UTTERSON	●			●				
VAL GAGNE	●	●		●		●		
VAL RITA	●	●		●				
VERMILLION BAY	●							
VERNER	●	●		●				
VIRGINIATOWN	●			●		●		
WABIGOON	●							
WAHNAPITAE	●	●	●	●				
WARREN	●	●	●	●				
WEBWOOD	●			●				
WHITE FISH	●	●	●	●				
WIKWEMIKONG				●				
WILBERFORCE	●				●			
WITHNEY					●			

CRITERIA: "B" CONTOURS

CABLE TELEVISION SERVICES IN ONTARIO

APPENDIX 2.3.2

SELECTED SIGNALS

COMMUNITIES	ACTUAL SUBS	POTENTIAL SUBS	CBC E	CBC F	OMNI	CTV	GLOBAL	TVA	CITY	CHCH
AJAX	6745	7426	—	—	—	—	—		—	—
ALGONQUIN	1121	2450	—	—	—	—	—	—		
ATTAWAPISKAT	1401	1704	—		—	—				
AURORA	4100	9538	—	—	—	—	—		—	—
AYLMER	1765	2000	—	—	—	—	—			—
BARRIE	12984	15191	—	—	—	—	—		—	—
BEARDMORE	401	310	—		—					
BELLEVILLE	19676	22800	—	—	—	—	—			
BLIND RIVER	489	1000	—	—	—	—	—	—		
BOLTON	1600	1700	—	—	—	—	—		—	—
BRACEBRIDGE	1702	1850	—	—	—	—	—			
BRAMPTON	28000	52000	—	—	—	—	—		—	—
BRANTFORD	25348	30500	—	—	—	—	—			—
BROCKVILLE	5224	7075	—	—	—	—	—			
BURLINGTON	21140	36770	—	—	—	—	—		—	—
CAMP BORDEN	1944	4250	—	—	—	—	—		—	—
CAMPBELLFORD	1160	1364	—	—		—	—			
CARDIFF	145	229	—			—	—			
CHAPLEAU	964	1050	—			—				
CHATHAM	11340	14180	—	—	—	—	—			
CHESLEY	368	750	—		—	—	—			—
COBOURG	1227	4900	—	—	—	—	—		—	—
COCHRANE	1102	1400	—	—	—	—	—	—		
COLLINGWOOD	3938	4756	—	—	—	—	—			—
CORNWALL	16417	17481	—	—	—	—		—		
DEEP RIVER	1443	1729	—	—	—	—	—			
DELHI	15	3100	—	—	—	—	—			—
DORCHESTER	80	500	—	—	—	—	—			
DRYDEN	1712	2280	—		—	—				
DUNDAS	5317	7207	—	—	—	—	—		—	—
DURHAM	162	1400	—		—	—	—			—
ELLIOT LAKE	2691	5800	—	—	—	—	—	—		
ESPANOLA	1480	1600	—	—	—	—	—	—		
EXETER	1017	1530	—	—	—	—	—			
FERGUS	2966	3450	—	—	—	—	—		—	—
FORT FRANCES	2461	3100	—		—					
GANANOQUE	2300	2010	—	—	—	—	—			
GEORGETOWN	7800	14000	—	—	—	—	—		—	—
GERALDTON	850	900	—		—					
GODERICH	3601	4290	—		—	—	—			—
GORE BAY	181	265	—			—				
GRAVENHURST	1522	3600	—	—	—	—	—			
GRIMSBY	2725	3710	—	—	—	—	—		—	—
GUELPH	21500	25700	—	—	—	—	—		—	—
HALIBURTON	275	360	—		—	—	—			
HAMILTON	90985	130347	—	—	—	—	—		—	—
HANOVER	3750	4500	—		—	—	—			—
HAWKESBURY	3150	3600	—	—	—	—		—		
HEARST	1558	1630	—	—	—	—	—	—		
HORNEPAYNE	172	430	—	—	—					
HORSESHOE VALLEY	30	121	—	—	—	—	—			
HUNTSVILLE	2071	2363	—			—	—			
IROQUOIS FALLS	1008	1600	—	—	—	—	—	—		
KAPUSKASING	2815	5000	—	—	—	—	—	—		
KEMPTVILLE	500	1000	—	—	—	—	—	—		
KENORA	2977	5600	—	—	—	—				
KESWICK	5300	9500	—	—	—	—	—			—
KINCARDINE	2266	2500	—		—	—	—			—
KINGSTON	22500	32900	—	—	—	—	—			
KIRKLAND LAKE	3160	3900	—	—	—	—	—			
KITCHENER	90500	113500	—	—	—	—	—			—
LEAMINGTON	1722	6119	—	—	—	—	—			
LINDSAY	5200	5400	—	—	—	—	—		—	—
LISTOWEL	3500	6000	—	—	—	—	—			—
LONDON	92726	101290	—	—	—	—	—			—
MADOC	487	508	—	—		—	—			
MANITOUWADGE	743	800	—	—	—	—				
MARATHON	676	700	—	—	—	—				
MATTICE	156	175	—	—		—				
MIDLAND	7055	7654	—	—	—	—	—			—
MINDEN	240	270	—	—	—	—	—			
MISSISSAUGA	66520	99700	—	—	—	—	—		—	—
MITCHELL	1140	2000	—		—	—	—			—
NAPANEE	1504	1700	—	—		—	—			
NEW LISKEARD	2252	3150	—	—	—	—	—			
NEW MARKET	10008	12000	—	—	—	—	—		—	—
NIAGARA FALLS	20000	42500	—	—	—	—	—		—	—
NORTH BAY	10107	14758	—	—	—	—	—	—		
OAKVILLE	11695	22882	—	—	—	—	—		—	—
ORANGEVILLE	3462	3600	—	—	—	—	—		—	—
ORILLIA	8115	8800	—	—	—	—	—		—	—
OSHAWA	19450	50140	—	—	—	—	—		—	—
OTTAWA	174471	205000	—	—	—	—	—	—		
OWEN SOUND	8501	9322	—	—		—	—			—
PAISLEY	168	300	—		—	—	—			
PARRY SOUND	1915	2200	—			—	—			
PEMBROKE	8215	10066	—	—	—	—	—	—		
PETERBOROUGH	20019	22290	—	—	—	—	—			—
PICKERING	6244	9500	—	—	—	—	—		—	—
PICTON	1754	1850	—	—		—	—			
PORT ELGIN	1100	3000	—		—	—	—			
PORT PERRY	1900	2700	—	—	—	—	—		—	—
RED ROCK	900	1050	—	—	—	—				
RENFREW	1190	2930	—	—	—	—	—	—		
RICHMOND HILL	24507	50871	—	—	—	—	—		—	—
ROCKLAND	650	1200	—	—	—	—	—	—		
SARNIA	19780	25180	—	—	—	—	—			
SAULT STE-MARIE	18851	22520	—	—	—	—				
SCHREIBER	490	520	—		—	—				
SIMCOE	3810	4536	—	—	—	—	—			—
SMITHS FALLS	2285	3980	—	—	—	—	—			
SMOOTH ROCK FALLS	605	700	—	—	—	—	—	—		
ST-MARY'S	1567	1692	—	—	—	—	—			—
ST-THOMAS	10650	15500	—	—	—	—	—			—
ST-CATHARINES	37696	43669	—	—	—	—	—			
STONEY CREEK	12500	15000	—	—	—	—	—		—	—
STRATHROY	2700	3000	—	—	—	—	—			
STURGEON FALLS	1523	2000	—	—	—	—	—	—		
SUDBURY	28000	41316	—	—	—	—	—	—		
SWASTIKA	124	140	—	—		—				
TERRACE BAY	2708	1568	—	—	—	—				
THUNDER BAY	30878	31530	—		—	—				
TILLSONBURG	3186	1550	—	—	—	—	—			—
TIMMINS	14400	20000	—	—	—	—	—	—		
TORONTO	809522	945619	—	—	—	—	—		—	—
UXBRIDGE	1850	2600	—	—	—	—	—		—	—
WALLACEBURG	1456	4637	—	—	—	—	—			
WAWA	741	1500	—	—		—				
WELLAND	14000	36000	—	—	—	—	—		—	—
WHITE RIVER	112	250	—	—	—	—				
WINGHAM	290	1000	—	—	—	—	—			—
WOODSTOCK	12500	12500	—	—	—	—	—			—

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- 3.1.2 Private microwave carriers
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- 3.2.2 Anik C 12 GHz transmit pattern
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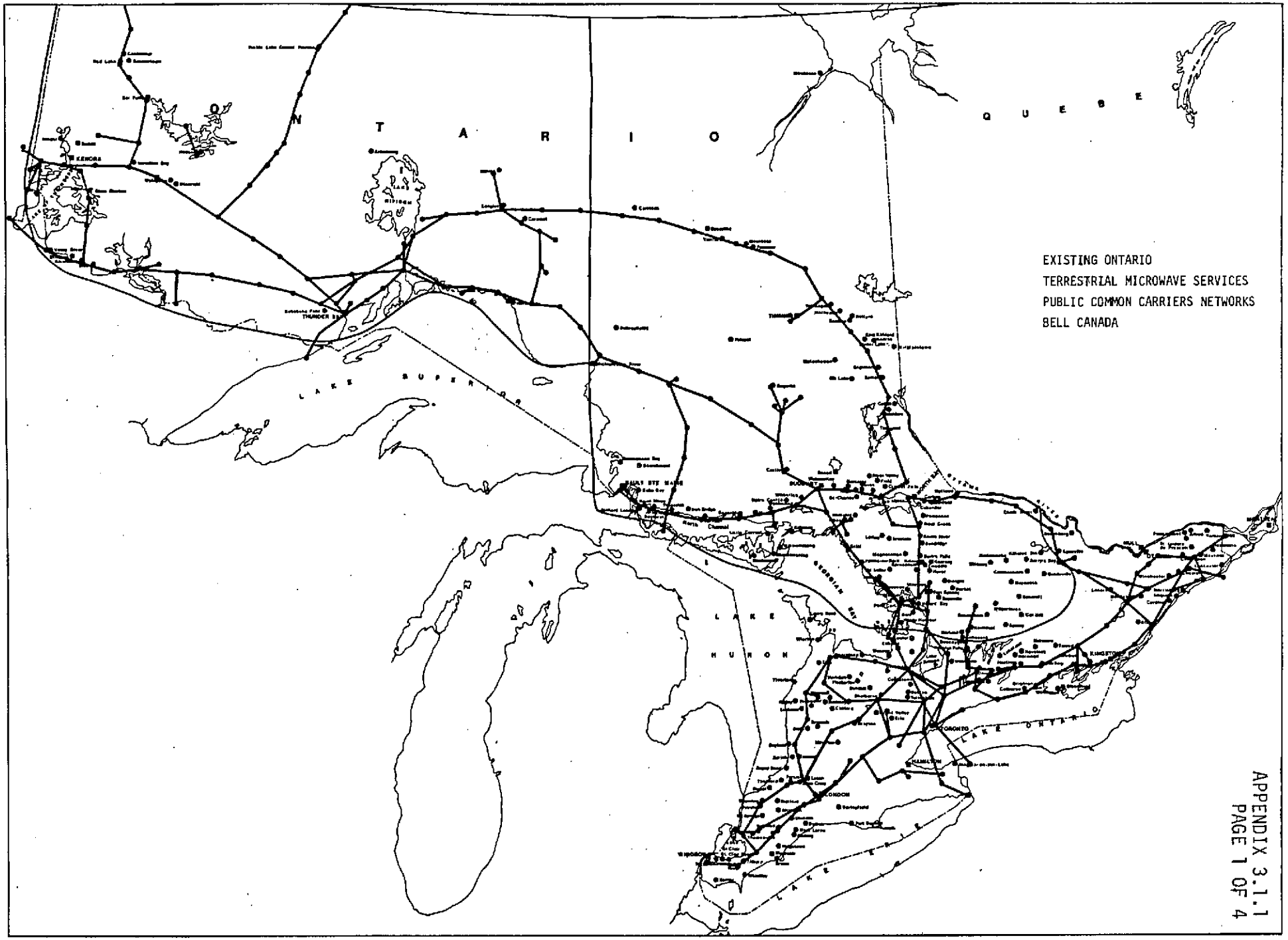

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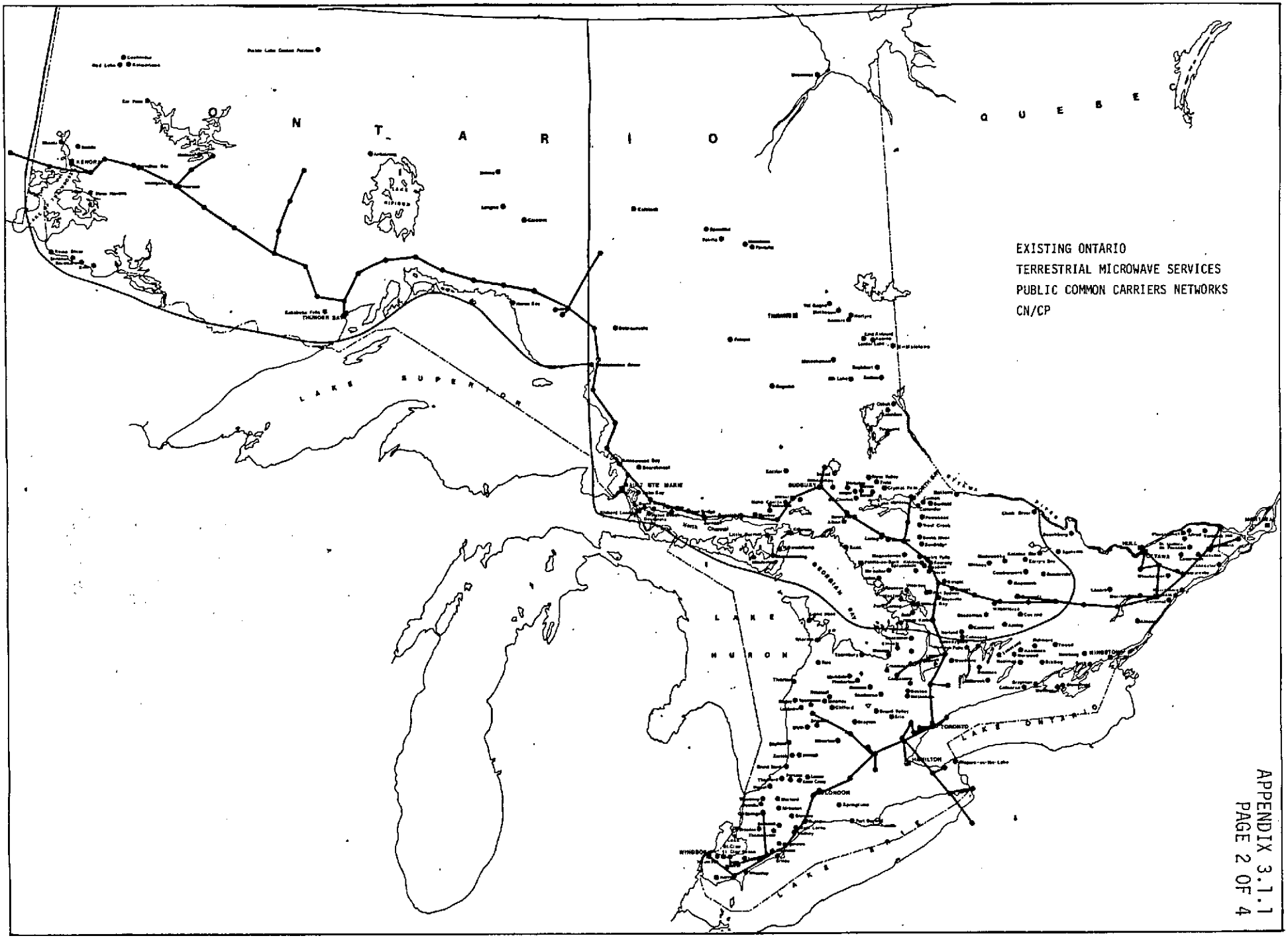

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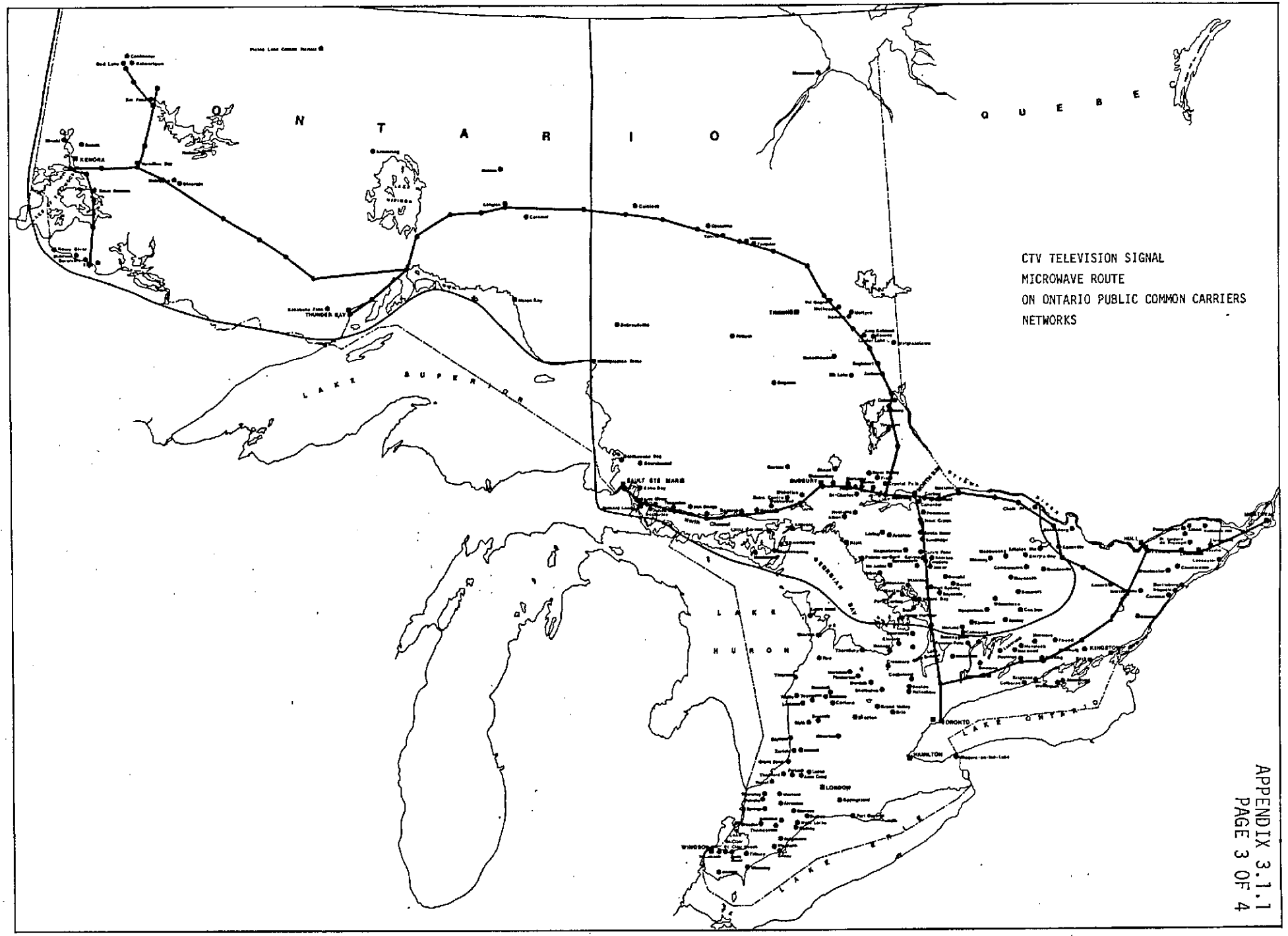

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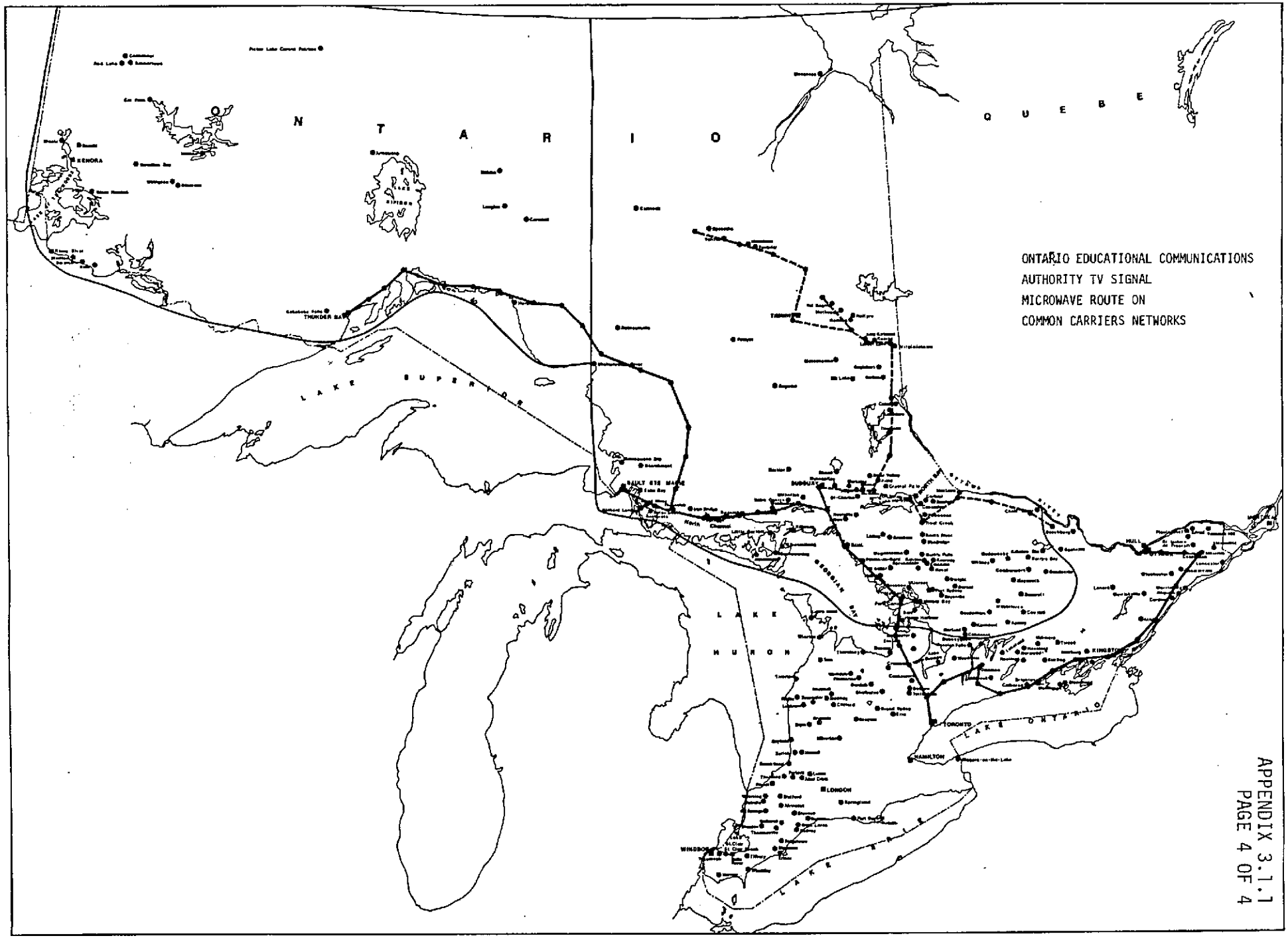

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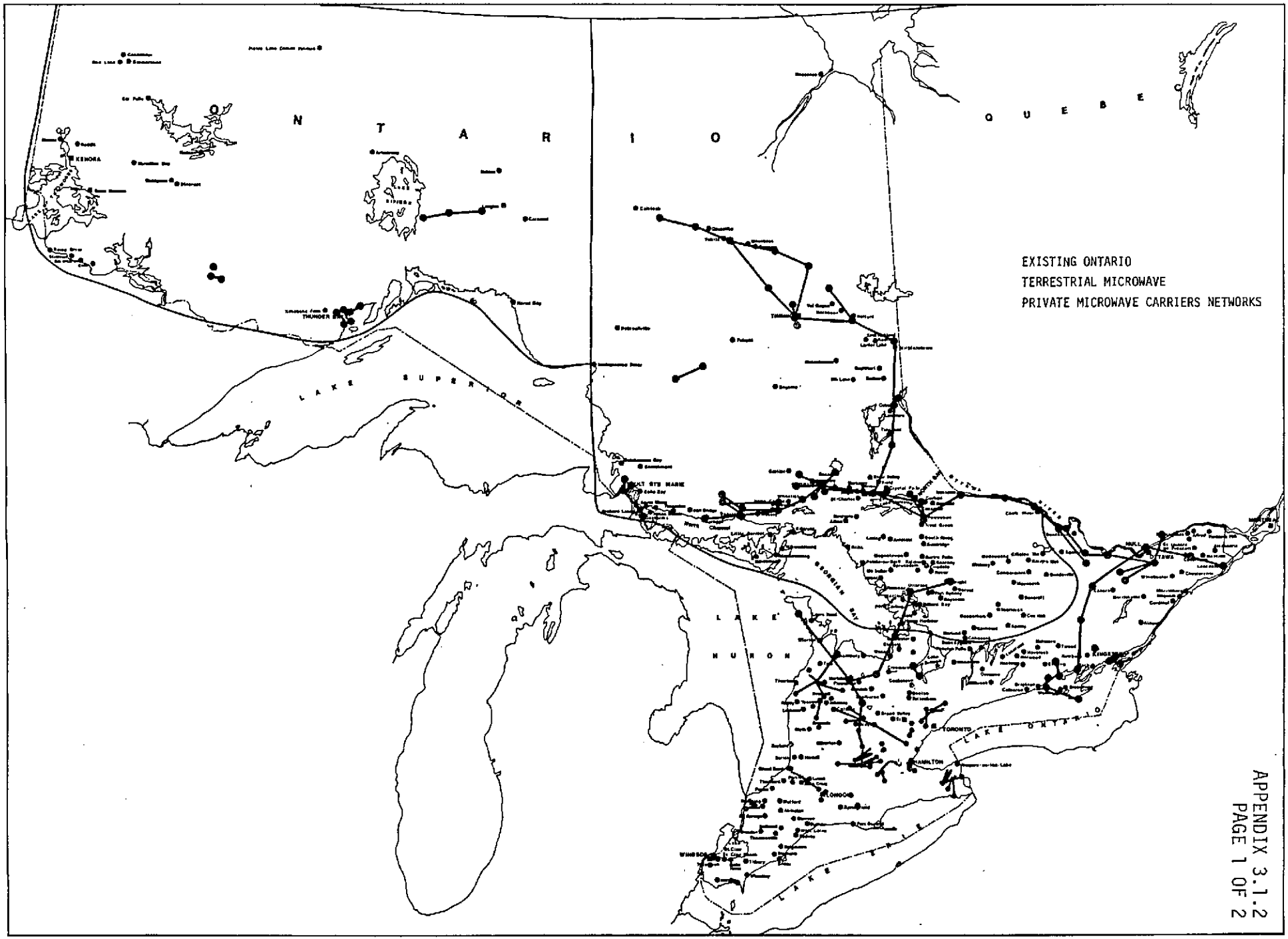

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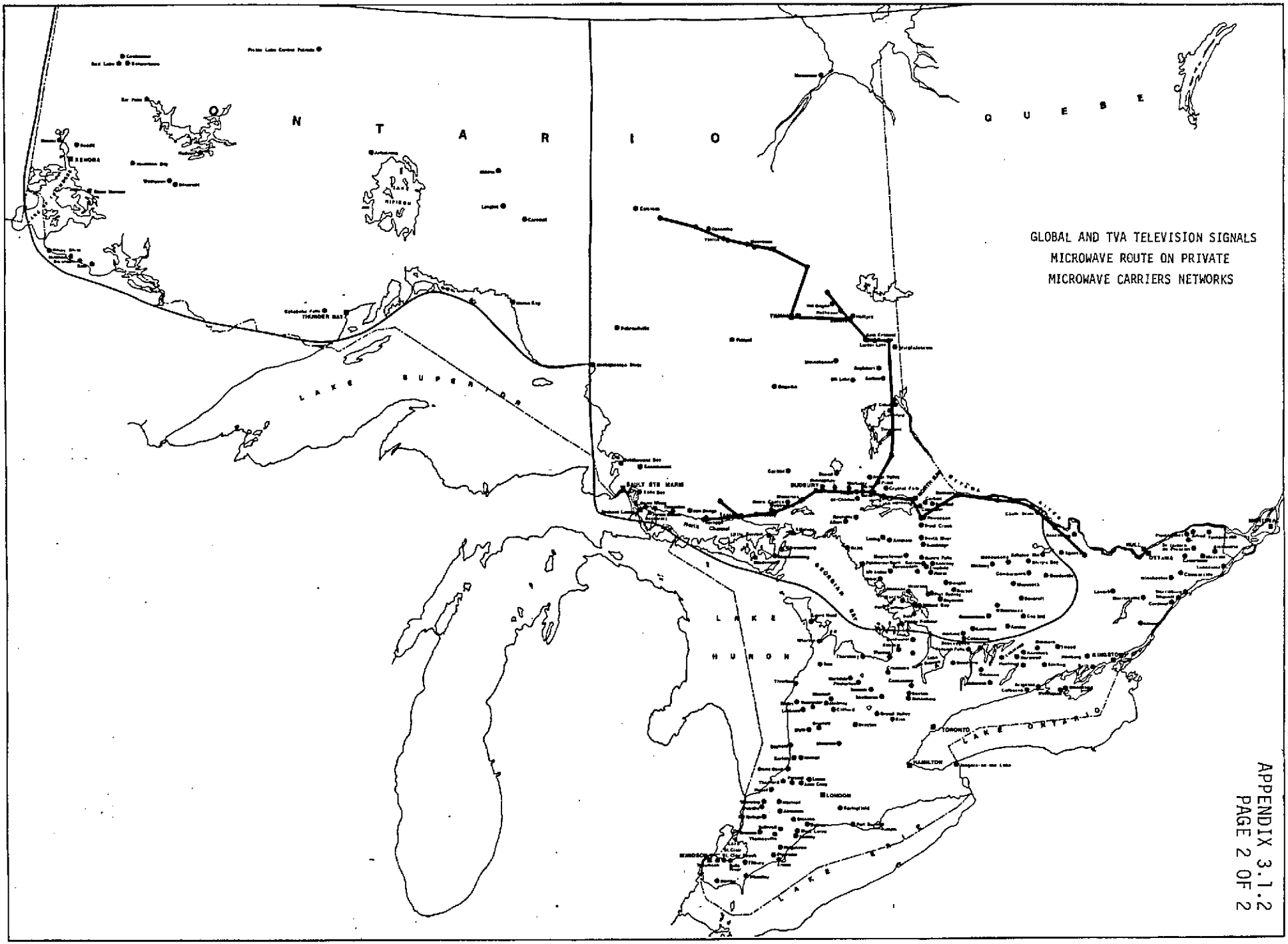

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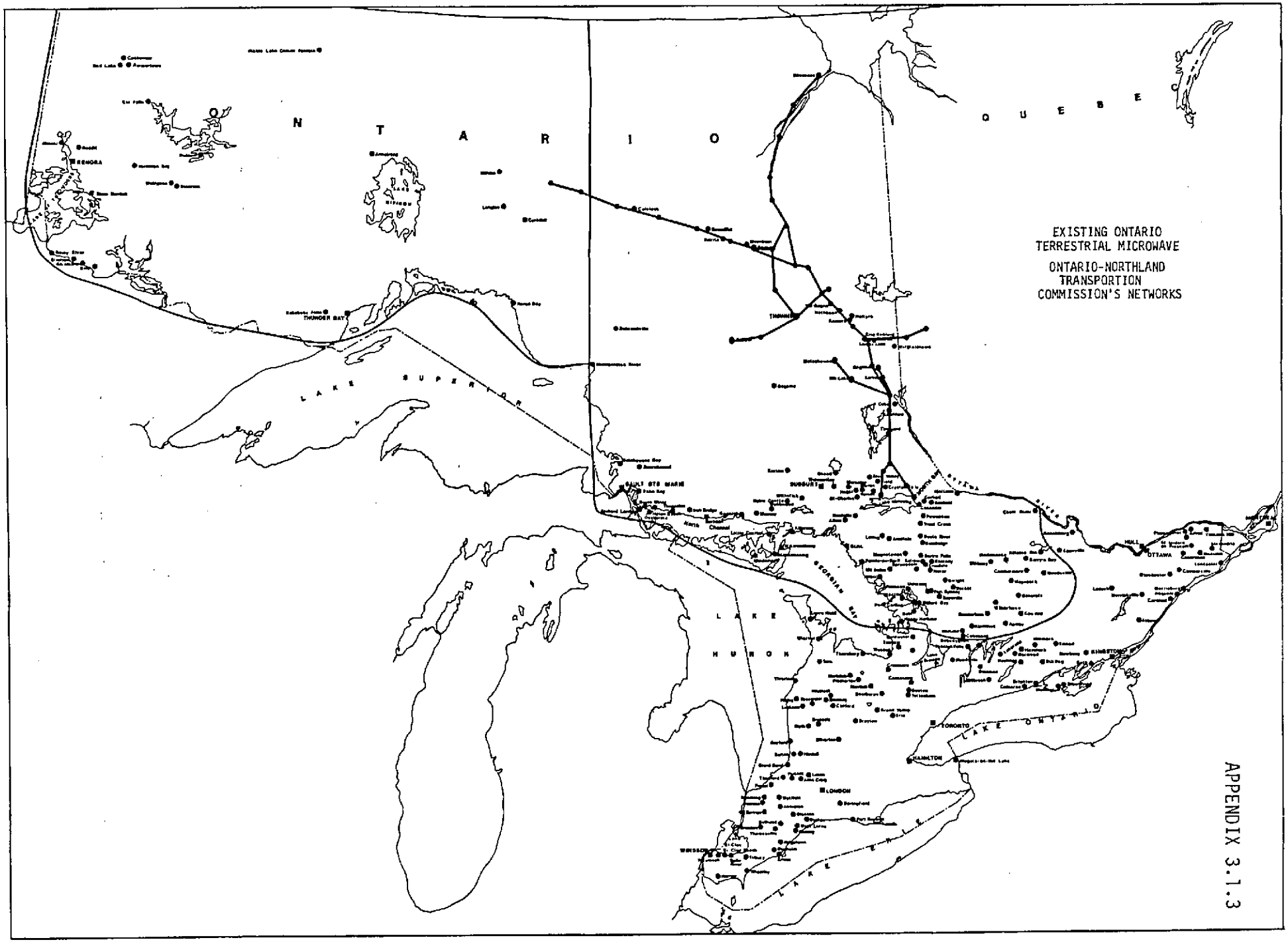

EXISTING ONTARIO
TERRESTRIAL MICROWAVE
ONTARIO-NORTHLAND
TRANSPORTION
COMMISSION'S NETWORKS
APPENDIX 3.1.3

APPENDIX 3.1.4

MICROWAVE SERVICE REQUIREMENTS AND COSTS

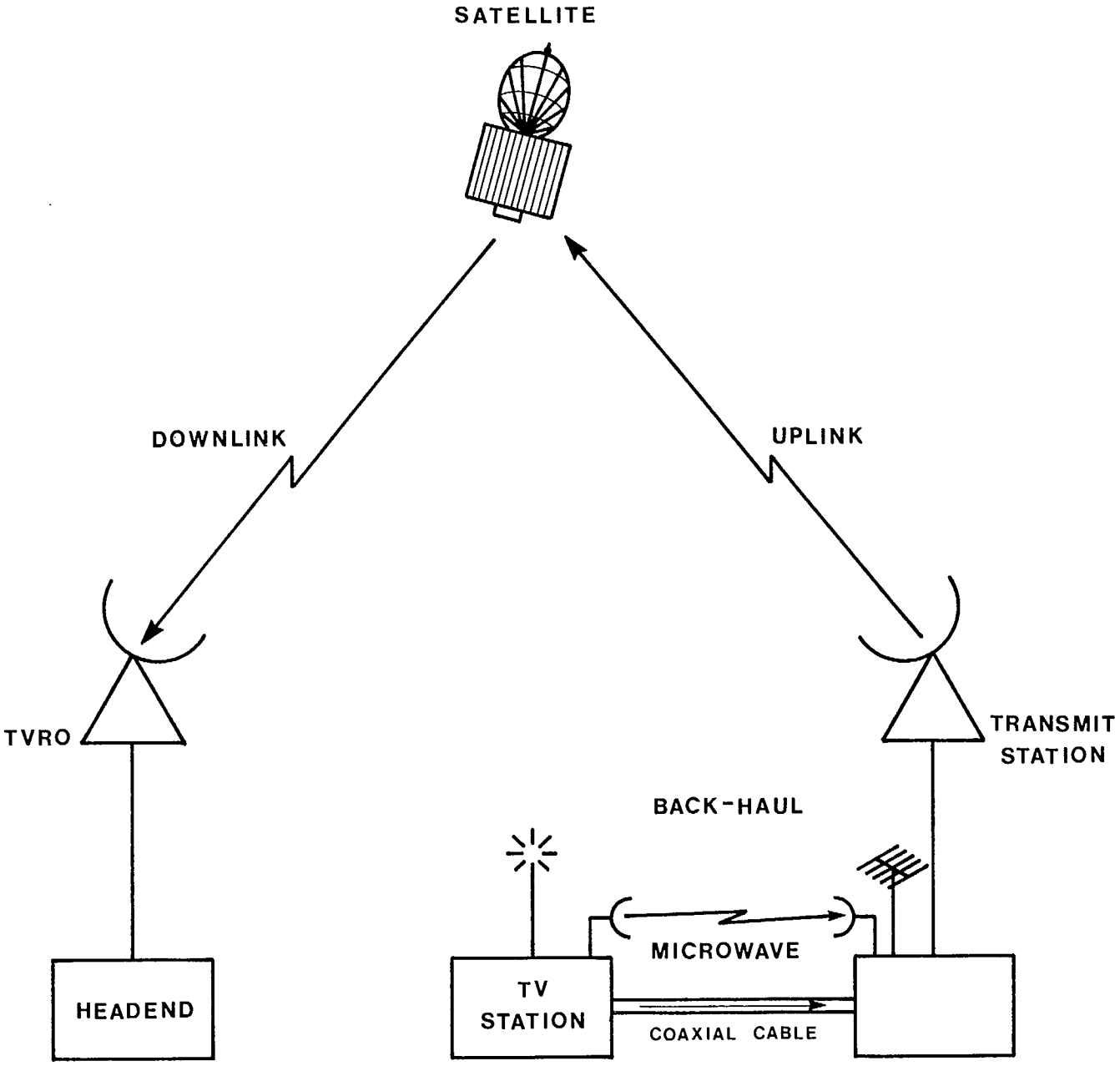
CTV SIGNAL

CLUSTERS	RESIDENCES	NUMBER OF REQUIRED HOPS	ANNUAL HOP COST ESTIMATED* $
MOOSONEE	299	5	90,000
LONGLAC	1,313	5	90,000
STRATTON	1,048	1	18,000
ARMSTRONG	196	12	216,000
PICKLE LAKE/ CENTRAL PATRICIA	216		
TOTAL	3,072	23	414,000

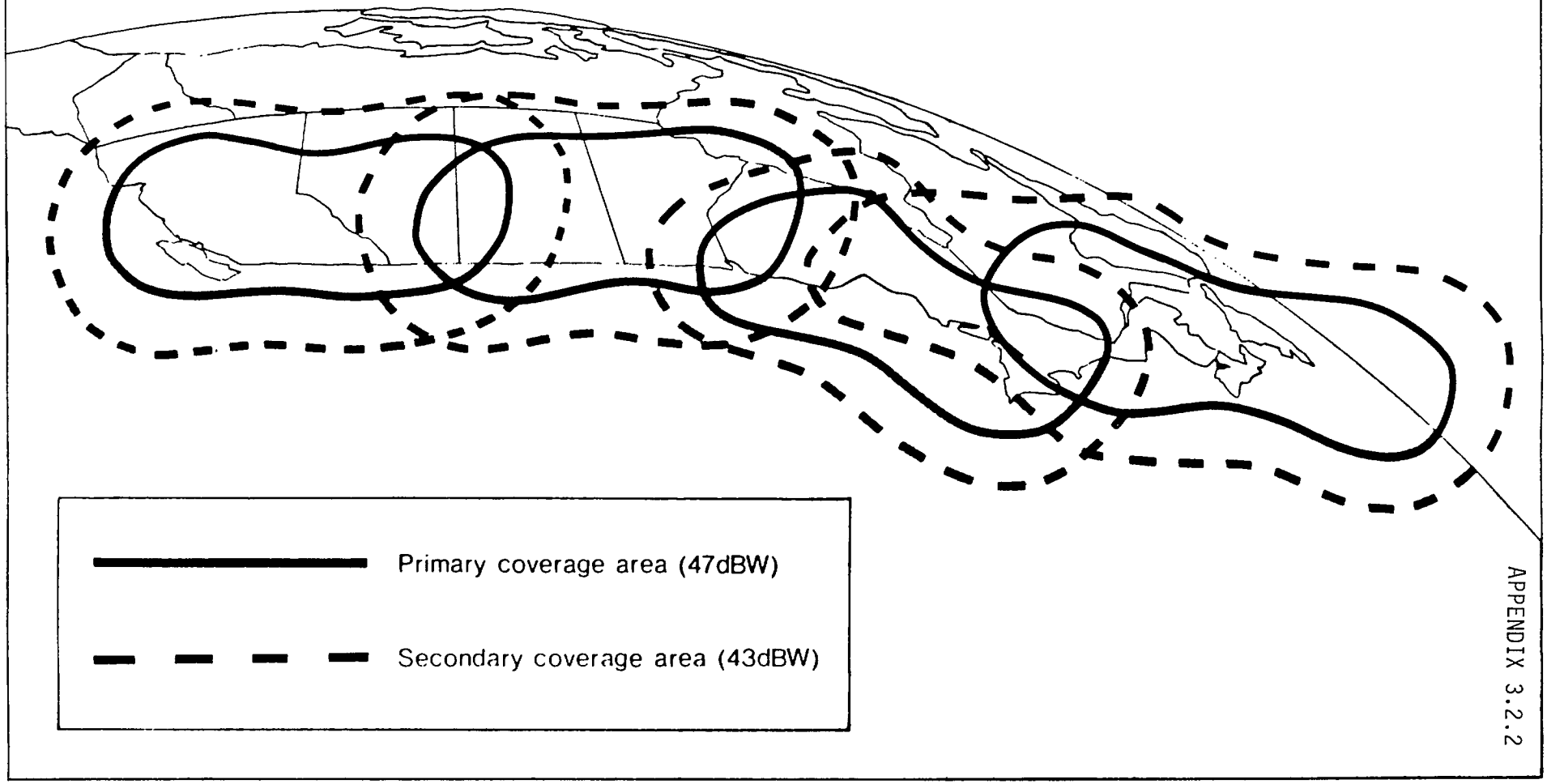
* Estimated average hop cost per channel per month is $1,500.00

APPENDIX 3.2.1

SATELLITE SERVICE CONFIGURATION



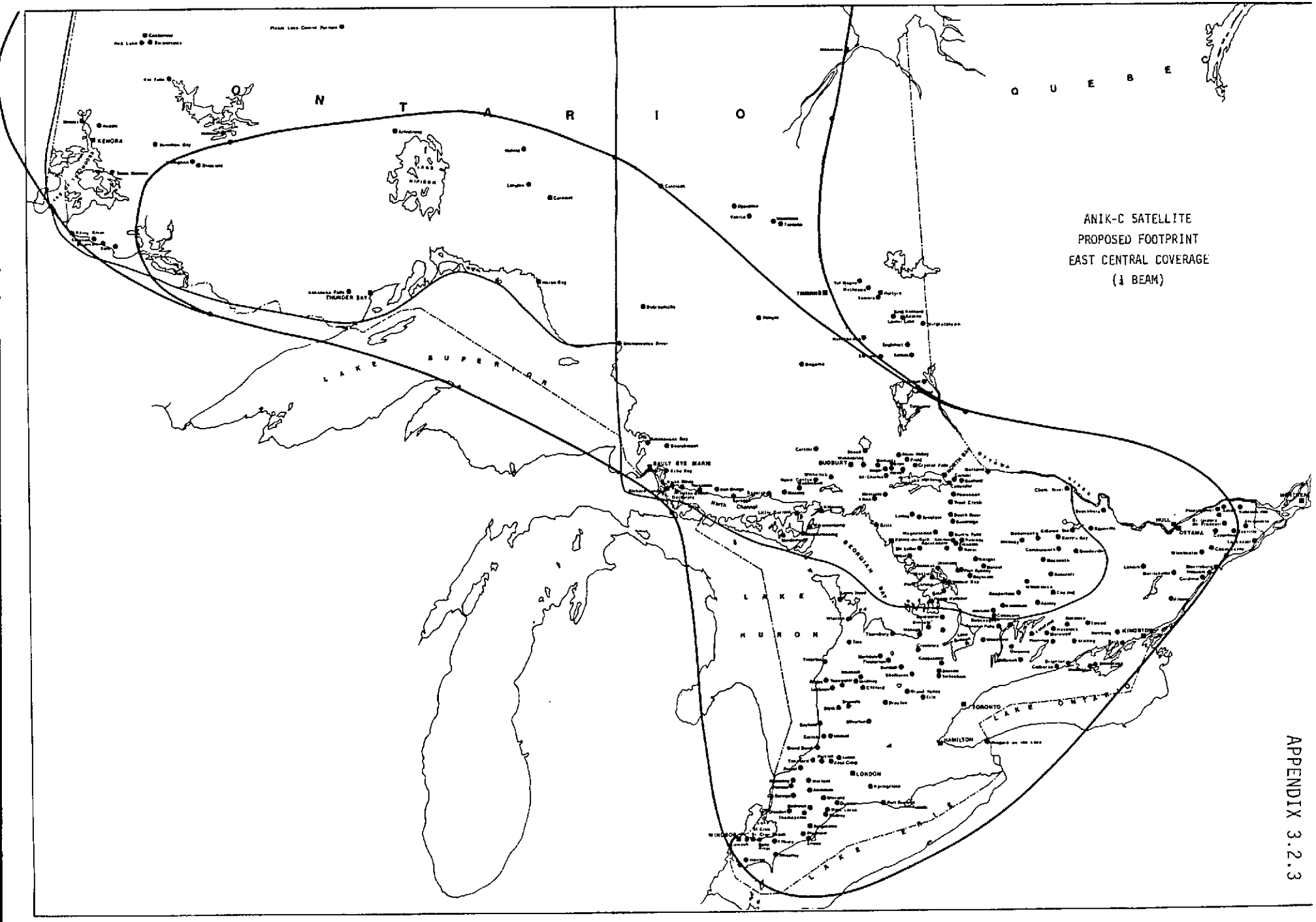
Anik C 12 GHz Transmit Pattern



APPENDIX 3.2.2

Adapted from Telesat Canada audio-visual presentation to the Committee, 11 April 1980/Ottawa/Hull

Source: Report of the Committee on Extension of Services of Northern and Remote Communities CRTC July 1980



APPENDIX 3.2.3

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- 4.2.5 Very High Capacity Microwave system configuration and material and cost lists
- 4.2.6 VHCM systems capital cost summary by cluster
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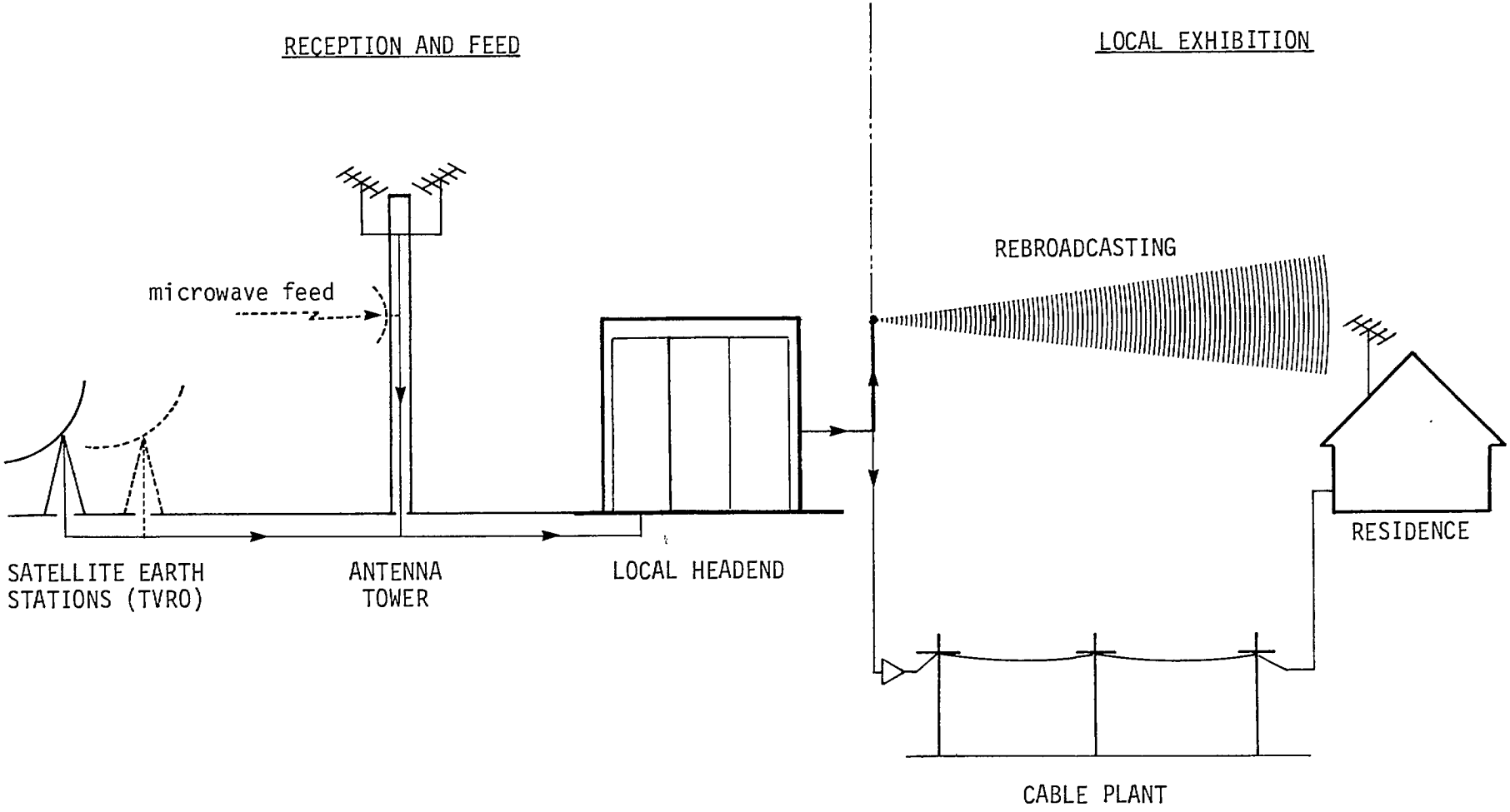
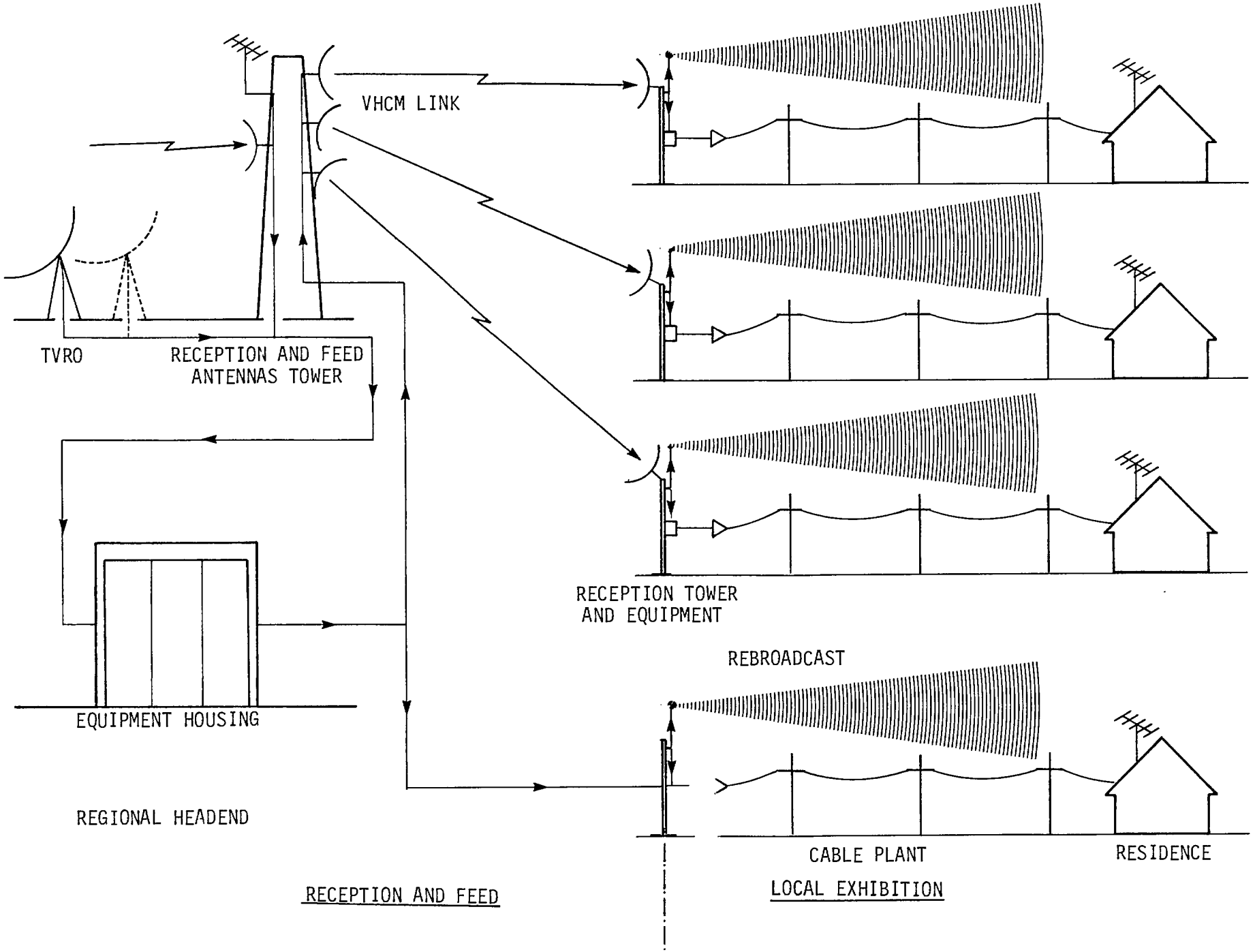
INDIVIDUAL COMMUNITY RECEPTION AND FEED
FACILITIES CONFIGURATION



Appendix 4.1.1

COMMUNITIES SHARING RECEPTION
AND FEED FACILITIES CONFIGURATION



Appendix 4.1.2

GROUPING OF COMMUNITIES INTO 32.KM RADIUS CLUSTERS

COMMUNITIES	RESIDENCES	CLUSTERS	TOTAL CLUSTERS RESIDENCES
BANCROFT	1,220	BANCROFT	1,789
COE HILL	185		
COMBERMERE	126		
MAYNOOTH	158		
QUADEVILLE	100		
APSLEY	532	GOODERHAM	1,476
COBOCONK	310		
GOODERHAM	157		
KINMOUNT	187		
NORLAND	125		
WILBERFORCE	165		
BURK'S FALLS	608	SUNDRIDGE	2,611
EMSDALE	176		
KATRINE	110		
KEARNEY	253		
SOUTH RIVER	629		
SUNDRIDGE	570		
TROUT CREEK	265		
BONFIELD	157	MATTAWA	2,268
CALLANDER	573		
CORBEIL	118		
MATTAWA	925		
POWASSAN	495		
LITTLE CURRENT	646	LITTLE CURRENT	1,443
MANITOWANING	366		
MINDEMOYA	202		
WIKWEMIKONG	229		
COBALT	806	COBALT	1,322
LATCHFORD	159		
TEMAGAMI	357		
HOLTYRE	134	RAMORE	1040
MATHESON	488		
RAMORE	240		
VAL GAGNE	178		
DUBREUILVILLE	311	MICHIPICOTEN RIVER	411
MICHIPICOTEN RIVER	100		
FAUQUIER	197	MOONBEAM	766
MOONBEAM	270		
OPASATIKA	136		
VAL RITA	163		

GROUPING OF COMMUNITIES
INTO 32.KM RADIUS CLUSTERS

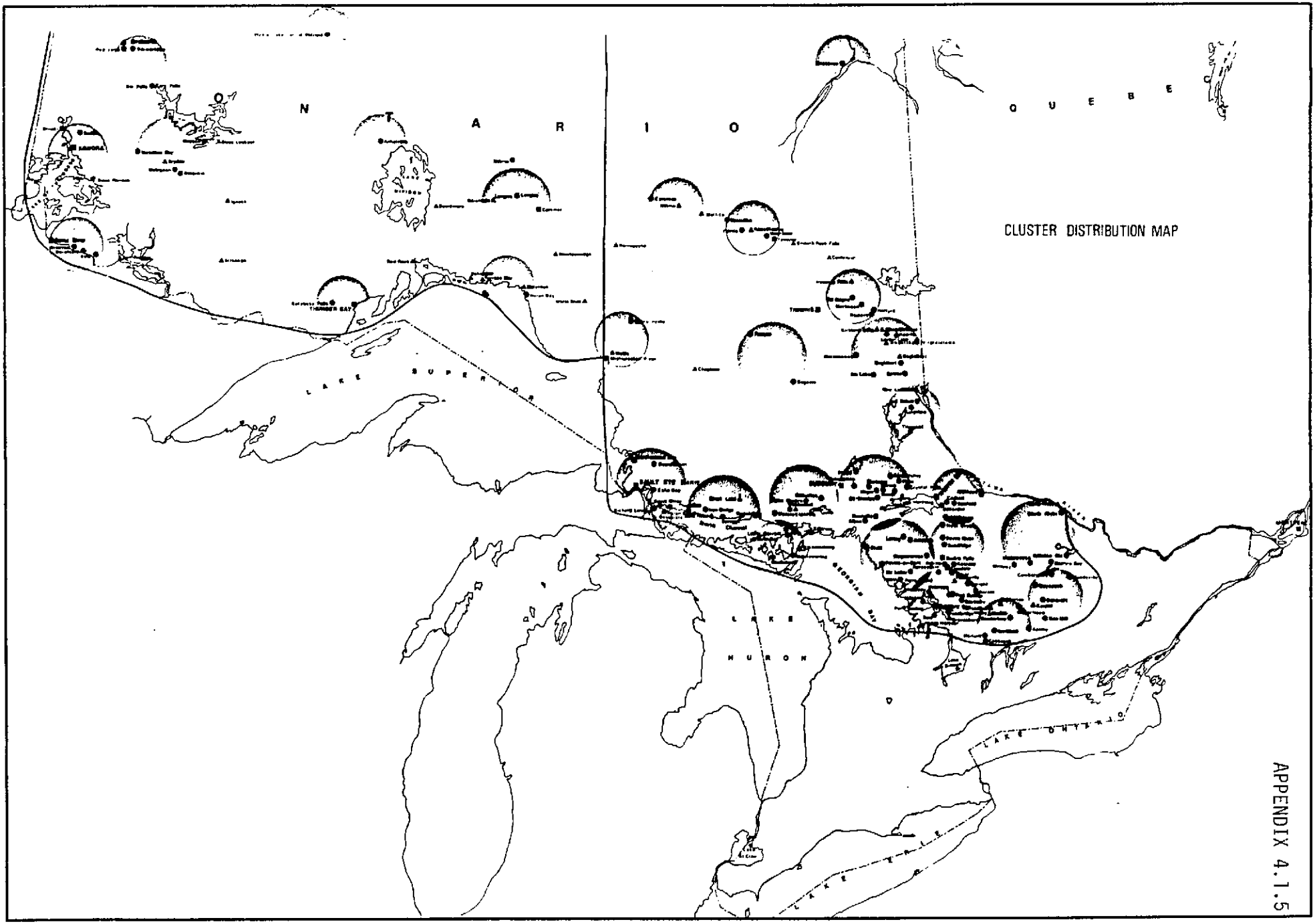
COMMUNITIES	RESIDENCES	CLUSTERS	TOTAL CLUSTERS RESIDENCES
CALSTOCK	201	CALSTOCK	201
MOOSONEE	299	MOOSONEE	299
KAKABEKA FALLS	218	KAKABEKA FALLS	218
BALMERTOWN COCHENOUR EAR FALLS RED LAKE	326 174 634 895	EAR FALLS	2,029
MINAKI REDDIT SIOUX NARROWS	131 129 210	REDDIT	470
BARWICK EMO RAINY RIVER STRATTON	102 390 443 113	STRATTON	1048
HERON BAY	139	HERON BAY	139
ARMSTRONG	196	ARMSTRONG	196
PICKLE L./C.PATRICIA	216	PICKLE LAKE	216

GROUPING OF COMMUNITIES
INTO 43.2 KM RADIUS CLUSTERS

COMMUNITIES	RESIDENCE	CLUSTER NAME	TOTAL CLUSTER RESIDENCE
BARRY'S BAY	1010	BARRY'S BAY	2201
CHALK RIVER	425		
KILLALOE STATION	306		
MADAWASKA	135		
WHITNEY	325		
BALA	527	SPRUCEDALE	2797
BAYSVILLE	242		
DORSET	205		
DWIGHT	188		
HONEY HARBOUR	155		
MACTIER	344		
MILFORD BAY	150		
NOVAR	131		
PORT CARLING	259		
PORT SYDNEY	147		
ROSSEAU	180		
SPRUCEDALE	160		
UTTERSON	109		
ARNSTEIN	110	MAGNETAWAN	961
BRITT	110		
LORING	112		
MAGNETAWAN	133		
MC KELLAR	172		
NOBEL	203		
POINTE AU BARIL	121		
ALBAN	280	ST-CHARLES	2732
CRYSTAL FALLS	150		
FIELD	168		
HAGAR	144		
MARKSTAY	255		
NOELVILLE	315		
RIVER VALLEY	104		
SKEAD	165		
ST-CHARLES	186		
VERNER	351		
WAHNAPITAE	354		
WARREN	260		
CARTIER	237	WEBBWOOD	1519
KILLARNEY	125		
MASSEY	609		
NAIRN CENTRE	161		
WEBWOOD	209		
WHITEFISH FALLS	178		
IRON BRIDGE	280	SPANISH	1261
SPANISH	347		
SPRAGGE	122		
THESSALON	512		

GROUPING OF COMMUNITIES
INTO 43.2 KM RADIUS CLUSTERS

COMMUNITIES	RESIDENCE	CLUSTER NAME	TOTAL CLUSTER RESIDENCE
BATCHAWANA BAY	126		
BRUCE MINES	236		
DESBARATS	158		
ECHO BAY	270	ECHO BAY	1257
HILTON BEACH	144		
RICHARD LANDING	158		
SEARCHMOUNT	165		
FOLEYET	186	FOLEYET	431
GOGAMA	245		
EARLTON	406		
ELK LAKE	250		
ENGLEHART	896		
KEARNS	139	KING KIRKLAND	2750
KING KIRKLAND	125		
LARDER LAKE	444		
MATACHEWAN	156		
VIRGINIATOWN	334		
CARAMAT	136		
LONGLAC	875	LONGLAC	1313
NAKINA	302		
DINORWIC	120		
HUDSON	140	HUDSON	714
VERMILLION BAY	276		
WABIGOON	178		


CLUSTER DISTRIBUTION MAP
APPENDIX 4.1.5

LOCAL HEADEND MATERIAL AND COST LIST

MATERIAL LIST	UNIT COST $	BASE MODEL MW SIGNAL $	INCREMENTAL COST SECOND SIGNAL $	THIRD, FOURTH... SIGNAL $	FIRST OFF-AIR SIGNAL $	INCREMENTAL OFF-AIR SIGNALS $	OTHER COSTS $
Equipment rack	150	150	-	-	-	-	5th signal 150
Antenna	375	-	-	-	375	375	-
Antenna mountings	250	-	-	-	250	-	3rd off-air signal 250
TV modulator	2,800	2,800	2,800	2,800	-	-	-
TV processor	2,800	-	-	-	2,800	2,800	-
Combiner (1)	250	-	250	-	-	-	-
Miscellaneous, connecting, cable, hardware, etc.	225	225	-	-	100	-	-
Installation	200	200	-	-	200	-	-
Housing (2)	600	600	-	-	-	-	-
Test equipment	800	800	-	-	-	-	-
Engineering	-	400	-	-	400	-	-
Total	-	5,175	3,050	2,800	4,125	3,175	-

1) Combiner to handle required no. of signals
2) Housing can accomodate TVRO equipment
4) Transportation, site preparation and other related costs not included
5) No contingency included
6) See following appendix for supporting structures

LOCAL HEADEND

SUPPORTING STRUCTURE COST LIST

STRUCTURE TYPE	OFF-AIR SIGNALS ONLY $	WITH MICROWAVE SIGNAL $
Antenna tower and installation	2,000.00	
Microwave dish type tower and installation		4,000.00 4,000.00
TOTAL:	2,000.00	8,000.00

Note: Mutually exclusive

REGIONAL HEADEND MATERIAL AND COST LIST

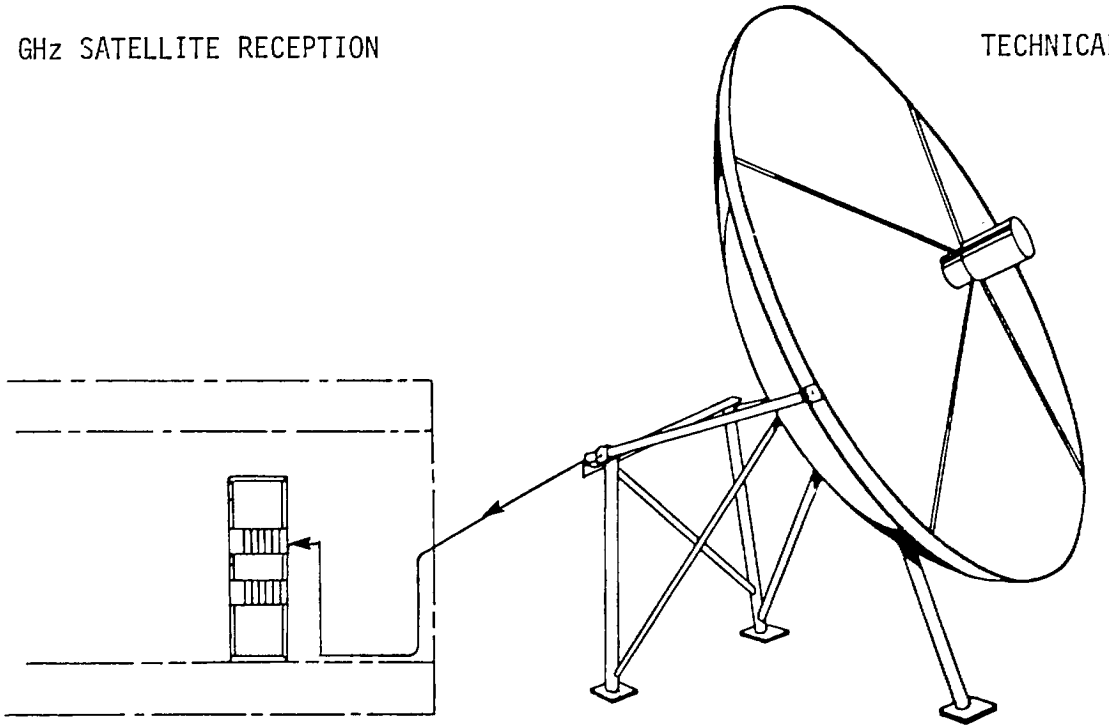
MATERIAL LIST	UNIT COST $	BASE MODEL MW SIGNAL $	INCREMENTAL COST SECOND SIGNAL $	THIRD OR FOURTH SIGNAL $	FIRST OFF-AIR SIGNAL $	INCREMENTAL OFF-AIR SIGNALS	OTHER COSTS
Equipment rack	300	300	-	-			fifth signal 300
Antenna	375	-	-	-	375	375	-
Antenna mounting (1)	500	-	-	-	500	-	-
TV modulator	2,800	2,800	2,800	2,800	-	-	-
TV processor	2,800	-	-	-	2,800	2,800	-
Combiner (2)	250	-	250	-	-	-	-
Miscellaneous, connecting cable, hardware, etc...	500	500	-	-	100	-	-
Installation	200	200	-	-	200	-	-
Housing (8' X 12') Multipurpose (3)	7,000	7,000	-	-	-	-	-
Test equipment	800	800	-	-	-	-	-
TOTAL CAPITAL		11,600	3,050	2,800	3,975	3,175	-

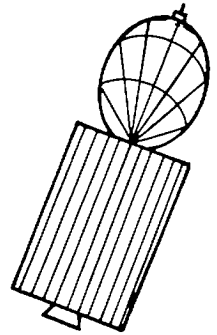
Notes:
1) Antenna mounting to satisfy all antenna requirements
2) Combiner to handle required number of signals
3) Housing will also accomodate VHCM and TVRO requirements
4) Engineering, transportation, site preparation and other related costs included in VHCM costing
5) Tower requirements to be met with VHCM TX tower
6) No contingency included

APPENDIX 4.2.2

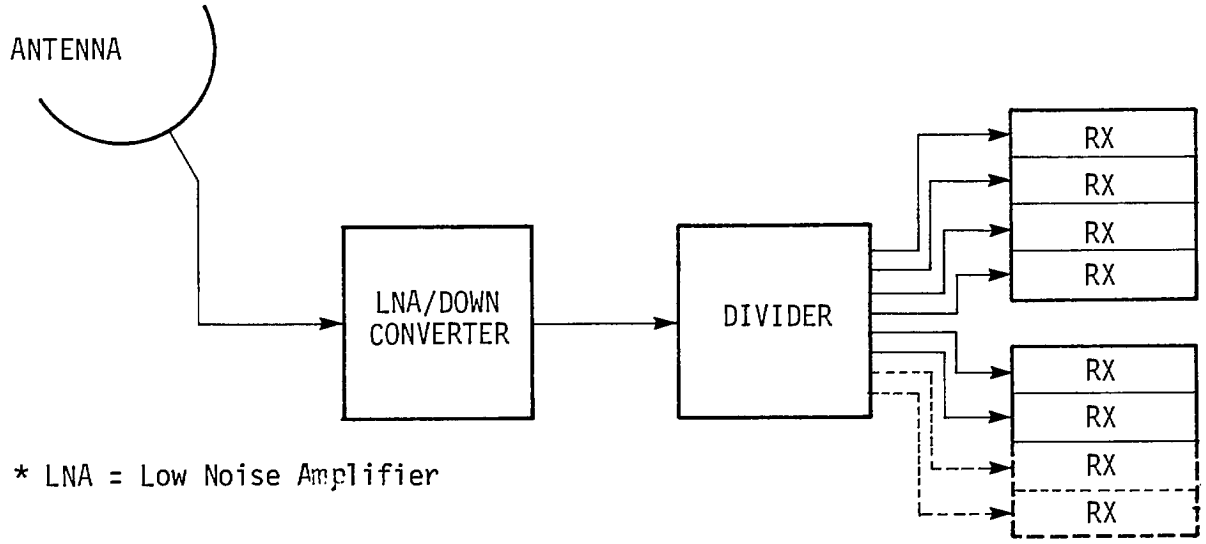
12 GHz SATELLITE RECEPTION

TECHNICAL CONFIGURATION





TVRO - 12 GHz



* LNA = Low Noise Amplifier

12 GHz SATELLITE RECEPTION
(TVRO) MATERIAL AND COST LIST

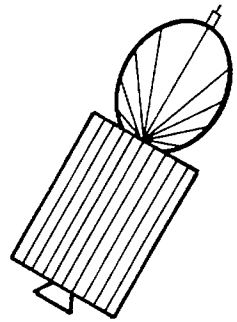
MATERIAL LIST	UNIT PRICE $	STANDARD QUANTITY	BASE MODEL 1st SIGNAL $	INCREMENTAL COST SECOND SIGNAL $	THIRD AND FOURTH SIGNAL $	FIFTH SIGNAL $	SIXTH SIGNAL $
Antenna (RX) (1) 3.0 m. (10') 3.7 m. (12') 4.5 m. (15')	 5,600 7,700 11,500	1		-	-	-	-
*LNA/Down Converter	11,000	1	11,000	-	-	-	-
Divider (2) 1F interface Link for 4 channels	300	2	-	300	-	300	-
Receiver	5,000	3 to 6	5,000	5,000	5,000	5,000	5,000
Miscellaneous	300	1	300	-	-	-	-
Foundation	2,000	1	2,000	-	-	-	-
Installation	1,000	1	1,000	-	-	-	-
Transportation	1,000	1	1,000	-	-	-	-
Engineering	1,000	1	1,000	-	-	-	-
SUB-TOTAL:			21,300	5,300	5,000	5,300	5,000

* LNA: Low Noise Amplifier

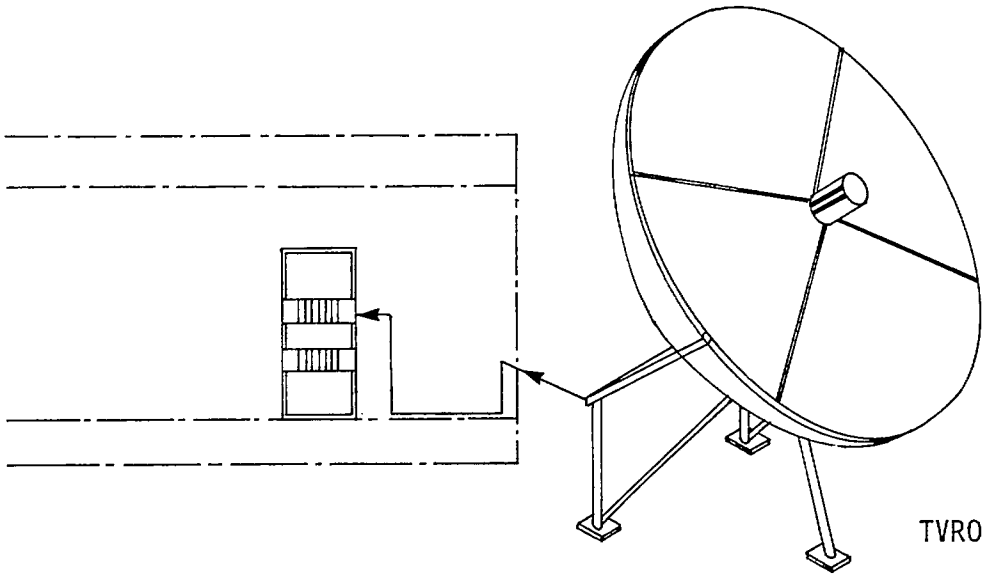
+ antenna

1) Classify each community cluster parts as to sat. foot prints
2) Dividers can handle 4 channels each
3) Housing costed separately see HE file
4) No contingencies included

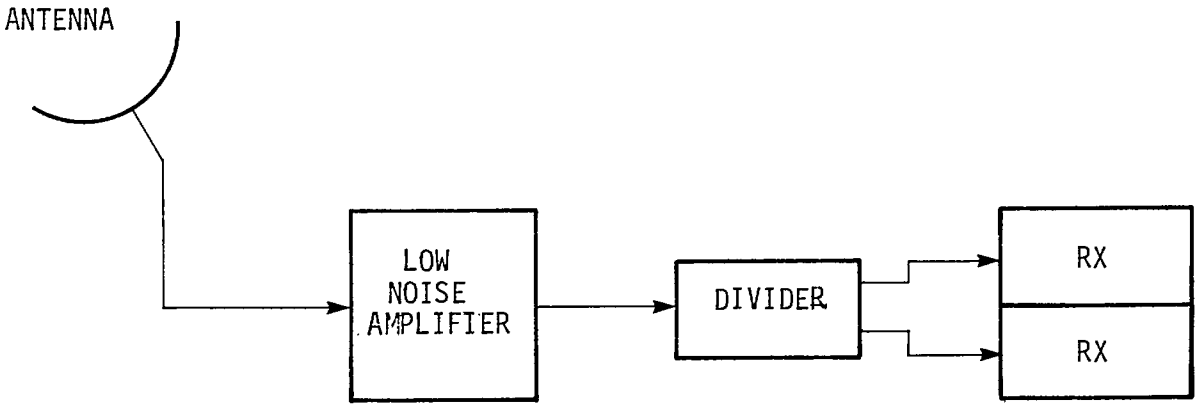
4 GHz SATELLITE RECEPTION TECHNICAL CONFIGURATION



TVRO
Earth Station



TVRO - 4 GHz

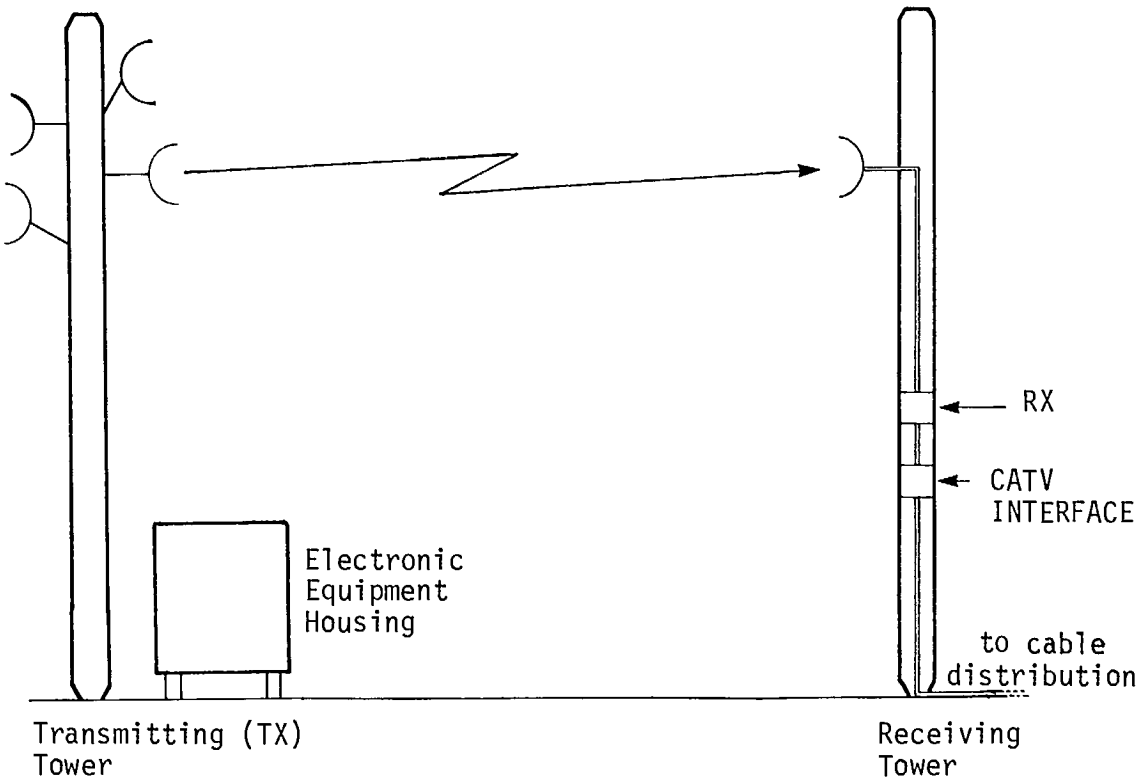


4 GHz SATELLITE RECEPTION
(TVRO) MATERIAL AND COST LIST

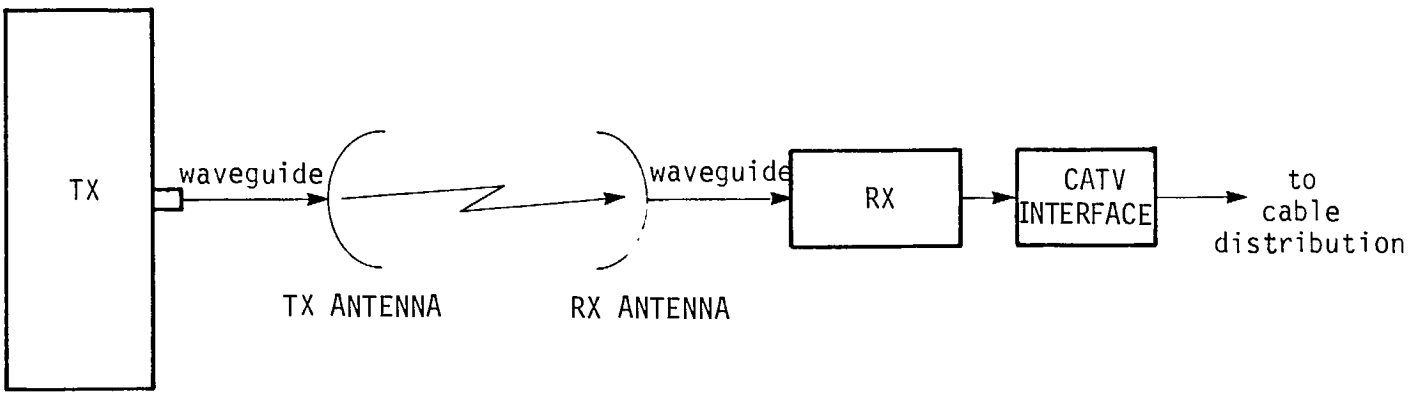
MATERIAL LIST	UNIT PRICE $	BASE MODEL 1 CBC SIGNAL $	INCREMENTAL SIGNAL $
Antenna (RX) 3.7 m. (12')	7,900	7,900	-
LNA *	4,000	4,000	-
Receiver	4,900	4,900	4,900
Miscellaneous	300	300	-
Foundation	2,000	2,000	-
Installation	1,000	1,000	-
Transportation	1,000	1,000	-
Engineering	1,000	1,000	-
Divider	300		300
TOTAL		22,100	5,200

* LNA: Low Noise Amplifier

VERY HIGH CAPACITY MICROWAVE
SYSTEM CONFIGURATION



ELECTRONIC CONFIGURATION (HIGH AND LOW POWER)



VERY HIGH CAPACITY MICROWAVE SYSTEM
MATERIAL AND COST LIST

EQUIPMENT DESCRIPTION		UNIT PRICE $	QUANTITY
Antenna - dish size	4'	1,003	Varies depending on path characteristics
	6'	1,225	
	8'	1,960	
	10'	2,928	
	12'	6,077	
Antenna mount - dish size	4'	294	as above
	6'	294	
	8'	546	
	10'	546	
	12'	840	
Power splitter		680	vary depending on no. of receiving site
Elliptical Wave Guide		9.38/ft	
Circular WG in 20 section		397	
Transition - single		1,738	
- dual		2,170	
Air pump		294	
Dehydrator & pressure eq.		2,000	1
Miscellaneous clamps		350	1
Transmitter high power		20,484	1/signal
TX monitor		7,983	1
Redundancy		2,551	1
MW test point		346	1
Bay low power		31,938	1/8 channels
Module		6,875	1/signal
TX monitor		5,211	1
HW test point		346	1
RX 232		19,125	1/receive site
AML CATV interface		2,662	"
Mounting bracket		217	"
Test adapt kit		106	"
Test box		412	"

VHCM TRANSMITTING TOWERS

MATERIAL AND INSTALLATION COST LIST

TOWER HEIGHT (feet)	MATERIAL COST $	INSTALLATION COST $
50	15,200	14,500
75	22,350	15,750
100	29,500	17,000
125	32,875	17,950
150	36,250	18,900
175	38,570	20,700
200	40,890	22,500
225	45,495	24,500
250	50,100	26,500
275	51,500	27,500
300	52,900	28,500

VHCM RECEIVING TOWERS MATERIAL
AND INSTALLATION COST SCHEDULE

TOWER HEIGHT ft.	DISH SIZE ft.	MATERIAL COST $	INSTALLATION COST $
50	4 6,8 10,12	4,000 4,000 6,500	4,000 4,000 6,500
75	4 6,8 10,12	6,000 6,000 9,150	5,750 5,750 7,500
100	4 6,8 10,12	8,000 8,000 11,800	7,500 7,500 8,500
125	4 6,8 10,12	8,500 8,900 14,150	7,850 8,250 10,750
150	4 6,8 10,12	9,000 9,800 16,500	8,200 9,000 12,000
175	4 6,8 10,12	9,600 10,250 19,250	8,600 9,000 14,000
200	4 6,8 10,12	10,200 10,700 22,000	9,000 9,000 16,000
225	4 6,8 10,12	11,600 14,450 24,750	9,000 9,950 16,500
250	4 6,8 10,12	13,000 18,200 27,500	9,000 11,900 17,000
275	4 6,8 10,12	13,750 20,800 30,250	9,750 12,200 17,750
300	4 6,8 10,12	14,500 23,400 33,000	10,500 12,500 18,500

VHCM CAPITAL COST SUMMARY BY CLUSTER

CLUSTERS	NUMBER OF COMMUNITIES	POWER (2)		BASE MODEL COST 1 CHANNEL(1) $	INCREMENTAL SIGNAL COST $
		HIGH	LOW		
BARRY BAY	5	X		342,190	20,484
BANCROFT	5		X	362,399	6,875
GOODERHAM	6		X	424,767	6,875
SPRUCEDALE	13	X		726,212	20,484
SUNDRIDGE	7		X	371,967	6,875
MATTAWA	5		X	331,893	6,875
MAGNETAWAN	7	X		431,834	20,484
ST-CHARLES	12	X		651,275	20,484
WEBBWOOD	6	X		350,981	20,484
LITTLE CURRENT	4		X	234,978	6,875
SPANISH	4	X		307,166	20,484
ECHOBAY	7	X		468,298	20,484
COBALT	3		X	192,028	6,875
FOLEYET	2	X		232,094	20,484
KING KIRKLAND	8	X		702,943	20,484
RAMORE	4		X	304,553	6,875
MICHIPICOTEN RIVER	2		X	215,643	6,875
MOONBEAM	4		X	304,096	6,875
CALSTOCK	*	-	-	-	-
MOOSONEE	*	-	-	-	-
LONGLAC	3	X		211,020	20,484
KAKABEKA FALLS	*	-	-	-	-
HUDSON	4	X		321,471	20,484
EAR FALLS	4		X	326,567	6,875
REDDIT	3		X	298,663	6,875
STRATTON	4		X	266,178	6,875
HERON BAY	*	-	-	-	-
ARMSTRONG	*	-	-	-	-
PICKLE LAKE	*	-	-	-	-

* One community cluster
(1) Control channel
(2) Determination based on requirements for study communities only

OPERATION AND MAINTENANCE COSTS
HEADENDS AND SATELLITE EARTH STATIONS

COST ELEMENT	HEADEND		TVRO	
	LOCAL $ - ANNUAL	REGIONAL $	12 GHz $	4 GHz $
OPERATING				
- Telephone		120	-	-
- Heating/cooling	300	300	-	-
- Equipment power	265	265	135	65
MAINTENANCE				
- Site access	200	200	-	-
- Installation/ snow, ice	120	120	120	120
- Spare parts	2,000	2,000	2,500	2,000
- Labour	1,000	1,500	200	200
- Transportation	-	1,000	-	-
Others	315	495	45	15
TOTAL ANNUAL	4,200	6,000	3,000	2,400
TOTAL MONTHLY	350	500	250	200

CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS

OPTION 1 - EACH COMMUNITY ESTABLISHES INDIVIDUAL FACILITIES

LOCATION	DUTSIDE CLUSTER SIGNALS								INSIDE CLUSTER SIGNALS NOT AVAILABLE TO ALL COMMUNITIES								INSIDE CLUSTER SIGNALS AVAILABLE TO ALL COMMUNITIES						CAPITAL COST	
CLUSTERS	NO. OF COMMUNITIES	NO. OF SATEL. SIGNS	NO. OF MW SIGNALS	CUMULATIVE SIGNALS	COST OF ESTABLISHING FACILITIES AND SERVICES (1)				NO. OF OFF-AIR SIGNS	NO. OF SATEL. SIGNS	NO. OF MW SIGNALS	CUMULATIVE TOTAL	INCREMENTAL COST OF ADDITIONAL FACILITIES				NO. OF OFF-AIR SIGNS	NO. OF SATEL. SIGNS	CUMULATIVE SIGNS	INCREMENTAL COST OF ADDITIONAL FACILITIES			TOTAL $	
					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST $	LOCAL HEADEND $	TOTAL CAPITAL COST $					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST $	LOCAL HEADEND $	TOTAL CAPITAL COST $				TVRO 4 GHz $	LOCAL HEADEND $ (4)	TOTAL CAPITAL COST $	TOTAL CAPITAL COST $	TOTAL MONTHLY EQUIVALENT CAPITAL $
BARRY BAY	5	3	-	3	186,000	-	55,125	241,125	-	1	1	5	25,000	7,500	[3] 68,750	93,750	2*	2*	8	98,800	50,375	149,175	484,050	7,533
BANCROFT	5	4	-	4	211,000	-	69,125	280,125	-	-	1	5	-	7,500	[2] 54,750	54,750	2*	2*	8	115,700	50,125	165,825	500,700	7,792
GOODERHAM	6	3	-	3	223,200	-	66,150	289,350	1*	2*	1	6	40,600	9,000	[2] 104,600	145,200	1	1	8	132,600	37,750	170,350	604,900	9,413
SPRUCEDALE	13	3	-	3	483,600	-	143,325	626,925	-	2	-	5	133,900	-	74,750	208,650	3*	1*	8	265,200	158,175(4)	423,375	1,258,950	19,591
SUNDRIDGE	7	5	-	5	332,500	-	117,425	449,925	-	-	-	5	-	-	-	0	3*	1*	8	132,600	85,325(4)	217,925	667,850	10,393
MATTAWA	5	2	-	2	161,000	-	41,125	202,125	-	3	-	5	76,500	-	42,750	119,250	3*	1*	8	22,100	63,000(4)	85,100	406,475	6,325
MAGNETAWAN	7	4	-	4	295,400	-	96,775	392,175	-	1	-	5	37,100	-	20,650	57,750	3*	1*	8	110,500	85,950(4)	196,450	646,375	10,059
ST-CHARLES	12	2	-	2	386,400	-	98,700	485,100	1*	3*	-	5	141,200	-	[4] 129,200	270,400	3*	1*	8	22,100	128,725(4)	150,825	906,325	14,104
WEBBWOOD	6	2	-	2	193,200	-	49,350	242,550	1*	3*	-	5	75,900	-	[4] 61,275	137,175	3*	1*	8	44,200	66,250(4)	110,450	490,175	7,628
LITTLE CURRENT	4	5	-	5	190,000	-	67,100	257,100	-	-	-	5	-	-	-	Ø	2*	2*	8	104,000	47,275(4)	151,275	408,375	6,355
SPANISH	4	2	-	2	128,800	-	32,900	161,700	-	3	-	5	61,200	-	34,200	95,400	3	-	8	-	50,900(4)	50,900	308,000	4,793
ECHOBAY	7	4	-	4	310,100	-	96,775	406,875	1*	1*	-	5	21,200	-	[4] 30,625	51,825	3*	1*	8	132,600	76,975(4)	209,575	668,275	10,399
COBALT	3	2	-	2	102,900	-	24,675	127,575	1*	3*	-	5	40,600	-	[4] 28,975	69,575	2*	2*	8	71,500	33,225(4)	104,725	301,875	4,698
FOLEYET	2	5	-	5	95,000	-	33,550	128,550	-	-	-	5	-	-	-	Ø	2	1	8	44,200	24,200(4)	68,400	196,950	3,065
KING KIRKLAND	8	2	-	2	304,800	-	65,800	370,600	1*	3*	-	5	90,600	-	[4] 88,350	178,950	2	1	8	176,800	80,600(4)	257,400	806,950	12,557
RAMORE	4	2	-	2	152,400	-	32,900	185,300	-	2	-	4	40,000	-	22,400	62,400	4*	1*	8	44,200	63,450(4)	107,650	355,350	5,530
MICHIPICOTEN RIVER	2	5	-	5	95,000	-	33,550	128,550	-	-	1	6	-	3,000	[2] 21,600	21,600	2*	1*	8	22,100	14,225	36,325	186,475	2,902
MOONBEAM	4	2	-	2	152,400	-	32,900	185,300	-	3	-	5	61,200	-	34,200	95,400	3	-	8	-	50,900(4)	50,900	331,600	5,160
CALSTOCK	1	2	-	2	34,300	-	8,225	42,525	-	3	1	6	15,300	[3] 1,500	[2] 19,350	34,650	2	-	8	-	7,300	7,300	84,475	1,315
MOOSONEE	1	5	1	6	53,400	Ø(1)	[2] 27,575	80,975	-	-	-	6	-	-	-	Ø	1	1	8	22,100	6,925	29,025	110,000	1,712
LONGLAC	3	5	1	6	142,500	4,500	[2] 82,725	225,225	-	-	-	6	-	-	-	Ø	1	1	8	66,300	20,775	87,075	312,300	4,860
KAKABEKA FALLS	1	4	-	4	42,200	-	13,825	56,025	-	-	-	4	-	-	-	Ø	4	-	8	-	16,050(4)	16,050	72,075	1,122
HUDSON	4	4	-	4	192,400	-	55,300	247,700	-	1	1	6	21,200	6,000	[2] 55,000	76,200	1	1	8	88,400	27,700	116,100	440,000	6,847
EAR FALLS	4	4	-	4	192,400	-	55,300	247,700	-	1	1	6	21,200	6,000	[2] 55,000	76,200	1	1	8	88,400	27,700	116,100	440,000	6,847
REDDIT	3	4	-	4	144,300	-	41,475	185,775	-	1	1	6	15,900	4,500	[2] 41,250	57,150	2	-	8	-	21,900	21,900	264,825	4,121
STRATTON	4	4	1	5	192,400	6,000	[2] 99,100	291,500	-	1	-	6	20,000	-	11,200	31,200	1	1	8	88,400	27,700	116,100	438,800	6,828
HERON BAY	1	4	-	4	42,200	-	13,825	56,025	-	1	1	6	5,300	[3] 1,500	[2] 13,750	19,050	1	1	8	22,100	6,925	29,025	104,100	1,620
ARMSTRONG	1	5	1	6	47,500	Ø(1)	[2] 27,575	75,075	-	-	-	6	-	-	0	Ø	1	1	8	22,100	6,925	29,025	104,100	1,620
PICKLE LAKE	1	5	1	6	47,500	Ø(1)	[2] 27,575	75,075	-	-	-	6	-	-	0	Ø	1	1	8	22,100	6,925	29,025	104,100	1,620
TOTAL	128				5,134,800	10,500	1,609,750	6,744,550					943,900	46,500	1,012,625	1,956,525				1,959,100	1,344,250	3,303,350	12,004,425	186,809

(1) Microwave CTV signal delivery assumed to be at cluster centre point;
(2) Includes tower for MW reception
(3) Obtained from closest cabled community
(4) First off-air signal pick-up includes 1 small tower for antenna's
* Signal available in cluster by off-air pick-up or satellite; maximum number of signals indicated

OPERATING AND MAINTENANCE AND TOTAL MONTHLY COSTS
OPTION 1 - EACH COMMUNITY ESTABLISHES INDIVIDUAL FACILITIES

CLUSTERS	O & M MONTHLY COSTS - $				TOTAL MONTHLY COSTS		
	TVRO		LOCAL HEADEND $	TOTAL O & M $	TOTAL MW LINKS SERVICE COST $	EQUIVALENT CAPITAL COST $	TOTAL COST $
	12 GHz $	4 GHz $					
BARRY BAY	1,250	800	1,750	3,800	7,500	7,533	18,833
BANCROFT	1,250	1,000	1,750	4,000	7,500	7,792	19,292
GOODERHAM	1,500	1,200	2,100	4,800	9,000	9,413	23,213
SPRUCEDALE	3,250	2,400	4,550	10,200	-	19,591	29,791
SUNDRIDGE	1,750	1,200	2,450	5,400	-	10,393	15,793
MATTAWA	1,250	200	1,750	3,200	-	6,325	9,525
MAGNETAWAN	1,750	1,000	2,450	5,200	-	10,059	15,259
ST-CHARLES	3,000	200	4,200	7,400	-	14,104	21,504
WEBBWOOD	1,500	400	2,100	4,000	-	7,628	11,628
LITTLE CURRENT	1,000	800	1,400	3,200	-	6,355	9,555
SPANISH	1,000	-	1,400	2,400	-	4,793	7,193
ECHOBAY	1,750	1,200	2,450	5,400	-	10,399	15,799
COBALT	750	600	1,050	2,400	-	4,698	7,098
FOLEYET	500	400	700	1,600	-	3,065	4,665
KING KIRKLAND	2,000	1,600	2,800	6,400	-	12,557	18,957
RAMORE	1,000	400	1,400	2,800	-	5,530	8,330
MICHIPICOTEN RIVER	500	200	700	1,400	3,000	2,902	7,302
MOONBEAM	1,000	-	1,400	2,400	-	5,160	7,560
CALSTOCK	250	-	350	600	1,500	1,315	3,415
MOOSONEE	250	200	350	800	-	1,712	2,512
LONGLAC	750	600	1,050	2,400	4,500	4,860	11,760
KAKABEKA FALLS	250	-	350	600	-	1,122	1,722
HUDSON	1,000	800	1,400	3,200	6,000	6,847	16,047
EAR FALLS	1,000	800	1,400	3,200	6,000	6,847	16,047
REDDIT	750	-	1,050	1,800	4,500	4,121	10,421
STRATTON	1,000	800	1,400	3,200	6,000	6,828	16,028
HERON BAY	250	200	350	800	1,500	1,620	3,920
ARMSTRONG	250	200	350	800	-	1,620	2,420
PICKLE LAKE	250	200	350	800	-	1,620	2,420
TOTAL	32,000	17,400	44,800	94,200	57,000	186,809	338,009

CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS
OPTION 2 - COMMUNITIES SHARE COMMON FACILITIES

LOCATION			OUTSIDE CLUSTER SIGNALS							INSIDE CLUSTER SIGNALS NOT AVAILABLE TO ALL COMMUNITIES							INSIDE CLUSTER SIGNALS AVAILABLE TO ALL COMMUNITIES							GRAND TOTAL	
CLUSTERS	# COMMUNITIES	# DIRECT VHCM	# SAT. SIGNALS	# MW SIGNALS	CUMUL. SIGNS	COST OF ESTABLISHING FACILITIES AT CLUSTER CENTER POINT				# OFF-AIR SIG	# SAT. SIGNALS	# MW SIGNALS	CUMUL. TOTAL	INCREMENTAL COST OF ADDITIONAL FACILITIES					# OFF-AIR SIG	# SAT SIGNALS	CUMUL. TOTAL	INCREMENTAL COST OF ADDITIONAL FACILITIES					
						TVRO 12 GHz $	REGIONAL HEADEND $	VHCM COST $	TOTAL CAPITAL COST - $					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST $	REGIONAL HEADEND $	VHCM COST $	TOTAL CAPITAL COST - $				TVRO 4 GHz $	REGIONAL HEADEND $	VHCM COST $	TOTAL CAPITAL COST - $	TOTAL CAPITAL COST - $	TOTAL MONTHLY EQUIVALENT CAPITAL $
BARRY BAY	5	5	3	-	3	37,200	17,450	403,642	458,292	-	1	1	5	5,000	1,500	5,900 (3)	40,968	51,868	2	1	8	22,100	9,950	61,452	93,502	603,662	9,394
BANCROFT	5	5	4	-	4	42,200	20,250	389,899	452,349	-	-	1	5	-	1,500	3,100 (3)	6,875	9,975	2	1	8	22,100	9,950	50,020	82,070	544,394	8,472
GOODERHAM	6	6	3	-	3	37,200	17,450	445,392	500,042	1	1	1	6	5,000	1,500	9,875(3)(4)	20,625	35,500	1	1	8	22,100	5,975	43,145	71,220	606,762	9,442
SPRUCEDALE	13	13	3	-	3	37,200	17,450	787,664	842,314	-	2	-	5	10,300	-	5,900	40,968	57,168	2	1	8	22,100	9,950	61,452	93,502	992,984	15,452
SUNDRIDGE	7	6	5	-	5	47,500	23,050	406,342	476,892	-	-	-	5	-	-	-	-	-	2	1	8	22,100	9,950	50,020	82,070	558,962	8,698
MATTAWA	5	5	2	-	2	32,200	14,650	345,643	392,493	-	3	-	5	15,300	-	8,700	20,625	44,625	2	1	8	22,100	9,950	50,020	82,070	519,188	8,079
MAGNETAWAN	7	7	4	-	4	42,200	20,250	513,770	576,220	-	1	-	5	5,300	-	3,100	20,484	28,884	2	1	8	22,100	9,950	61,452	93,502	698,606	10,871
ST-CHARLES	12	12	2	-	2	32,200	14,650	692,243	739,093	1	2	-	5	10,000	-	9,875 (4)	61,452	81,327	3	-	8	-	9,525	61,452	70,977	891,397	13,871
WEBBWOOD	6	5	2	-	2	32,200	14,650	391,949	438,799	1	2	-	5	10,000	-	9,875 (4)	61,452	81,327	3	-	8	-	9,525	61,452	70,977	591,103	9,198
LITTLE CURRENT	4	4	5	-	5	47,500	23,050	269,353	339,903	-	-	-	5	-	-	-	-	-	1	2	8	27,300	9,575	50,020	86,895	426,798	6,642
SPANISH	4	4	2	-	2	32,200	14,650	348,134	394,984	-	3	-	5	15,300	-	8,700	61,452	85,452	3	-	8	-	10,325	61,452	71,777	552,213	8,593
ECHOBAY	7	7	4	-	4	44,300	20,250	550,234	614,784	1	-	-	5	-	-	4,275 (4)	20,484	24,759	3	-	8	-	9,525	61,452	70,977	710,520	11,057
COBALT	3	2	2	-	2	34,300	14,650	205,778	254,728	1	2	-	5	10,000	-	9,875 (4)	20,625	40,500	1	2	8	27,300	8,775	50,020	86,095	381,323	5,934
FOLEYET	2	2	5	-	5	47,500	23,050	334,514	405,064	-	-	-	5	-	-	-	-	-	2	1	8	22,100	9,950	61,452	93,502	498,566	7,758
KING KIRKLAND	8	7	2	-	2	38,100	14,650	743,911	796,661	1	2	-	5	10,000	-	9,875 (4)	61,452	81,327	2	1	8	22,100	9,150	61,452	92,702	970,690	15,105
RAMORE	4	4	2	-	2	38,100	14,650	318,304	371,054	-	2	-	4	10,000	-	5,600	13,750	29,350	4	-	8	-	13,800	56,895	70,695	471,099	7,331
MICHIPICOTEN RIVER	2	2	5	-	5	47,500	23,050	250,018	320,568	-	-	1	6	-	1,500	2,800 (3)	6,875	9,675	1	1	8	22,100	6,775	43,145	72,020	402,263	6,260
MOONBEAM	4	4	2	-	2	38,100	14,650	317,847	370,597	-	3	-	5	15,300	-	8,700	20,625	44,625	3	-	8	-	10,325	60,020	60,345	475,567	7,401
CALSTOCK	1	1	2	-	2	(1)	(1)	-	42,525 (2)	-	3	1	6	(1)	1,500(2)	(1)	-	34,650 (2)	2	-	8	(1)	(1)	-	7,300(2)	84,475 (2)	1,315 (2)
MOOSONEE	1	1	5	1	6	(1)	(1)	-	80,975 (2)	-	-	-	6	(1)	-	(1)	-	- (2)	1	1	8	(1)	(1)	-	29,025(2)	110,000 (2)	1,712 (2)
LONGLAC	3	2	5	1	6	47,500	(5) 25,850 (3)	333,924	407,274	-	-	-	6	-	-	-	-	-	1	1	8	22,100	6,775	40,968	69,843	477,117	7,425
KAKABEKA FALLS	1	1	4	-	4	(1)	(1)	-	66,025 (2)	-	-	-	4	(1)	-	(1)	-	- (2)	4	-	8	(1)	(1)	-	16,050(2)	72,075 (2)	1,122 (2)
HUDSON	4	4	4	-	4	48,100	20,250	403,407	471,757	-	1	1	6	5,300	1,500	5,900 (3)	40,968	52,168	1	1	8	22,100	6,775	40,968	69,843	593,768	9,240
EAR FALLS	4	4	4	-	4	48,100	20,250	354,068	422,418	-	1	1	6	5,300	1,500	5,900 (3)	13,750	24,950	1	1	8	22,100	6,775	43,145	72,020	519,388	8,082
REDDIT	3	3	4	-	4	48,100	20,250	326,163	394,513	-	1	1	6	5,300	1,500	5,900 (3)	13,750	24,950	2	-	8	-	7,150	43,145	50,295	469,758	7,310
STRATTON	4	3	4	1	5	48,100	(5) 23,050 (3)	300,553	371,703	-	1	-	6	5,300	-	2,800	6,875	14,975	1	1	8	22,100	6,775	43,145	72,020	458,698	7,138
HERON BAY	1	1	4	0	4	(1)	(1)	-	56,025 (2)	-	1	1	6	(1)	1,500(2)	(1)	-	19,050 (2)	1	1	8	(1)	(1)	-	29,025 (2)	104,100 (2)	1,620 (2)
ARMSTRONG	1	1	5	1	6	(1)	(1)	-	75,075 (2)	-	-	-	6	(1)	-	(1)	-	- (2)	1	1	8	(1)	(1)	-	29,025 (2)	104,100 (2)	1,620 (2)
PICKLE LAKE	1	1	5	1	6	(1)	(1)	-	75,075 (2)	-	-	-	6	(1)	-	(1)	-	- (2)	1	1	8	(1)	(1)	-	29,025 (2)	104,100 (2)	1,620 (2)
TOTAL	128					947,600	432,150	9,432,752	11,198,202					142,700	13,500	126,650	554,055	877,105				364,000	207,175	1,207,744	1,918,369	13,993,676	217,762

(1) Clusters of 1 community have no common facilities for sharing with other communities; cost evaluation for these communities are included in alternative 1
(2) Includes cost of clusters with 1 community for comparison purposes
(3) Tower for microwave receive included with VHCM costs; equipment for microwave receive included in regional headend
(4) Tower for off-air pick-up antenna included with VHCM costs
(5) CTV signal delivered at cluster centre point

OPERATING AND MAINTENANCE AND TOTAL MONTHLY COSTS
OPTION 2 - COMMUNITIES SHARE COMMON FACILITIES

CLUSTERS	O & M MONTHLY COSTS - $				TOTAL MONTHLY COSTS			
	TVRO		REGIONAL HEADEND $	VHCM $	TOTAL O & M $	TOTAL MW LINKS SERVICE COSTS $	EQUIVALENT CAPITAL COST $	TOTAL COST $
	12 GHz $	4 GHz $						
BARRY BAY	250	200	500	1,104	2,054	1,500	9,394	12,948
BANCROFT	250	200	500	1,061	2,011	1,500	B,472	11,983
GOODERHAM	250	200	500	1,218	2,168	1,500	9,442	13,110
SPRUCEDALE	250	200	500	1,875	2,825	-	15,452	18,277
SUNDRIDGE	250	200	500	1,124	2,074	-	8,698	10,772
MATTAWA	250	200	500	1,017	1,967	-	8,079	10,046
MAGNETAWAN	250	200	500	1,257	2,207	-	10,871	13,078
ST-CHARLES	250	-	500	1,689	2,439	-	13,871	16,310
WEBBWOOD	250	-	500	1,108	1,858	-	9,198	11,056
LITTLE CURRENT	250	200	500	859	1,809	-	6,642	8,451
SPANISH	250	-	500	1,000	1,750	-	8,593	10,343
ECHOBAY	250	-	500	1,326	2,076	-	11,057	13,133
COBALT	250	200	500	672	1,622	-	5,934	7,556
FOLEYET	250	200	500	839	1,789	-	7,758	9,547
KING KIRKLAND	250	200	500	1,509	2,459	-	15,105	17,564
RAMORE	250	-	500	953	1,703	-	7,331	9,034
MICHIPICOTEN RIVER	250	200	500	681	1,631	1,500	6,260	9,391
MOONBEAM	250	-	500	951	1,701	-	7,401	9,102
CALSTOCK	(1)	(1)	(1)	-	600(2)	1,500 (2)	1,315 (2)	3,415 (2)
MOOSONEE	(1)	(1)	(1)	-	800(2)	-	1,712 (2)	2,512 (2)
LONGLAC	250	200	500	804	1,754	-	7,425	9,179
KAKABEKA FALLS	(1)	(1)	(1)	-	600(2)	-	1,122 (2)	1,722 (2)
HUDSON	250	200	500	1,020	1,970	1,500	9,240	12,710
EAR FALLS	250	200	500	976	1,926	1,500	8,082	11,508
REDDIT	250	-	500	919	1,669	1,500	7,310	10,479
STRATTON	250	200	500	800	1,750	-	7,138	8,888
HERON BAY	(1)	(1)	(1)	-	800(2)	1,500 (2)	1,620 (2)	3,920
ARMSTRONG	(1)	(1)	(1)	-	800(2)	-	1,620 (2)	2,420
PICKLE LAKE	(1)	(1)	(1)	-	800(2)	-	1,620 (2)	2,420
TOTAL	5,750	3,20D	11,500	24,762	49,612	13,500	217,762	280,874

APPENDIX 4.3.2
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ASSUMPTION MODIFICATION PROJECTED MID 1980's TVRO COSTS

ELEMENTS	CAPITAL COST ESTIMATES 12 GHz			CAPITAL COST ESTIMATES 4 GHz			OPERATION AND MAINTENANCE COST ESTIMATES		
	LOCAL HEADEND REQUIREMENTS $	REGIONAL HEADEND REQUIREMENTS $	INCREMENTAL COST PER SIGNAL $	LOCAL HEADEND REQUIREMENTS $	REGIONAL HEADEND REQUIREMENTS $	INCREMENTAL COST PER SIGNAL $	ELEMENTS	ANNUAL $	MONTHLY $
MATERIAL:									
- Antenna	1,000	1,500	-	3,000	3,000	-	Cleaning	60	20
- LNA*	2,000	3,000	-	2,000	3,000	-	Power	60	20
- Receiver	500	500	500	500	500	500			
- Miscellaneous	500	500	-	500	500	-	Parts	600	20
FOUNDATION	500	800	-	1,100	1,100	-			
INSTALLATION AND COMMISSIONING	200	300	-	600	600	-	Labour	240	20
ENGINEERING	300	400	-	300	300	-			
TOTAL	5,000	7,000	500	8,000	9,000	500	TOTAL	960	80

* Low Noise Amplifier

TVRO COST REDUCTION - REVISED CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS
OPTION 1 - EACH COMMUNITY ESTABLISHES INDIVIDUAL FACILITIES

CLUSTERS	OUTSIDE CLUSTER SIGNALS								INSIDE CLUSTER SIGNALS NOT AVAILABLE TO ALL COMMUNITIES								AVAILABLE TO ALL COMMUNITIES					
	# COMMUNITIES	# SAT. SIGNALS	# MW SIGNALS	CUMULATIVE SIGNS	COST OF ESTABLISHING FACILITIES AND SERVICES				# OFF-AIR SIGNALS	# SAT. SIGNALS	# MW SIGNALS	CUMULATIVE SIGNS	INCREMENTAL COST OF ADDITIONAL FACILITIES				# OFF-AIR SIGNS	# SAT. SIGNS	CUMULATIVE SIGNS	INCREMENTAL COST OF ADDITIONAL FACILITIES		
					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST	LOCAL HEADEND $	TOTAL CAPITAL COST					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST	LOCAL HEADEND $	TOTAL CAPITAL COST $				TVRO 4 GHz $	LOCAL HEADEND COST $	TOTAL CAPITAL COST $
BARRY BAY	5	3	-	3	30,000	-	55,125	85,125	-	1	1	5	2,500	7,500	68,750	71,250	3*	2*	8	33,000	50,375	83,375
BANCROFT	5	4	-	4	32,500	-	69,125	101,625	-	-	1	5	-	7,500	54,750	54,750	2*	2*	8	40,500	50,125	90,625
GOODERHAM	6	3	-	3	36,000	-	66,150	102,150	1*	2*	1	6	4,000	9,000	104,600	108,600	1	1	8	48,000	37,750	85,750
SPRUCEDALE	13	3	-	3	78,000	-	143,325	221,325	-	2	-	5	13,000	-	74,750	87,750	3*	1*	8	96,000	158,175	254,175
SUNORIOGE	7	5	-	5	49,000	-	117,425	166,425	-	-	-	5	-	-	-	0	3*	1*	8	48,000	85,325	133,325
MATTAWA	5	2	-	2	27,500	-	41,125	68,625	-	3	-	5	7,500	-	42,750	50,250	3*	1*	8	8,000	63,000	71,000
MAGNETAWAN	7	4	-	4	45,500	-	96,775	142,275	-	1	-	5	3,500	-	20,650	24,150	3*	1*	8	40,000	85,950	125,950
ST-CHARLES	12	2	-	2	66,000	-	98,700	164,700	1*	3*	-	5	14,000	-	129,200	143,200	3*	1*	8	8,000	128,725	136,725
WEBBWOOD	6	2	-	2	33,000	-	49,350	82,350	1*	3*	-	5	7,500	-	61,275	68,775	3*	1*	8	16,000	66,250	82,250
LITTLE CURRENT	4	5	-	5	28,000	-	67,100	95,100	-	-	-	5	-	-	-	0	2*	2*	8	33,500	47,275	80,775
SPANISH	4	2	-	2	22,000	-	32,900	54,900	-	3	-	5	6,000	-	34,200	40,200	3	-	8	-	50,900	50,900
ECHOBAY	7	4	-	4	45,500	-	96,775	142,275	1*	1*	-	5	2,000	-	30,625	32,625	3*	1*	8	48,000	76,975	124,975
COBALT	3	2	-	2	16,500	-	24,675	41,175	1*	3*		5	4,000	-	28,975	32,975	2*	2*	8	24,500	33,225	57,725
FOLEYET	2	5	-	5	14,000	-	33,550	47,550	-	-	-	5	-	-	-	-	2	1	8	16,000	24,200	40,200
KING KIRKLAND	8	2	-	2	44,000	-	65,800	109,800	1*	3*		5	9,000	-	88,350	97,350	2	1	8	64,000	80,600	144,600
RAMORE	4	2	-	2	22,000	-	32,900	54,900	-	2	-	4	4,000	-	22,400	26,400	4*	1*	8	16,000	63,450	79,450
MICHIPICOTEN RIVER	2	5	-	5	14,000	-	33,550	47,550	-	-	1	6	-	3,000	21,600	21,600	2*	1*	8	8,000	14,225	22,225
MOONBEAM	4	2	-	2	22,000	-	32,900	54,900	-	3	-	5	6,000	-	34,200	40,200	3	-	8	-	50,900	50,900
CALSTOCK	1	2	-	2	5,500	-	8,225	13,725	-	3	1	6	1,500	1,500	19,350	20,850	2	-	8	-	7,300	7,300
MOOSONEE	1	5	1	6	7,000	0	27,575	34,575	-	-	-	6	-	-	-	0	1	1	8	8,000	6,925	14,925
LONGLAC	3	5	1	6	21,000	4,500	82,725	103,725	-	-	-	6	-	-	-	0	1	1	8	24,000	20,775	44,775
KAKABEKA FALLS	1	4	-	4	6,500	-	13,825	20,325	-	-	-	4	-	-	-	0	4	-	8	-	16,050	16,050
HUDSON	4	4	-	4	26,000	-	55,300	81,300	-	1	1	6	2,000	6,000	55,000	57,000	1	1	8	32,000	27,700	59,700
EAR FALLS	4	4	-	4	26,000	-	55,300	81,300	-	1	1	6	2,000	6,000	55,000	57,000	1	1	8	32,000	27,700	59,700
REDDIT	3	4	-	4	19,500	-	41,475	60,975	-	1	1	6	1,500	4,500	41,250	42,750	2	0	8	-	21,900	21,900
STRATTON	4	4	1	5	26,000	6,000	99,100	125,100	-	1	-	6	2,000	-	11,200	13,200	1	1	8	32,000	27,700	59,700
HERON BAY	1	4	-	4	6,500	-	13,825	20,325	-	1	1	6	500	1,500	13,750	14,250	1	1	8	8,000	6,925	14,925
ARMSTRONG	1	5	1	6	7,000	0	27,575	34,575	-	-	-	6	-	-	0	0	1	1	8	8,000	6,925	14,925
PICKLE LAKE	1	5	1	6	7,000	0	27,575	34,575	-	-	-	6	-	-	0	0	1	1	8	8,000	6,925	14,925
TOTAL	128				783,500	10,500	1,609,750	2,393,250					92,500	46,500	1,012,625	1,105,125				699,500	1,344,250	2,043,750

* Signal available in cluster by off-air pick-up or satellite; maximum number of signals indicated.

APPENDIX 4.4.1
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TVRO COST REDUCTION - REVISED OPERATION AND MAINTENANCE AND TOTAL MONTHLY COSTS

OPTION 1

CLUSTERS	TOTAL CAPITAL COST $	MONTHLY CAPITAL COST EQUIVALENT $	MONTHLY OPERATION AND MAINTENANCE COST					
			TVRO		LOCAL HEADEND COST $	TOTAL O & M COST $	SERVICE COST MW $	MONTHLY TOTAL COST $
			12 GHz *	4 GHz *				
BARRY BAY	239,750	3,731	400	320	1,750	2,470	7,500	13,701
BANCROFT	247,000	3,844	400	400	1,750	2,550	7,500	13,894
GOODERHAM	296,500	4,614	480	480	2,100	3,060	9,000	16,674
SPRUCEDALE	563,250	8,765	1,040	960	4,550	6,550	-	15,315
SUNDRIDGE	299,750	4,666	560	480	2,450	3,490	-	8,156
MATTAWA	189,875	2,955	400	80	1,750	2,230	-	5,185
MAGNETAWAN	292,375	4,550	560	400	2,450	3,410	-	7,960
ST-CHARLES	444,625	6,919	960	80	4,200	5,240	-	12,159
WEBBWOOD	233,375	3,632	480	160	2,100	2,740	-	6,372
LITTLE CURRENT	175,875	2,737	320	320	1,400	2,040	-	4,777
SPANISH	146,000	2,272	320	0	1,400	1,720	-	3,992
ECHOBAY	299,875	4,666	560	480	2,450	3,490	-	8,156
COBALT	131,875	2,052	240	240	1,050	1,530	-	3,582
FOLEYET	87,750	1,366	160	160	700	1,020	-	2,386
KING KIRKLAND	351,750	5,474	640	640	2,800	4,080	-	9,554
RAMORE	160,750	2,502	320	160	1,400	1,880	-	4,382
MICHIPICOTEN RIVER	91,375	1,422	160	80	700	940	3,000	5,362
MOONBEAM	146,000	2,272	320	0	1,400	1,720	-	3,992
CALSTOCK	41,875	652	80	0	350	430	1,500	2,582
MOOSENEE	49,500	770	80	80	350	510	0	1,280
LONGLAC	148,500	2,311	240	240	1,050	1,530	4,500	8,341
KAKABEKA FALLS	36,375	566	80	0	350	430	-	996
HUDSON	198,000	3,081	320	320	1,400	2,040	6,000	11,121
EAR FALLS	198,000	3,081	320	320	1,400	2,040	6,000	11,121
REDDIT	125,625	1,955	240	0	1,050	1,290	4,500	7,745
STRATTON	198,000	3,081	320	320	1,400	2,040	6,000	11,121
HERON BAY	49,500	770	80	80	350	510	1,500	2,780
ARMSTRONG	49,500	770	80	80	350	510	0	1,280
PICKLE LAKE	49,500	770	80	80	350	510	0	1,280
TOTAL	5,542,125	86,246	10,240	6,960	44,800	62,000	57,000	205,246

APPENDIX 4.4.1
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TVRO COST REDUCTION REVISED
CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS
OPTION 2 - COMMUNITIES SHARE COMMON FACILITIES

CLUSTERS	OUTSIDE CLUSTER SIGNALS									INSIDE CLUSTER SIGNALS NOT AVAILBLE TO ALL COMMUNITIES										INSIDE CLUSTER SIGNALS AVAILABLE TO ALL COMMUNITIES							
	# COMMUNITIES	# DIRECT. VHCM	# SAT. SIGNALS	# MW SIGNALS	CUMULATIVE SIGNS	COST OF ESTABLISHING FACILITIES AND SERVICES				# OFF-AIR SIGNS	# SAT. SIGNALS	# MW SIGNALS	CUMULATIVE TOTAL	INCREMENTAL COST OF ADDITIONAL FACILITIES					# OFF-AIR SIGNS	# SAT. SIGNALS	CUMULATIVE TOTAL	INCREMENTAL COST OF ADDITIONAL FACILITIES			
						TVRO 12 GHz $	VHCM COST $	REGIONAL HEADEND $	TOTAL CAPITAL COST - $					TVRO 12 GHz $	CTV MW LINK MONTHLY SERVICE COST $	REGIONAL HEADEND $	VHCM COST $	TOTAL CAPITAL COST - $				TVRO 4 GHz $	REGIONAL HEADEND $	VHCM COST $	TOTAL CAPITAL COST - $
BARRY BAY	5	5	3	-	3	8,000	403,642	17,450	429,092	-	1	1	5	500	1,500	5,900(3)	40,968	47,368	2	1	8	9,000	9,950	61,452	80,402
BANCROFT	5	5	4	-	4	8,500	389,899	20,250	418,649	-	-	1	5	-	1,500	3,100(3)	6,875	9,975	2	1	8	9,000	9,950	50,020	68,970
GOODERHAM	6	6	3	-	3	8,000	445,392	17,450	470,842	1	1	1	6	500	1,500	(3)9,875(4)	20,625	31,000	1	1	8	9,000	5,975	43,145	58,120
SPRUCEDALE	13	13	3	-	3	8,000	787,664	17,450	813,114	-	2	-	5	1,000	-	5,900	40,968	47,868	2	1	8	9,000	9,950	61,452	80,402
SUNDRIDGE	7	6	5	-	5	9,000	406,342	23,050	438,392	-	-	-	5	-	-	-	-	0	2	1	8	9,000	9,950	50,020	68,970
MATTAWA	5	5	2	-	2	7,500	345,643	14,650	367,793	-	3	-	5	1,500	-	8,700	20,625	30,825	2	1	8	9,000	9,950	50,020	68,970
MAGNETAWAN	7	7	4	-	4	8,500	513,770	20,250	542,520	-	1	-	5	500	-	3,100	20,484	24,084	2	1	8	9,000	9,950	61,452	80,402
ST-CHARLES	12	12	2	-	2	7,500	692,243	14,650	714,393	1	2	-	5	1,000	-	9,875(4)	61,452	72,327	3	-	8	-	9,525	61,452	70,977
WEBBWOOD	6	5	2	-	2	7,500	391,949	14,650	414,099	1	2	-	5	1,000	-	9,875(4)	61,452	72,327	3	-	8	-	9,525	61,452	70,977
LITTLE CURRENT	4	4	5	-	5	9,000	269,353	23,050	301,403	-	-	-	5	-	-	-	-	0	1	2	8	9,500	9,575	50,020	69,095
SPANISH	4	4	2	-	2	7,500	348,134	14,650	370,284	-	3	-	5	1,500	-	8,700	61,452	71,652	3	-	8	-	10,325	61,452	71,777
ECHOBAY	7	7	4	-	4	8,500	550,234	20,250	578,984	1	-	-	5	-	-	4,275(4)	20,484	24,759	3	-	8	-	9,525	61,452	70,977
COBALT	3	2	2	-	2	7,500	205,778	14,650	227,928	1	2	-	5	1,000	-	9,875(4)	20,625	31,500	1	2	8	9,500	8,775	50,020	68,295
FOLEYET	2	2	5	-	5	9,000	334,514	23,050	366,564	-	-	-	5	-	-	-	-	0	2	1	8	9,000	9,950	61,452	80,402
KING KIRKLAND	8	7	2	-	2	7,500	743,911	14,650	766,061	1	2	-	5	1,000	-	9,875(4)	61,452	72,327	2	1	8	9,000	9,150	61,452	79,602
RAMORE	4	4	2	-	2	7,500	318,304	14,650	340,454	-	2	-	4	1,000	-	5,600	13,750	20,350	4	-	8	-	13,800	56,895	70,695
MICHIPICOTEN RIVER	2	2	5	-	5	9,000	250,018	23,050	282,068	-	-	1	6	-	1,500	2,800(3)	6,875	9,675	1	1	8	9,000	6,775	43,145	58,920
MOONBEAM	4	4	2	0	2	7,500	317,847	14,650	339,997	-	3	-	5	1,500	-	8,700	20,625	30,825	3	-	8	-	10,325	50,020	60,345
CALSTOCK	1	1	2	-	2	(1)	-	(1)	(1)	-	3	1	6	(1)	1,500(2)	(1)	-	(1)	2	-	8	(1)	(1)	-	(1)
MOOSENEE	1	1	5	1	6	(1)	-	(1)	(1)	-	-	-	6	(1)	-	(1)	-	(1)	1	1	8	(1)	(1)	-	(1)
LONGLAC	3	2	5	1	6	9,000	333,924	(5)25,850(3)	368,774	-	-	-	6	-	-	-	-	0	1	1	8	9,000	6,775	40,968	56,743
KAKABEKA FALLS	1	1	4	-	4	(1)	-	(1)	(1)	-	-	-	4	(1)	-	(1)	-	(1)	4	-	8	(1)	(1)	-	(1)
HUDSON	4	4	4	-	4	8,500	403,407	20,250	432,157	-	1	1	6	500	1,500	5,900(3)	40,968	47,368	1	1	8	9,000	6,775	40,968	56,743
EAR FALLS	4	4	4	-	4	8,500	354,068	20,250	382,818	-	1	1	6	500	1,500	5,900(3)	13,750	20,150	1	1	8	9,000	6,775	43,145	58,920
REDDIT	3	3	4	-	4	8,500	326,163	20,250	354,913	-	1	1	6	500	1,500	5,900(3)	13,750	20,150	2	-	8	-	7,150	43,145	50,295
STRATTON	4	3	4	1	5	8,500	300,553	(5)23,050(3)	332,103	-	1	-	6	500	-	2,800(3)	6,875	10,175	1	1	8	9,000	6,775	43,145	58,920
HERON BAY	1	1	4	0	4	(1)	-	(1)	(1)	-	1	1	6	(1)	1,500(2)	(1)	-	(1)	1	1	8	(1)	(1)	-	(1)
ARMSTRONG	1	1	5	1	6	(1)	-	(1)	(1)	-	0	0	6	(1)	-	(1)	-	(1)	1	1	8	(1)	(1)	-	(1)
PICKLE LAKE	1	1	5	1	6	(1)	-	(1)	(1)	-	0	0	6	(1)	-	(1)	-	(1)	1	1	8	(1)	(1)	-	(1)
TOTAL						188,500	9,432,752	432,150	10,053,402					14,000	10,500	126,650	554,055	694,705				145,000	207,175	1,207,744	1,559,919

(1) Clusters of 1 community have no common facilities for sharing with other communities; cost evaluation for these communities are included in alternative 1
(2) Includes costs of clusters with 1 community for comparison purpose
(3) Tower for microwave receive included with VHCM costs; equipment for microwave receive included in regional headend
(4) Tower for off-air pick-up antenna included with VHCM costs
(5) CTV signal delivered at cluster center point

TVRD COST REDUCTION
REVISED DPERATIDN MAINTENANCE AND
TOTAL MONTHLY COSTS - DPTION 2

CLUSTERS	TOTAL CAPITAL COST $	MONTHLY CAPITAL COST EQUIVALENT	MONTHLY OPERATION AND MAINTENANCE COST						
			TVRO		REGIONAL HEADEND $	VHCM COST $	O & M TDTAL	SERVICE MW TOTAL CHARGES	MONTHLY GRAND TOTAL
			12 GHz	4 GHz					
BARRY BAY	556,862	8,666	80	80	500	1,104	1,764	1,500	11,930
BANCROFT	497,594	7,743	80	80	500	1,061	1,721	1,500	10,964
GOODERHAM	559,962	8,714	80	8D	500	1,218	1,878	1,500	12,092
SPRUCEDALE	941,384	14,649	80	80	500	1,875	2,535	-	17,184
SUNDRIDGE	507,362	7,895	80	80	500	1,124	1,784	-	9,679
MATTAWA	467,588	7,276	8D	80	500	1,017	1,677	-	8,953
MAGNETAWAN	647,006	10,068	80	80	50D	1,257	1,917	-	11,985
ST-CHARLES	857,697	13,347	8D	-	500	1,689	2,269	-	15,616
WEBBWDOD	557,403	8,674	80	-	500	1,108	1,688	-	10,362
LITTLE CURRENT	370,498	5,765	80	8D	5D0	859	1,519	-	7,284
SPANISH	513,713	7,994	80	-	5D0	1,DD0	1,58D	-	9,574
ECHOBAY	674,720	10,500	80	-	500	1,326	1,906	-	12,406
COBALT	327,723	5,10D	80	80	50D	672	1,332	-	6,432
FOLEYET	446,966	6,955	80	80	500	839	1,499	-	8,454
KING KIRKLAND	917,990	14,285	80	80	500	1,509	2,169	-	16,454
RAMORE	431,499	6,715	80	-	50D	953	1,533	-	8,248
MICHIPICOTEN RIVER	350,663	5,457	80	8D	500	681	1,341	1,500	8,298
MDONBEAM	431,167	6,71D	80	-	500	951	1,531	-	8,241
CALSTDCK	41,875(2)	-	(1)	(1)	(1)	-	(1)	-	2,582(2)
MOOSONEE	49,500(2)	-	(1)	(1)	(1)	-	(1)	-	1,280(2)
LONGLAC	425,517	6,622	80	80	500	804	1,464	-	8,086
KAKABEKA FALLS	36,375(2)	-	(1)	(1)	(1)	-	(4)	-	996(2)
HUDSON	536,268	8,345	80	80	500	1,020	1,680	1,500	11,525
EAR FALLS	461,888	7,188	80	80	500	976	1,636	1,500	10,324
REDDIT	425,358	6,619	80	-	50D	919	1,499	1,500	9,618
STRATTON	401,198	6,243	8D	8D	500	800	1,46D	-	7,703
HERON BAY	49,500(2)	-	(1)	(1)	(1)	-	(1)	(2)	2,780(2)
ARMSTRONG	49,500(2)	-	(1)	(1)	(1)	-	(1)	-	1,280(2)
PICKLE LAKE	49,500(2)	-	(1)	(1)	(1)	-	(1)	-	1,28D(2)
TOTAL	12,584,276 (2)	191,530	1,840	1,280	11,500	24,762	39,382	1D,500	251,610(2)

REVISED CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS ON THE BASIS OF A MICROWAVE LONG HAUL TRANSMISSION MODEL

OPTION 1 - EACH COMMUNITY ESTABLISHES INDIVIDUAL FACILITIES

CLUSTERS	OUTSIDE CLUSTER SIGNALS								INSIDE CLUSTER SIGNALS NOT AVAILABLE TO ALL COMMUNITIES								INSIDE CLUSTER SIGNALS AVAILABLE TO ALL COMMUNITIES					
	No. of communities	No. of sat. sign.	No. of MW signals	Cumulative sign.	COST OF ESTABLISHING FACILITIES AND SERVICES (1)				No. of off-air s.	No. of sat. sign.	No. of MW signals	Cumulative sign.	INCREMENTAL COST OF ADDITIONAL FACILITIES				No. of off-air s.	No. of sat. sign.	Cumulative sign.	INCREMENTAL COST OF ADDITIONAL FACILITIES		
					TVRO 12 GHz $	MW LINKS MONTHLY SERVICE COST - $	LOCAL HEADEND $	TOTAL CAPITAL COST					TVRO 12 GHz $	MW LINKS MONTHLY SERVICE COST - $	LOCAL HEADEND $	TOTAL CAPITAL COST				TVRO 4 GHz $	LOCAL HEADEND $	TOTAL CAPITAL COST
BARRY BAY	5	-	3	3	-	22,500	95,125	95,125	-	1	1	5	134,500	7,500	28,750	163,250	2*	2*	8	98,800	50,375	149,175
BANCROFT	5	1	3	4	134,500	22,500	109,125	243,625	-	-	1	5	-	7,500	14,750	14,750	2*	2*	8	115,700	50,125	165,825
GODDERHAM	6	-	3	3	-	27,000	114,150	114,150	1*	1	2*	6	161,400	12,000	56,600	218,000	1	1	8	132,600	37,750	170,350
SPRUCEDALE	13	-	3	3	-	58,500	247,325	247,325	-	1	1	5	349,700	19,500	74,750	424,450	3*	1*	8	265,200	158,175	423,375
SUNDRIDGE	7	1	4	5	188,300	(2)36,000	(3)165,425	353,725	-	-	-	5	-	-	-	-	3*	1*	8	132,600	85,325	217,925
MATTAWA	5	-	2	2	-	15,000	81,125	81,125	-	1	2	5	134,500	15,000	42,750	177,250	3*	1*	8	22,100	63,000	85,100
MAGNETAWAN	7	1	3	4	188,300	31,500	152,775	341,075	-	-	1	5	-	10,500	20,650	20,650	3*	1*	8	110,500	85,950	196,450
ST-CHARLES	12	-	2	2	-	36,000	194,700	194,700	1*	1*	2	5	107,600	36,000	113,650	221,250	3*	1*	8	22,100	128,725	150,825
WEBBWOOD	6	-	2	2	-	(2)15,000	(3) 89,350	89,350	1*	1*	2	5	80,700	18,000	55,275	135,975	3*	1*	8	44,200	66,250	110,450
LITTLE CURRENT	4	1	4	5	107,600	24,000	99,100	206,700	-	-	-	5	-	-	-	-	2*	2*	8	104,000	47,275	151,275
SPANISH	4	-	2	2	-	12,000	64,900	64,900	-	1	2	5	107,600	12,000	34,200	141,800	3	-	8	-	50,900	50,900
ECHOBAY	7	-	4	4	-	42,000	152,775	152,775	1*	1*	-	5	116,000	-	24,625	140,625	3*	1*	8	132,600	76,975	209,575
COBALT	3	-	2	2	-	(2) 6,000	(3) 40,675	40,675	1*	1	2*	5	87,000	7,500	26,975	113,975	2*	2*	8	71,500	33,225	104,725
FOLEYET	2	1	4	5	53,800	24,000	49,550	103,350	-	-	-	5	-	-	-	-	2	1	8	44,200	24,200	68,400
KING KIRKLAND	8	-	2	2	-	24,000	(3)121,800	121,800	1*	1	2*	5	262,400	15,000	76,350	338,750	2	1	8	176,800	80,600	257,400
RAMORE	4	-	2	2	-	12,000	64,900	64,900	-	1	1	4	131,200	6,000	22,400	153,600	4*	1*	8	44,200	63,450	107,650
MICHIPICOTEN RIVER	2	1	4	5	53,800	12,000	49,550	103,350	-	-	1	6	-	3,000	5,600	5,600	2*	1*	8	22,100	14,225	36,325
MOONBEAM	4	-	2	2	-	12,000	64,900	64,900	-	1	2	5	131,200	12,000	34,200	165,400	3	-	8	-	50,900	50,900
CALSTOCK	1	-	2	2	-	(1)(2)	(4) 16,225	16,225	-	1	3	6	29,000	1,500	11,350	40,350	2	-	8	-	7,300	7,300
MOOSONEE	1	1	5	6	26,900	(1)(2)	27,575	54,475	-	-	-	6	-	-	-	-	1	1	8	22,100	6,925	29,025
LONGLAC	3	1	5	6	80,700	(2)15,000	(3) 76,725	157,425	-	-	-	6	-	-	-	-	1	1	8	66,300	20,775	87,075
KAKABEKA FALLS	1	-	4	4	-	(1)(2)	21,825	21,825	-	-	-	4	-	-	-	-	4	0'	8	-	16,050	16,050
HUDSON	4	-	4	4	-	24,000	87,300	87,300	-	1	1	6	131,200	6,000	23,000	154,200	1	1	8	88,400	27,700	116,100
EAR FALLS	4	-	4	4	-	24,000	87,300	87,300	-	1	1	6	131,200	6,000	23,000	154,200	1	1	8	88,400	27,700	116,100
REDDIT	3	-	4	4	-	18,000	65,475	65,475	-	1	1	6	98,400	4,500	17,250	115,650	2	-	8	-	21,900	21,900
STRATTON	4	-	5	5	-	(2)22,500	99,100	99,100	-	1	-	6	131,200	-	11,200	142,400	1	1	8	88,400	27,700	116,100
HERON BAY	1	-	4	4	-	(1)(2)	21,825	21,825	-	1	1	6	26,900	1,500	5,750	32,650	1	1	8	22,100	6,925	29,025
ARMSTRONG	1	1	5	6	26,900	(1)(2)	27,575	54,475	-	-	-	6	-	-	-	-	1	1	8	22,100	6,925	29,025
PICKLE LAKE	1	1	5	6	32,800	(1)(2)	27,575	60,375	-	-	-	6	-	-	-	-	1	1	8	22,100	6,925	29,025
								3,409,350								3,074,775				1,959,100	1,344,250	3,303,350

(1) Microwave delivery assumed to be at cluster centre point

(2) Community adjacent to cluster centre point does not require MW service

(3) Community adjacent to cluster centre point or to another community permits elimination of a MW receive tower

(4) Cluster of 1 community requires tower to take delivery of MW signals

* Maximum available off-air to some communities or maximum microwave

REVISED OPERATION AND MAINTENANCE AND TOTAL MONTHLY COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS ON THE BASIS OF A MICROWAVE LONG HAUL TRANSMISSION MODEL

OPTION 1 - EACH COMMUNITY ESTABLISHES INDIVIDUAL FACILITIES

CLUSTERS	TOTAL CAPITAL COST	TOTAL MONTHLY EQUIVALENT CAPITAL	MONTHLY OPERATION AND MAINTENANCE COSTS					
			TVRO		LOCAL HEADEND COST	TOTAL O & M COST	TOTAL MONTHLY MW SERVICE COSTS - $	TOTAL COST
			TVRO 12 GHz (1)	TVRO 4 GHz				
BARRY BAY	407,550	6,342	1,000	800	1,750	3,550	30,000	39,892
BANCROFT	424,200	6,601	1,000	1,000	1,750	3,750	30,000	40,351
GOODERHAM	502,500	7,820	1,200	1,200	2,100	4,500	39,000	51,320
SPRUCEDALE	1,095,150	17,042	2,600	2,400	4,550	9,550	78,000	104,592
SUNDRIDGE	571,650	8,896	1,400	1,200	2,450	5,050	36,000	49,946
MATTAWA	343,475	5,345	1,000	200	1,750	2,950	30,000	38,295
MAGNETAWAN	558,175	8,686	1,400	1,000	2,450	4,850	42,000	55,536
ST-CHARLES	566,775	8,820	800	200	4,200	5,200	72,000	86,020
WEBBWOOD	335,775	5,225	600	400	2,100	3,100	33,000	41,325
LITTLE CURRENT	357,975	5,571	800	800	1,400	3,000	24,000	32,571
SPANISH	257,600	4,009	800	-	1,400	2,200	24,000	30,209
ECHOBAY	502,975	7,827	800	1,200	2,450	4,450	42,000	54,277
COBALT	259,375	4,036	600	600	1,050	2,250	13,500	19,786
FOLEYET	171,750	2,673	400	400	700	1,500	24,000	28,173
KING KIRKLAND	717,950	11,171	1,600	1,600	2,800	6,000	39,000	56,171
RAMORE	326,150	5,075	800	400	1,400	2,600	18,000	25,675
MICHIPICOTEN RIVER	145,275	2,261	400	200	700	1,300	15,000	18,561
MOONBEAM	281,200	4,376	200	-	1,400	1,600	24,000	29,976
CALSTOCK	63,875	994	200	-	350	550	1,500	3,044
MOOSONEE	83,500	1,299	200	200	350	750	-	2,049
LONGLAC	244,500	3,805	600	600	1,050	2,250	15,000	21,055
KAKABEKA FALLS	37,875	589	-	-	350	350	-	939
HUDSON	357,600	5,565	800	800	1,400	3,000	30,000	38,565
EAR FALLS	357,600	5,565	800	800	1,400	3,000	30,000	38,565
REDDIT	203,025	3,159	600	-	1,050	1,650	22,500	27,309
STRATTON	357,600	5,565	800	800	1,400	3,000	22,500	31,065
HERON BAY	83,500	1,299	200	200	350	750	1,500	3,549
ARMSTRONG	83,500	1,299	200	200	350	750	-	2,049
PICKLE LAKE	89,400	1,391	200	200	350	750	-	2,141
TOTAL	9,787,475	152,306	22,000	17,400	44,800	84,200	736,500	973,006

REVISED CAPITAL AND SERVICE COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS ON THE BASIS OF A MICROWAVE LONG HAUL TRANSMISSION MODEL

OPTION 2 - COMMUNITIES SHARE COMMON FACILITIES

CLUSTERS	OUTSIDE CLUSTER SIGNALS				INSIDE CLUSTER SIGNALS NOT AVAILABLE TO ALL COMMUNITIES					INSIDE CLUSTER SIGNALS AVAILABLE TO ALL COMMUNITIES				TOTAL	
	COST OF ESTABLISHING FACILITIES AT CLUSTER CENTER POINT				INCREMENTAL COST OF ADDITIONAL FACILITIES					INCREMENTAL COST OF ADDITIONAL FACILITIES					
	TVRO 12 GHz	REGIONAL HEADEND	VHCM	TOTAL	TVRO 12 GHz	MW LINK MONTHLY SERVICE COSTS	REGIONAL HEADEND	VHCM	TOTAL CAPITAL COST	TVRO 4 GHz	REGIONAL HEADEND	VHCM	TOTAL	TOTAL CAPITAL	TOTAL MONTHLY EQUIVALENT
BARRY BAY	-	17,450	403,642	421,092	26,900	1,500	5,900	40,968	73,768	22,100	9,950	61,452	93,502	588,362	9,156
BANCROFT	26,900	20,250	389,899	437,049	-	1,500	3,100	6,875	9,975	22,100	9,950	50,020	82,070	529,094	8,233
GOODERHAM	-	17,450	445,392	462,842	26,900	1,500	9,875	20,625	57,400	22,100	5,975	43,145	71,220	591,462	9,204
SPRUCEDALE	-	17,450	787,664	805,114	26,900	1,500	5,900	40,968	73,768	22,100	9,950	61,452	93,502	972,384	15,132
SUNDRIDGE	26,900	23,050	406,342	456,292	-	-	-	-	-	22,100	9,950	50,020	82,070	538,362	8,378
MATTAWA	-	14,650	345,643	360,293	26,900	3,000	8,700	20,625	56,225	22,100	9,950	50,020	82,070	498,588	7,758
MAGNETAWAN	26,900	20,250	513,770	560,920	-	1,500	3,100	20,484	23,584	22,100	9,950	61,452	93,502	678,006	10,551
ST-CHARLES	-	14,650	692,243	706,893	-	3,000	9,875	61,452	71,327	-	9,525	61,452	70,977	849,197	13,215
WEBBWOOD	-	14,650	391,949	406,599	-	3,000	9,875	61,452	71,327	-	9,525	61,452	70,977	548,903	8,542
LITTLE CURRENT	26,900	23,050	269,353	319,303	-	-	-	-	-	27,300	9,575	50,020	86,895	406,198	6,321
SPANISH	-	14,650	348,134	362,784	26,900	3,000	8,700	61,452	97,052	-	10,325	61,452	71,777	532,063	8,279
ECHOBAY	-	20,250	550,234	570,484	-	-	4,275	20,484	24,759	-	9,525	61,452	70,977	666,220	10,367
COBALT	-	14,650	205,778	220,428	29,000	1,500	9,875	20,625	59,500	27,300	8,775	50,020	86,095	366,023	5,696
FOLEYET	26,900	23,050	334,514	384,464	-	-	-	-	-	22,100	9,950	61,452	93,502	477,966	7,438
KING KIRKLAND	-	14,650	743,911	758,561	32,800	1,500	9,875	61,452	104,127	22,100	9,150	61,452	92,702	955,390	14,867
RAMORE	-	14,650	318,304	332,954	32,800	1,500	5,600	13,750	52,150	-	13,800	56,895	70,695	455,799	7,093
MICHIPICOTEN RIVER	26,900	23,050	250,018	299,968	-	1,500	2,800	6,875	9,675	22,100	6,775	43,145	72,020	381,662	5,939
MOONBEAM	-	14,650	317,847	332,497	32,800	3,000	8,700	20,625	62,125	-	10,325	50,020	60,345	454,967	7,080
CALSTOCK	-	16,225*	-	16,225*	29,000*	1,500*	11,350*	-	40,350*	- *	7,300*	-	7,300*	63,875*	994
MOOSONEE	26,900*	27,575*	-	54,475*	-	-	-	-	-	0	6,925*	-	29,025*	83,500*	1,299
LONGLAC	26,900*	25,850	333,924	386,674	-	-	-	-	-	22,100	6,775	40,968	69,843	456,517	7,104
KAKABEKA FALLS	-	21,825*	-	21,825*	-	-	-	-	-	- *	16,050*	-	16,050*	37,875*	589
HUDSON	-	20,250	403,407	423,657	32,800	1,500	5,900	40,968	79,668	22,100	6,775	40,968	69,843	573,168	8,919
EAR FALLS	-	20,250	354,068	374,318	32,800	1,500	5,900	13,750	52,450	22,100	6,775	43,145	72,020	498,788	7,762
REDDIT	-	20,250	326,163	346,413	32,800	1,500	5,900	13,750	52,450	-	7,150	43,145	50,295	449,158	6,990
STRATTON	-	23,050	300,553	323,603	32,800	-	2,800	6,875	42,475	22,100	6,775	43,145	72,020	438,098	6,817
HERON BAY	-	21,825*	-	21,825*	26,900*	1,500*	5,750*	-	32,650	22,100*	6,925*	-	29,025*	83,500*	1,299
ARMSTRONG	26,900*	27,575*	-	54,475*	-	-	-	-	-	22,100*	6,925*	-	29,025*	83,500*	1,299
PICKLE LAKE	32,800*	27,575*	-	60,375*	-	-	-	-	-	22,100*	6,925*	-	29,025*	89,400*	1,391
TOTAL														13,348,025	207,712

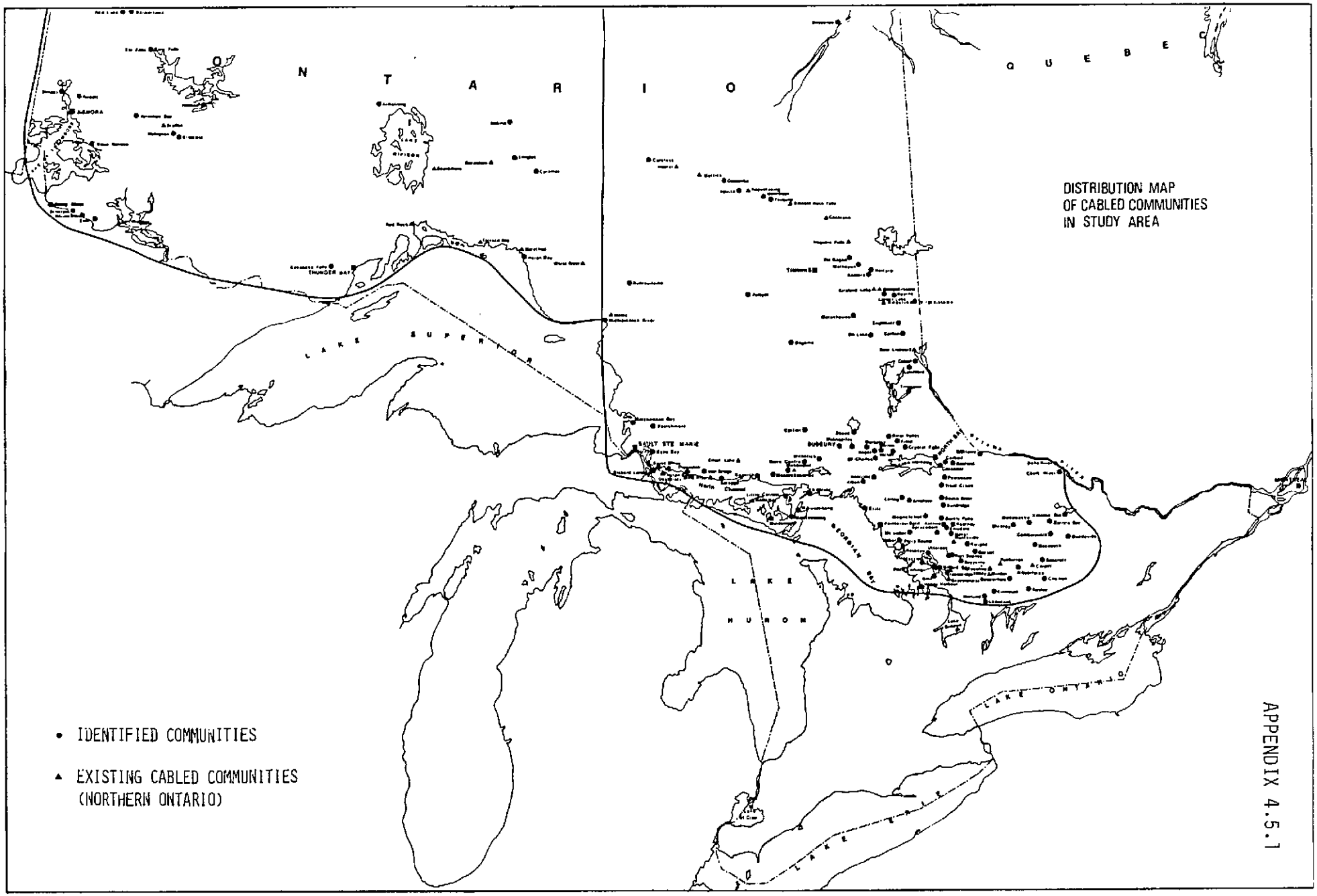
* Same as alternative 1 since only 1 community in cluster

APPENDIX 4.4.2
PAGE 3 OF 4

REVISED OPERATION AND MAINTENANCE AND TOTAL MONTHLY COSTS TO RECEIVE AND FEED 8 TELEVISION SIGNALS ON THE BASIS OF A MICROWAVE LONG HAUL TRANSMISSION MODEL

OPTION 2 - COMMUNITIES SHARE COMMON FACILITIES

CLUSTERS	O & M MONTHLY COSTS - $					TOTAL MONTHLY COSTS		
	TVRO		REGIONAL HEADEND	VHCM	TOTAL O & M COST a)	TOTAL MICROWAVE MONTHLY SERVICE b) COSTS	EQUIVAL CAPITAL COST c)	TOTAL COST a + b + c
	12 GHz	4 GHz						
BARRY BAY	200	200	500	1,104	2,004	1,500	9,156	12,660
BANCROFT	200	200	500	1,061	1,961	1,500	8,233	11,694
GOODERHAM	200	200	500	1,218	2,118	1,500	9,204	12,822
SPRUCEDALE	200	200	500	1,875	2,775	1,500	15,132	19,407
SUNDRIDGE	200	200	500	1,124	2,024	-	8,378	10,402
MATTAWA	200	200	500	1,017	1,917	3,000	7,758	12,675
MAGNETAWAN	200	200	500	1,257	2,157	1,500	10,551	14,208
ST-CHARLES	200	-	500	1,689	2,389	3,000	13,215	18,604
WEBBWOOD	200	-	500	1,108	1,808	3,000	8,542	13,350
LITTLE CURRENT	200	200	500	859	1,759	-	6,321	8,080
SPANISH	200	-	500	1,000	1,700	3,000	8,279	12,979
ECHOBAY	200	-	500	1,326	2,026	-	10,367	12,393
COBALT	200	200	500	672	1,572	1,500	5,696	8,768
FOLEYET	200	200	500	839	1,739	-	7,438	9,177
KING KIRKLAND	200	200	500	1,509	2,409	1,500	14,867	18,776
RAMORE	200	-	500	953	1,653	1,500	7,093	10,246
MICHIPICOTEN RIVER	200	200	500	681	1,581	1,500	5,939	9,020
MOONBEAM	200	-	500	951	1,651	3,000	7,080	11,731
CALSTOCK				-	550*	1,500*	994*	3,044*
MOOSONEE				-	750*	-	1,299*	2,049*
LONGLAC	200	200	500	804	1,704	-	7,104	8,808
KAKABEKA FALLS	-*	-*		-	350*	-	589	939*
HUDSON	200	200	500	1,020	1,920	1,500	8,919	12,339
EAR FALLS	200	200	500	976	1,876	1,500	7,762	11,138
REDDIT	200	-	500	919	1,619	1,500	6,990	10,109
STRATTON	200	200	500	800	1,700	-	6,817	8,517
HERON BAY				-	750*	1,500*	1,299	3,549*
ARMSTRONG				-	750*	-	1,299	2,049*
PICKLE LAKE				-	750*	-	1,391	2,141*
TOTAL							207,712	291,674



APPENDIX 4.5.1

CABLE TELEVISION SERVICES FOR NORTHERN ONTARIO

SIGNALS OFFERED

COMMUNITIES	ACTUAL SUBS	POTENTIAL SUBS	CBC		OECA	CTV	GLOBAL	TVA	CITY	CHCH
			E	F						
BLIND RIVER	489	1000	-	-	-	-	-	-		
BRACEBRIDGE	1702	1850	-	-	-	-	-			
CARDIFF	143	220	-			-	-			
COCHRANE	1102	1400	-	-	-	-	-	-		
DEEP RIVER	1443	1723	-	-	-	-				
DRYDEN	1712	2260	-		-	-				
ELLIOT LAKE	2691	3800	-	-	-	-	-	-		
ESPANOLA	146	1600	-	-	-	-	-	-		
FORT FRANCES	2461	3100	-		-					
GERALDTON	850	900	-							
GORE BAY	181	265	-			-				
HALIBURTON	275	360	-		-	-	-			
HEARST	1556	1630	-	-	-	-	-	-		
HUNTSVILLE	2071	2363	-			-	-			
IROQUOIS FALLS	1008	1600	-	-	-	-		-		
KAPUSKASING	2815	3000	-	-	-	-	-	-		
KENORA	2977	5600	-	-	-	-				
KIRKLAND LAKE	3160	3900	-	-	-	-	-			
MARATHON	676	700	-	-	-	-				
MATTICE	156	175	-	-	-	-				
MINDEN	240	270	-		-	-	-			
NEW LISKEARD	2259	3150	-	-	-	-	-			
NORTH BAY	10107	14758	-	-	-	-	-	-		
PARRY SOUND	1915	2200	-			-	-			
SAULT STE-MARIE	18851	22520	-	-	-	-				
STURGEON FALLS	1523	2000	-	-	-	-	-	-		
SUDBURY	28000	43316	-	-	-	-	-	-		
SWASTIKA	124	140	-	-		-				
TERRACE BAY	2708	3568	-	-	-	-				
THUNDER BAY	30878	33530	-	-	-	-				
TIMMINS	14000	20000	-	-	-	-	-	-		
GRAVENHURST	1522	1600	-	-	-	-	-			
WAWA	750	1500	-	-		-				
SMOOTH ROCK FALLS	605	700	-	-	-	-	-	-		

CABLED COMMUNITIES WITHIN CLUSTERS
CANADIAN TELEVISION SERVICES

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
BARRY'S BAY CLUSTER							
1. DEEP RIVER	●	●	●	●			
BANCROFT CLUSTER							
1. CARDIFF	●			●	●		
GOODERHAM CLUSTER							
1. HALIBURTON	●		●	●	●		
2. MINDEN	●		●	●	●		
SPRUCEDALE CLUSTER							
1. BRACEBRIDGE	●	●	●	●	●		
2. GRAVENHURST	●	●	●	●	●		
3. HUNTSVILLE	●		●	●			
SUNDRIDGE CLUSTER							
-							
MATTAWA CLUSTER							
1. NORTH BAY	●	●	●	●	●	●	

CABLED COMMUNITIES WITHIN CLUSTERS
CANADIAN TELEVISION SERVICES

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
MAGNETAWAN CLUSTER							
1. PARRY SOUND	●			●	●		
ST-CHARLES CLUSTER							
1. STURGEON FALLS	●	●	●	●	●	●	
2. SUDBURY	●	●	●	●	●	●	
WEBBWOOD CLUSTER							
1. ESPANOLA	●	●	●	●	●	●	
LITTLE CURRENT CLUSTER							
1. GORE BAY	●			●			
SPANISH CLUSTER							
1. BLIND RIVER	●	●	●	●	●	●	
2. ELLIOT LAKE	●	●	●	●	●	●	
ECHO BAY CLUSTER							
1. SAULT STE-MARIE	●	●	●	●			

CABLED COMMUNITIES WITHIN CLUSTERS
CANADIAN TELEVISION SERVICES

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
COBALT CLUSTER							
1. NEW LISKEARD	●	●	●	●	●		
FOLEYET CLUSTER							
-							
KING KIRKLAND CLUSTER							
1. KIRKLAND LAKE	●	●	●	●	●		
2. SWASTIKA	●	●		●			
RAMORE CLUSTER							
1. COCHRANE	●	●	●	●	●	●	
2. IROQUOIS FALLS	●	●	●	●	●	●	
3. TIMMINS	●	●	●	●	●	●	
MICHIPICOTEN RIVER CLUSTER							
1. WAWA	●	●		●			

CABLED COMMUNITIES WITHIN CLUSTERS
CANADIAN TELEVISION SERVICES

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
MOONBEAM CLUSTER							
1. KAPUSKASING	●	●	●	●	●	●	
2. SMOOTH ROCK FALLS	●	●	●	●	●	●	
CALSTOCK CLUSTER							
1. HEARST	●	●	●	●	●	●	
2. MATTICE	●	●	●	●			
MOOSONEE CLUSTER							
-							
LONGLAC CLUSTER							
1. GERALDTON	●						
KAKEBEKA FALLS CLUSTER							
1. THUNDER BAY	●	●	●	●			
HUDSON CLUSTER							
1. DRYDEN	●		●	●			

CABLED COMMUNITIES WITHIN CLUSTERS
CANADIAN TELEVISION SERVICES

STATIONS / TARGET COMMUNITIES	BASIC TV SERVICE				OPTIONAL		
	CBC		OECA	CTV	GLOBAL	TVA	PRIVATE
	CBC-E	CBC-F	OECA				CHCH / CITY
EAR FALLS CLUSTER							
REDDIT CLUSTER							
1. KENORA	●	●	●	●			
STRATTON CLUSTER							
1. FORT-FRANCES	●		●				
HERON BAY CLUSTER							
1. MARATHON	●	●	●	●			
2. TERRACE BAY	●	●	●	●			
ARMSTRONG CLUSTER							
-							
PICKLE LAKE/							
CENTRAL PATRICIA CLUSTER							
-							

VHCM LINK CAPITAL INVESTMENT REQUIREMENT
FOR EXISTING CABLE OPERATORS

RECEPTION SITE REQUIREMENTS	COST - $
Antennas and accessories	6,500
Electronic equipment	22,500
Engineering and installation	1,000
TOTAL:	30,000

Case 1: Cost increase due to:

- headend site or tower unfitness;
- larger antenna requirement

Case 2: Cost decrease due to:

- disposal of headend equipment;
- smaller antenna requirement.

APPENDICES

TO

SECTION 5 - LOCAL EXHIBITION

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5.2.2 Cost summary of Existing Housing model

5.2.3 Rebroadcast station and cable distribution cost per residence curves

Community layout patterns

During the data gathering phase, the most recent aerial photographs and maps were collected for each community. Attached is a 1975 aerial photo for the community of Burk's Falls, District of Parry Sound. Since the density and layout of a community determine the cable plant costs, the aerial photos for each community were examined to determine similarities and dissimilarities. The examination lead to the establishment of six (6) layout patterns, namely:

1) Linear: rectilinear pattern of settlement along a highway and/or rural road(s),

2) Linear with development: primarily rectilinear pattern of settlement along a road with complementary small sub-division(s),

3) Spread development: decentralized pattern of settlement where residences are dispersed along several roads and/or streets with no uniformity;

4) Semi-dense: centralized pattern of settlement where 400 or less residences are arranged in a systematic fashion,

5) Dense centralized pattern of settlement where 400 or more residences are arranged in a systematic fashion,

6) Dispersed development: decentralized pattern of settlement where two (2) or more sub-divisions are spatially separated.

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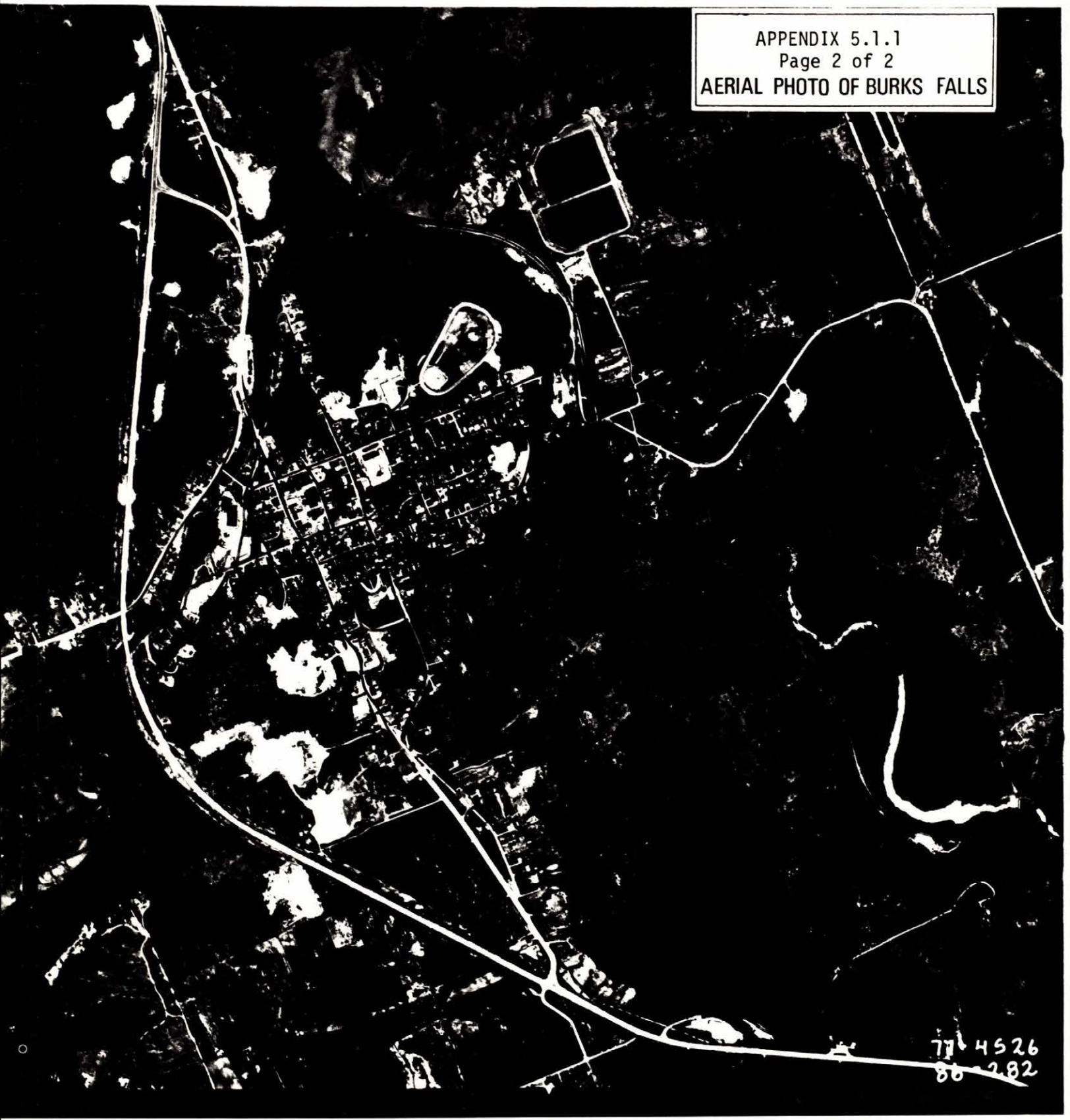
AERIAL PHOTO OF BURKS FALLS



Source: Ministry of Natural Resources

Community categorization

The 128 communities were then classified into each of the categories. The distribution of communities within each category is the following: Linear 28, linear with development 16, spread development 15, semi-dense 45, dense 21, dispersed development 3. Detailed lists will be used later in this section.

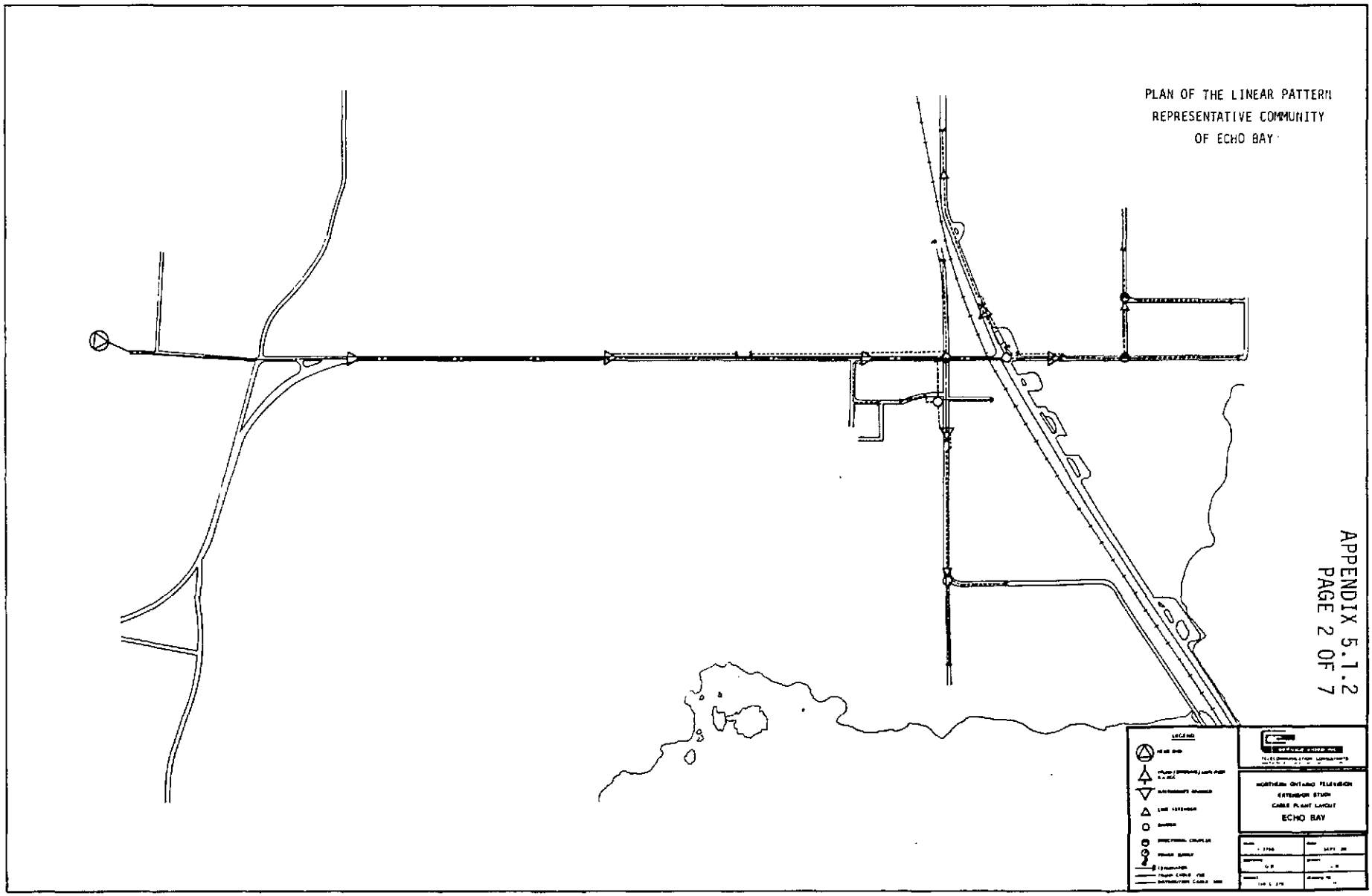
Choice of reference communities

Six (6) communities were then singled out for detailed design and costing, one (1) community per layout pattern. The resultant cable plant cost, to be stated as the cable plant cost per residence, will therefore represent the cost for each of the communities making up the grouping. The selected communities for detailed analysis were:

Category	Representative community
1) Linear:	Echo Bay
2) Linear with development:	Emo
3) Spread development:	Plantagenet
4) Semi-dense:	Mattice
5) Dense:	Mattawa
6) Dispersed development:	Caramat

It should be noted that although Plantagenet and Mattice are not included in the revisedd study area, they were retained as representative communities because of the quality of their municipal plans.

PLAN OF THE LINEAR PATTERN
REPRESENTATIVE COMMUNITY
OF ECHO BAY



APPENDIX 5.1.2
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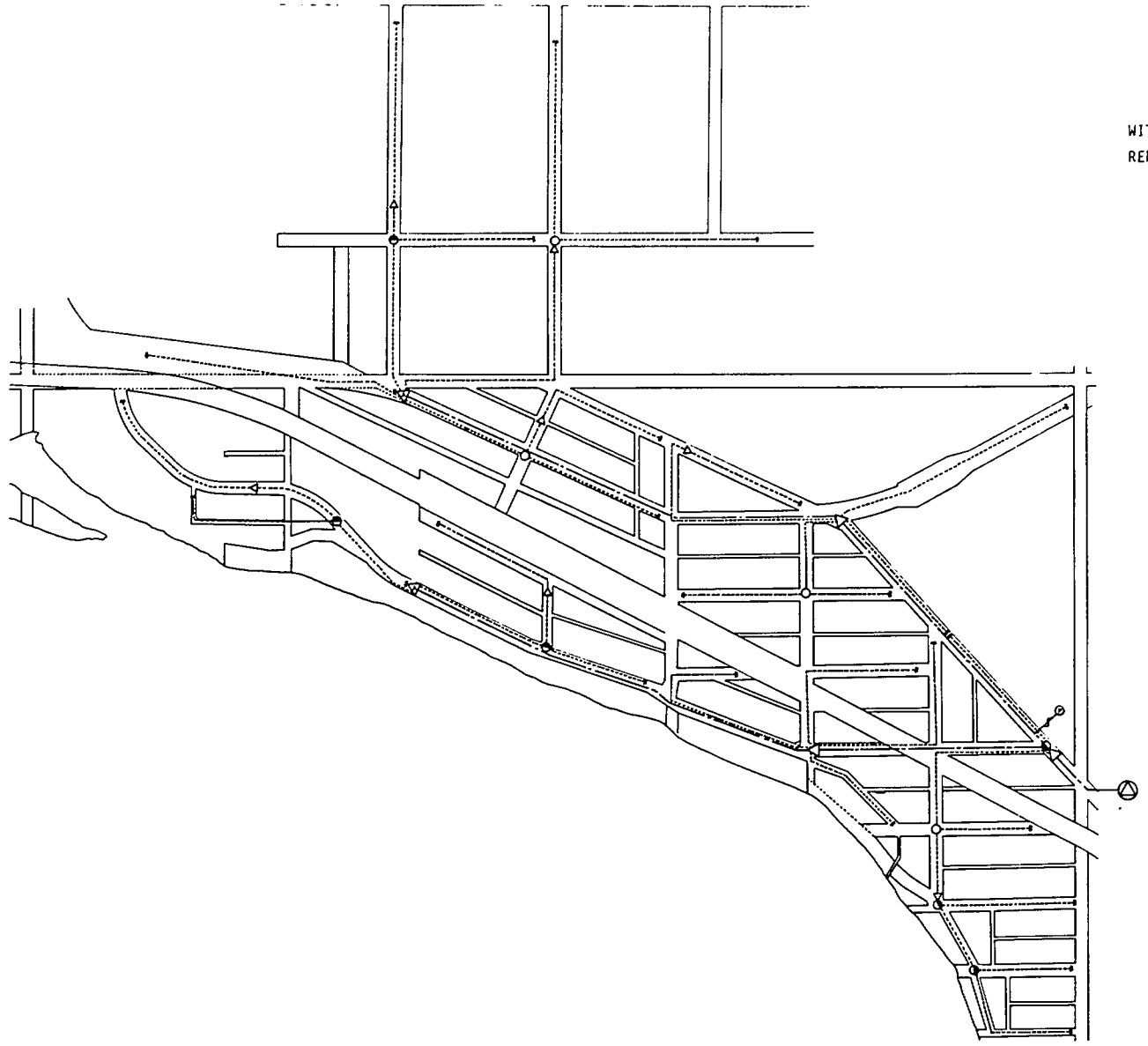
PLAN OF THE LINEAR
WITH DEVELOPMENT PATTERN
REPRESENTATIVE COMMUNITY
OF EMO



APPENDIX 5.1.2
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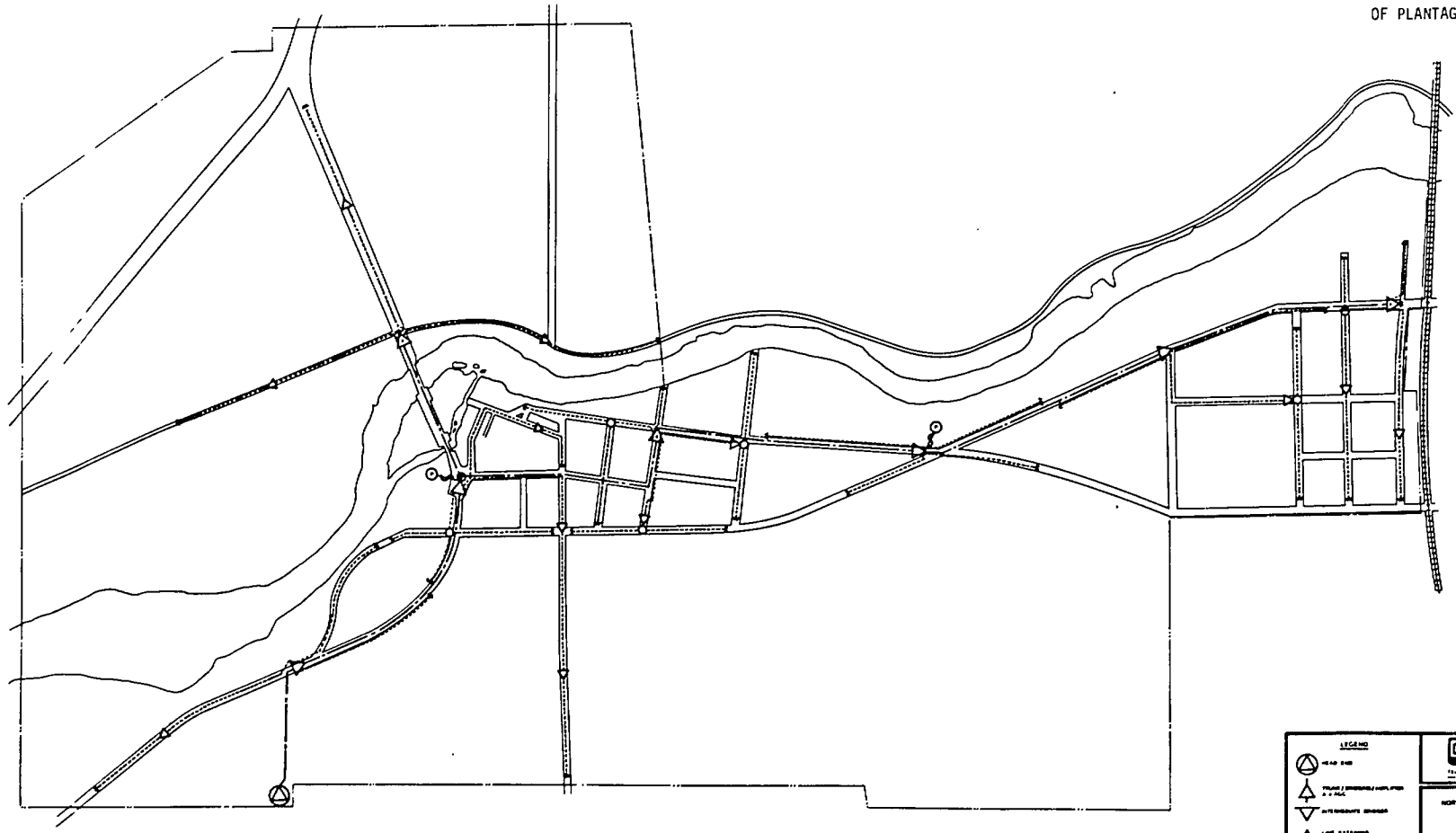
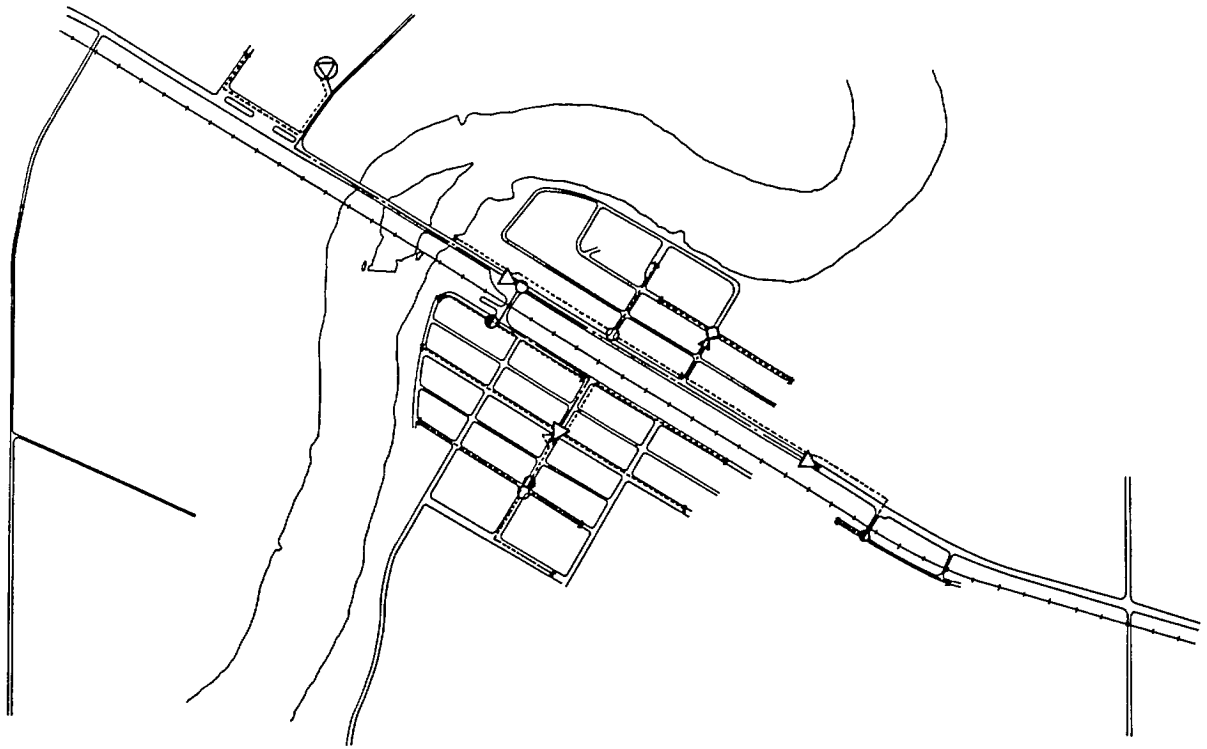
PLAN OF THE SPREAD
DEVELOPMENT PATTERN
REPRESENTATIVE COMMUNITY
OF PLANTAGENET



APPENDIX 5.1.2
PAGE 4 OF 7

NORTHERN ONTARIO TELEVISION
EXTENSION STUDY
CABLE PLANT LAYOUT
PLANTAGENET

PLAN OF THE SEMI-DENSE PATTERN
REPRESENTATIVE COMMUNITY
OF MATTICE



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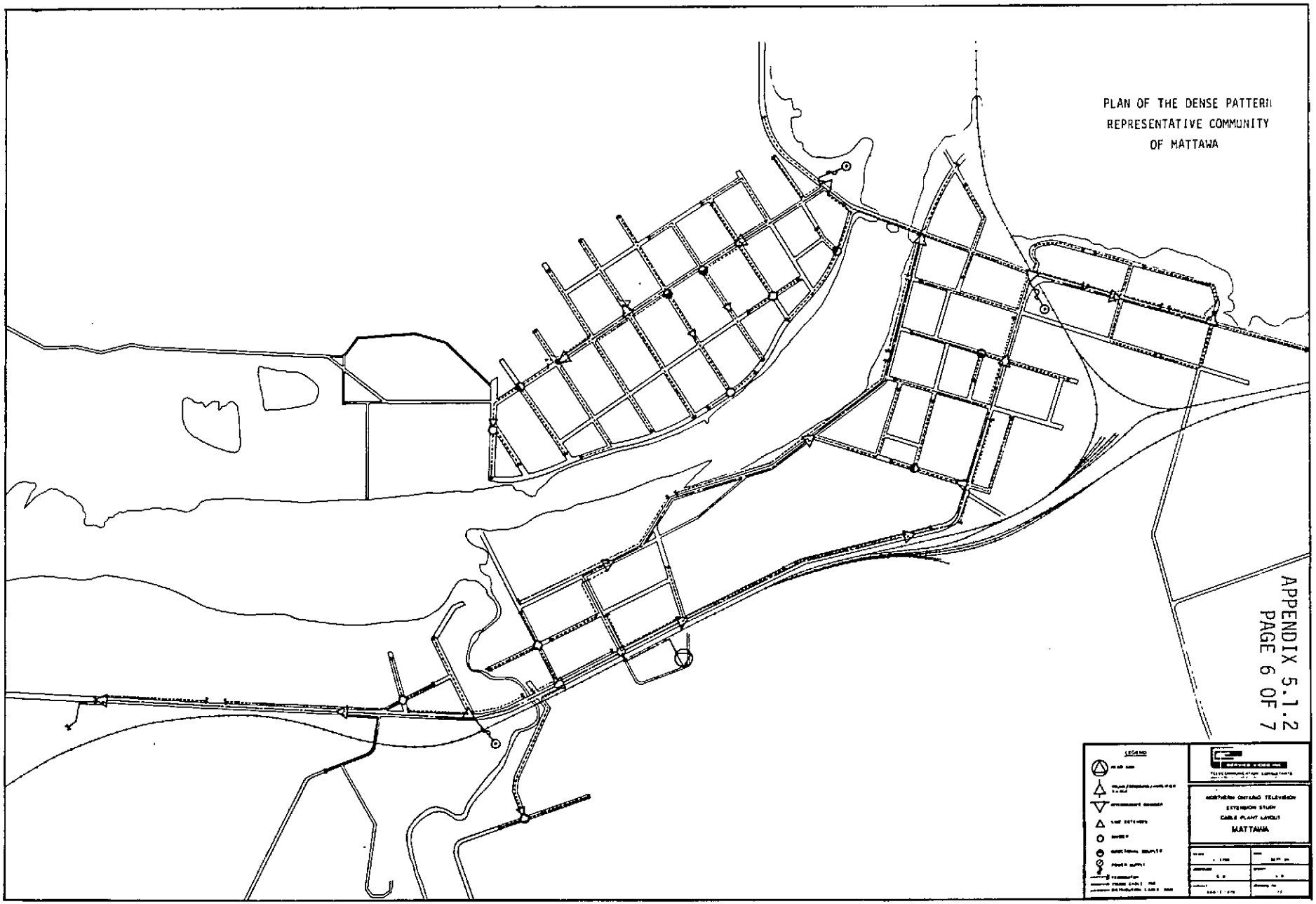
LEGEND

NORTHERN ONTARIO TELEVISION
EXTENSION STUDY
CABLE PLANT LAYOUT
MATTICE


PLAN OF THE DENSE PATTERN
REPRESENTATIVE COMMUNITY
OF MATTAWA
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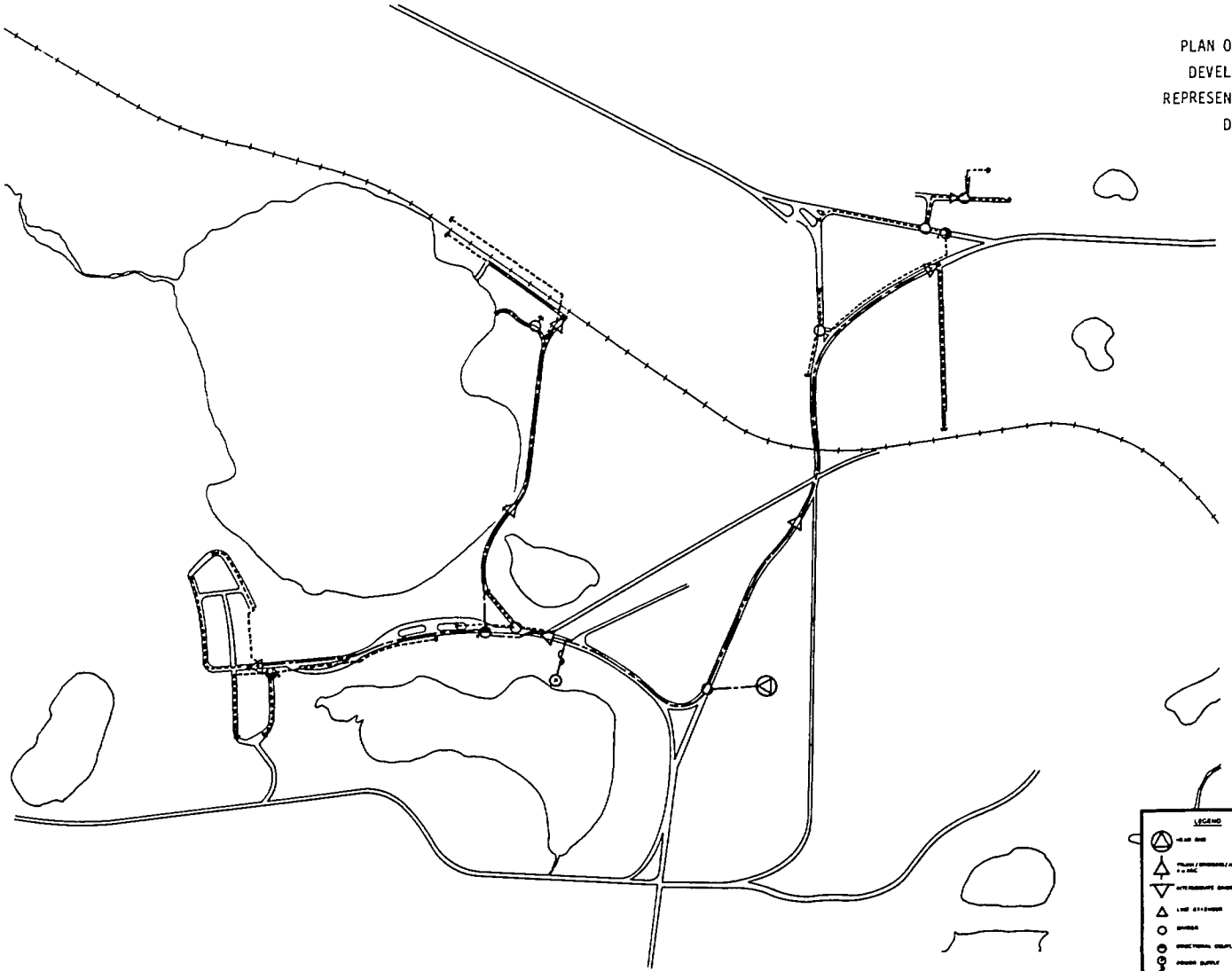
LEGEND
NORTHERN ONTARIO TELEVISION
EXTENSION STUDY
CABLE PLANT LAYOUT
MATTAWA

PLAN OF THE DISPERSED
DEVELOPMENT PATTERN
REPRESENTATIVE COMMUNITY
OF CARAMAT



APPENDIX 5.1.2
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Cable distribution system design parameters

The cable distribution systems were designed to conform with Department of Communication standards. The system design parameters and assumptions are the following:

1) Signal quality:
   - 40 dB Signal to Noise ratio at subscriber set;
   - 48 dB Cross-modulation;
   - 57 dB inter-modulation.

2) Frequency bandwidth:
   - 300 MHz.

3) Trunk:
   - amplifiers (33 1/3%, AGC, 20 dB spacing at 300MHz);
   - .750 cable;
   - no multitaps.

4) Distribution:
   - multitaps (8 dB flat loss),
   - line extenders (18 dB cable loss);
   - maximum of 2 line extenders in cascade;
   - .500 cable;
   - couplers/splitters.

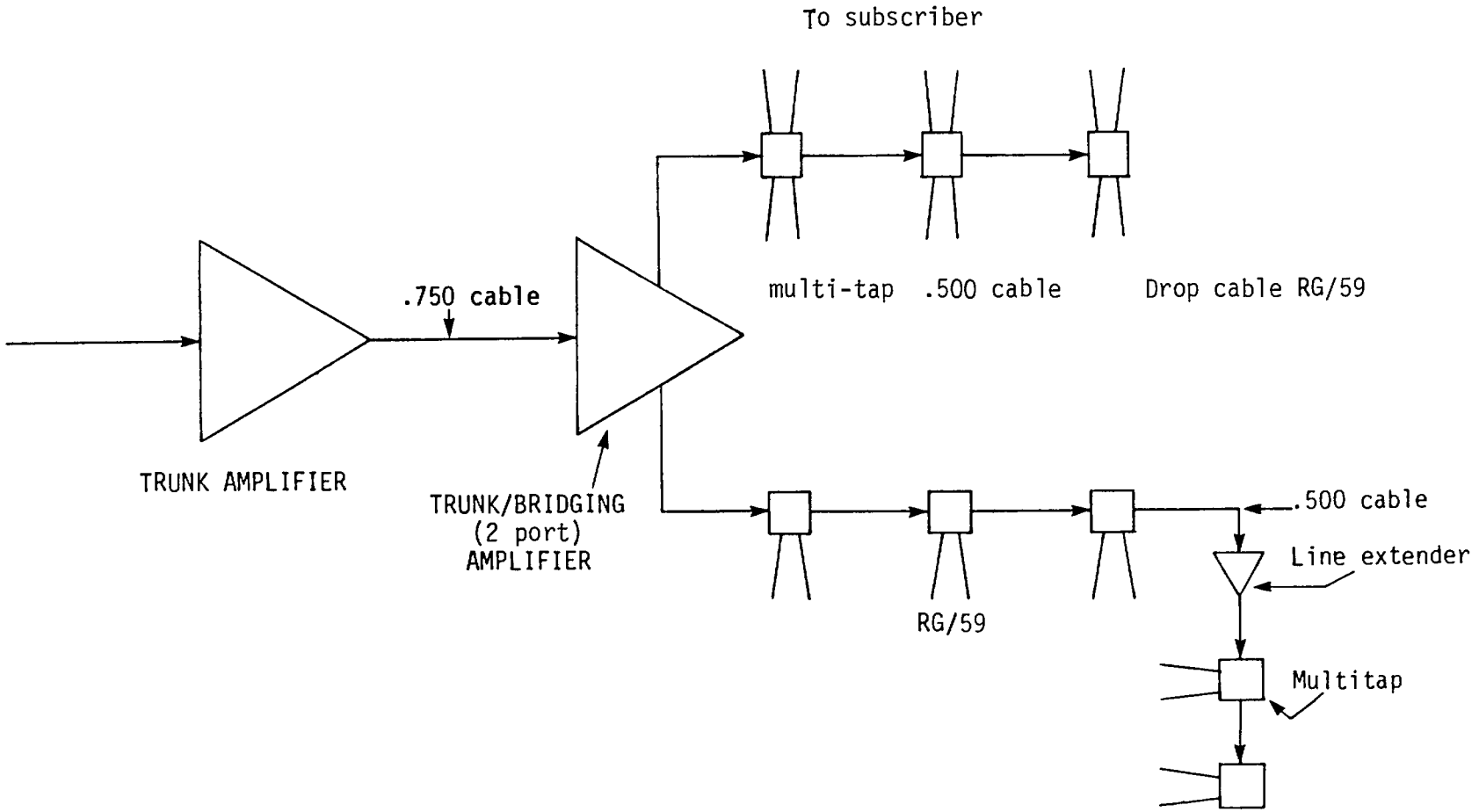
5) 12 amp. power supply;

6) Pole attachment;

7) RG/59 drop cable.

The configuration for the cable distribution plant is on the following page.

TYPICAL CABLE DISTRIBUTION CONFIGURATION



Design and costing cable of plant for each reference community

A cable distribution plant was designed for each reference community and the layouts were shown on the municipal plans in appendix 5.1.2 fore mentioned.

The capital, operation and maintenance costs for cabling representative communities are based on the following assumptions:

1) The eight (8) signals are fed to each cable system starting at the first trunk amplifier. No headend considerations are taken into account;

2) The installation of 100% of the cable drops to serve the community;

3) The capital costs include the materials costs, transportation costs, the aerial installation of cable and equipment, and the engineering costs. Transportation costs and engineering costs have been assumed to be approximately 2% and 10% respectively of the material cost.

4) No provision has been made for contingency costs;

5) The initial capital costs required to build the cable distribution system have been transformed into equivalent monthly costs on the basis of a 10 year loan at 15% per annum compounded for end of month payments (factor: 64.26125);

6) The operation and maintenance annual costs which include the administration of subscriptions have been assumed to be 25% of the capital costs. This percentage was established on the basis of actual operating statistics collected by the CRTC for cable operators in the study area. Appendix 5.1.6.1 presents selected operating statistics furnished by the CRTC.

The costing of each plant was computed using individual material and cost list.

ECHOBAY

CABLE DISTRIBUTION MATERIAL AND COST LIST

(LINEAR PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	2,881 m.	2.637/m.	7,597.99	3.08/m.	8,883.00	16,480.99
.500 CABLE DISTRIBUTION	4,919 m.	1.043/m.	5,132.87	2,038 m. @ 2.36/m.	4,813.20	9,946.07
RG/59 DROP CABLE	8,231 m.	0.198/m.	1,636.74	270 hrs @ $10./hr	2,700.00	4,336.74
LINE EXTENDER	3	235.00	705.00	1.5 hr @ $10	15.00	720.00
TRUNK/BRIDGING AMPLIFIER MAN.	3	630.00	1,890.00	3 hrs @ $10	30.00	1,920.00
AGC	3	695.00	2,085.00	3 hrs @ $10	30.00	2,115.00
TRUNK / AMPLIFIER OR INTERMEDIATE	-	-	-	-	-	-
MULTITAPS	129	13.50	1,741.50	32.25 hrs @ $10./hr	322.50	2,064.00
COUPLERS/SPLITTERS	6	22.25	133.50	1.5 hr @ $10./hr	15.00	148.50
POWER SUPPLY	1	475.00	-	4 hrs @ $10	40.00	515.00
POWER INSERTER	1	25.00	25.00	-	included above	25.00
POLE ATTACHMENT	137	-	-	-	included above	-
MISC.: .750	18	7.70	138.60	-	"	138.60
.500	294	3.05	896.70	-	"	896.70
Bracket	166	2.25	373.50	-	"	373.50
Strand	5,206	0.328/m.	1,707.60	-	"	1,707.60
SUB-TOTAL						41,387.70
TRANSPORTATION	2% of sub-total					827.75
ENGINEERING	10% of sub-total					4,138.77
TOTAL						46,354.22
ANNUAL RECURRING COST	25% of total					11,589.00

m = meters

CABLE DISTRIBUTION MATERIAL AND COST LIST
(LINEAR WITH DEVELOPMENT PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	2,454 m.	2.637/m.	6,472.36	3.08/m.	7,567.00	14,039.36
.500 CABLE DISTRIBUTION	9,085 m.	1.043/m.	9,479.98	6,631 m. @ 2.36/m.	15,6 .00	25,139.98
RG/59 DROP CABLE	11,890 m.	0.198/m.	2,364.18	390 hrs @ $10./hr	3,900.00	6,264.18
LINE EXTENDER	8	235.00	1,880.00	4 hrs @ $10.	40.00	1,920.00
TRUNK/BRIDGING AMPLIFIER MAN.	3	630.00	1,890.00	3 hrs @ $10	30.00	1,920.00
AGC	2	695.00	1,390.00	2 hrs @ $10	20.00	1,410.00
TRUNK / AMPLIFIER OR INTERMEDIATE	-	-	-	-	-	-
MULTITAPS	239	13.50	3,226.50	59.75 hrs @ $10	597.50	3,824.00
COUPLERS/SPLITTERS	9	22.25	200.25	2.25 hrs @ $10	22.50	222.75
POWER SUPPLY	1	475.00	475.00	4 hrs @ $10	40.00	515.00
POWER INSERTER	1	25.00	25.00	-	included above	25.00
POLE ATTACHMENT	246	-	-	-	included above	-
MISC.: .750	12	7.70	92.40	-	"	92.40
.550	540	3.05	1,647.00	-	"	1,647.00
Bracket	285	2.25	641.25	-	"	641.25
Strand	9,348	0.328/m.	3,066.10	-	"	3,066.10
SUB-TOTAL						60,727.02
TRANSPORTATION	2% of sub-total					1,214.54
ENGINEERING	10% of sub-total					6,072.70
TOTAL						68,014.26
ANNUAL RECURRING COST	25% of total					17,004.00

m = meters

CABLE DISTRIBUTION MATERIAL AND COST LIST
(SPREAD PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	3,927 m.	2.637/m.	10,355.78	3.08/m.	12,107.20	22.462.98
.500 CABLE DISTRIBUTION	11,902 m.	1.043/m.	12,419.40	7,976 m. @ 2.36/m.	18,835.20	31,254.60
RG/59 DROP CABLE	8,628 m.	0.198/m.	1,715.55	283 hrs @ $10./hr	2,830.00	4,545.55
LINE EXTENDER	12	235.00	2,820.00	6 hrs @ $10./hr	60.00	2,880.00
TRUNK/BRIDGING AMPLIFIER MAN.	4	630.00	2,520.00	4 hrs @ $10	40.00	2,560.00
AGC	3	695.00	2,085.00	3 hrs @ $10	30.00	2,115.00
TRUNK / AMPLIFIER OR INTERMEDIATE	-	-	-	-	-	-
MULTITAPS	289	13.50	3,901.50	72.25 hrs @ $10./hr	722.50	4,624.00
COUPLERS/SPLITTERS	7	22.25	155.75	2 hrs @ $10	20.00	175.75
POWER SUPPLY	2	475.00	950.00	8 hrs @ $10	80.00	1,030.00
POWER INSERTER	2	25.00	50.00	-	included above	50.00
POLE ATTACHMENT	320	-	-	-	included above	-
MISC.: .750	14	7.70	107.80	-	"	107.80
.500	650	3.05	1,982.50	-	"	1,982.50
Bracket	336	2.25	756.00	-	"	756.00
Strand	13,171	0.328/m.	4,320.00	-	"	4,320.00
SUB-TOTAL						78,864.18
TRANSPORTATION	2% of sub-total					1,577.28
ENGINEERING	10% of sub-total					7,886.41
TOTAL						88,327.87
ANNUAL RECURRING COST	25% of total					22,082.00

m = meters

MATTICE

CABLE DISTRIBUTION MATERIAL AND COST LIST
(SEMI-DENSE PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	1,835 m.	2.637/m.	4,840.20	3.08/m.	5,658.80	10,499.00
.500 CABLE DISTRIBUTION	4,727 m.	1.043/m.	4,932.45	2,892 m. @ 2.36/m.	6,829.20	11,761.65
RG/59 DROP CABLE	7,103 m.	0.198/m.	1,412.45	233 hrs @ $10./hr	2,330.00	3,742.45
LINE EXTENDER	1	235.00	235.00	½hr @ $10./hr	5.00	240.00
TRUNK/BRIDGING AMPLIFIER MAN.	3	630.00	1,890.00	1.5 hr @ $10	15.00	1,905.00
AGC						
TRUNK / AMPLIFIER INTERMEDIATE	-	-	-	-	-	-
MULTITAPS	125	13.50	1,687.50	31.25 hrs @ $10./hr	312.50	2,000.00
COUPLERS/SPLITTERS	7	22.25	155.75	1.75 hr @ $10./hr	17.50	173.25
POWER SUPPLY	1	475.00	475.00	4 hrs @ $10	40.00	515.00
POWER INSERTER	1	25.00	25.00	-	included above	25.00
POLE ATTACHMENT	136	-	-	-	included above	-
MISC.: .750	8	7.70	61.60	-	"	61.60
.500	282	3.05	860.10	-	"	860.10
Bracket	141	2.25	317.25	-	"	317.25
Strand	5,154	0.328/m.	1,690.50	-	"	1,690.50
SUB-TOTAL						33,790.80
TRANSPORTATION	2% of sub-total					675.82
ENGINEERING	10% of sub-total					3,379.08
TOTAL						37,845.70
ANNUAL RECURRING COST	25% of total					9,462.00

m = meters

MATTAWA

CABLE DISTRIBUTION MATERIAL AND COST LIST
(DENSE PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	6,936 m.	2.637/m.	18,291.46	3.08/m.	21,385.00	39,676.46
.500 CABLE DISTRIBUTION	18,225 m.	1.043/m.	19,017.21	11,290 m. @ 2.36/m.	26,661.60	45,678.81
RG/59 DROP CABLE	28,201 m.	0.198/m.	5,607.35	925 hrs @ $10./hr	9,250.00	14,857.35
LINE EXTENDER	4	235.00	940.00	2 hrs @ $10	20.00	960.00
TRUNK/BRIDGING AMPLIFIER MAN.	7	630.00	4,410.00	7 hrs @ $10	70.00	4,480.00
AGC	5	695.00	3,475.00	5 hrs @ $10	50.00	3,525.00
TRUNK / AMPLIFIER OR INTERMEDIATE	6	395.00	2,370.00	6 hrs @ $10	60.00	2,430.00
MULTITAPS	479	13.50	6,466.50	119.75 hrs @ $10./hr	1,197.50	7,664.00
COUPLERS/SPLITTERS	12	22.25	267.00	6 hrs @ $10	60.00	327.00
POWER SUPPLY	3	475.00	1,425.00	12 hrs @ $10./hr	120.00	1,545.00
POWER INSERTER	3	25.00	75.00	-	included above	75.00
POLE ATTACHMENT	501	-	-	-	included above	-
MISC.: .750	44	7.70	338.80	-	"	338.80
.500	1,064	3.05	3,245.20	-	"	3,245.20
Bracket	525	2.25	1,181.25	-	"	1,181.25
Strand	19,038	0.328/m.	6,244.50	-	"	6,244.50
SUB-TOTAL						132,228.37
TRANSPORTATION	2% of sub-total					2,644.57
ENGINEERING	10% of sub-total					13,222.83
TOTAL						148,095.77
ANNUAL RECURRING COST	25% of total					37,024.00

m = meters

CARAMAT

CABLE DISTRIBUTION MATERIAL AND COST LIST
(DISPERSED DEVELOPMENT PATTERN)

MATERIAL LIST	QUANTITY	MATERIAL UNIT COST $	TOTAL MATERIAL COST $	INSTALLATION UNIT COST $	TOTAL INSTALLATION COST $	TOTAL COST $
.750 TRUNK CABLE	3,095 m.	2.637/m.	8,160.80	3.08/m.	9,541.00	17,701.80
.500 CABLE DISTRIBUTION	4,311 m.	1.043/m.	4,498.22	1,216 m. @ 2.36/m.	2,872.80	7,371.02
RG/59 DROP CABLE	4,146 m.	0.198/m.	824.43	136 hrs @ $10./hr	1,360.00	2,184.43
LINE EXTENDER	1	235.00	235.00	½hr @ $10./hr	5.00	240.00
TRUNK/BRIDGING AMPLIFIER MAN.	2	630.00	1,260.00	2 hrs @ $10	20.00	1,280.00
AGC	2	695.00	1,390.00	2 hrs @ $10	20.00	1,410.00
TRUNK / AMPLIFIER OR INTERMEDIATE	MAN. 2	235.00	470.00	1 hr @ $10./hr	10.00	480.00
	AGC 1	300.00	300.00	½ hr @ $10./hr	5.00	305.00
MULTITAPS	114	13.50	1,539.00	28.5 hrs @ $10./hr	285.00	1,824.00
COUPLERS/SPLITTERS	9	22.25	200.25	2.25 hrs @ $10./hr	22.50	222.75
POWER SUPPLY	1	475.00		4 hrs @ $10	40.00	515.00
POWER INSERTER	1	25.00	25.00	-	included above	25.00
POLE ATTACHMENT	167	-	-	-	included above	-
MISC.: .750	18	7.70	138.60	-	"	138.60
.500	263	3.05	802.15	-	"	802.15
Bracket	140	2.25	315.00	-	"	315.00
Strand	6,328	0.328/m.	2,075.50	-	"	2,075.00
SUB-TOTAL						36,889.75
TRANSPORTATION	2% of sub-total					737.80
ENGINEERING	10% of sub-total					3,688.98
TOTAL						41,316.53
ANNUAL RECURRING COST	25% of total					10,329.00

m = meters

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

LINEAR

REPRESENTATIVE	:	ECHOBAY
# OF RESIDENCES	:	270
TOTAL CAPITAL COST FOR CABLE PLANT	:	$46,355
ANNUAL RECURRING COST	:	$11,589
MONTHLY CAPITAL COST/RESIDENCE	:	$2.67
MONTHLY OPERATION COST/RESIDENCE	:	$3.58
TOTAL MONTHLY COST/RESIDENCE	:	$6.25

COMMUNITIES	RESIDENCES	80% PENETRATION	COMMUNITIES	RESIDENCES	80% PENETRATION
ALBAN	280	224	MAYNOOTH	158	126
BATCHAWANA BAY	126	101	MINDEMOYA	202	162
BRITT	110	88	NOBEL	203	162
COE HILL	185	148	NOELVILLE	315	252
COMBERMERE	126	101	QUADEVILLE	100	80
CORBEIL	118	94	RIVER VALLEY	104	83
DORSET	205	164	SEARCHMOUNT	165	132
ECHO BAY	270	216	SPRAGGE	122	87
EMSDALE	176	141	SPRUCEDALE	160	128
HAGAR	144	115	STRATTON	113	90
HERON BAY	139	111	UTTERSON	109	87
KATRINE	110	88	VAL GAGNE	178	142
KEARNEY	253	202	WILBERFORCE	165	132
LORING	112	89			
MADAWASKA	135	108			

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

LINEAR WITH DEVELOPMENT

REPRESENTATIVE	:	EMO
# OF RESIDENCES	:	390
TOTAL CAPITAL COST FOR CABLE PLANT	:	$68,015
ANNUAL RECURRING COST	:	$17,004
MONTHLY CAPITAL COST/RESIDENCE	:	$2.72
MONTHLY OPERATION COST/RESIDENCE	:	$3.63
TOTAL MONTHLY COST/RESIDENCE	:	$6.35

COMMUNITIES	RESIDENCES	80% PENETRATION
APSLEY	532	426
ARMSTRONG	196	157
BALA	527	422
BARWICK	102	89
BRUCE MINES	236	189
CRYSTAL FALLS	150	120
DESBARATS	158	126
DINORWIRC	120	96
EMO	390	312
HOLTYRE	134	107
MACTIER	344	275
NORLAND	125	100
NOVAR	131	105
VERMILLION BAY	276	221
WHITE FISH	178	142
WIKWEMIKONG	229	183

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

SPREAD

REPRESENTATIVE	: PLANTAGENET
# OF RESIDENCES	: 283
TOTAL CAPITAL COST FOR CABLE PLANT	: $88,328
ANNUAL RECURRING COST	: $22,082
MONTHLY CAPITAL COST/RESIDENCE	: $4.87
MONTHLY OPERATION COST/RESIDENCE	: $6.50
TOTAL MONTHLY COST/RESIDENCE	: $11.37

COMMUNITIES	RESIDENCES	80% PENETRATION
FIELD	168	134
GOODERHAM	157	126
HONEY HARBOUR	155	124
KINMOUNT	187	150
MILFORD BAY	150	120
MINAKI	131	105
PORT CARLING	259	207
ROSSEAU	180	144
SIOUX NARROWS	210	168
SKEAD	165	132
ARNSTEIN	110	88
DWIGHT	188	150
MC KELLAR	172	138
POINTE-AU-BAR	121	97
PORT SYDNEY	147	118

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

SEMI-DENSE

REPRESENTATIVE	:	MATTICE
# OF RESIDENCES	:	233
TOTAL CAPITAL COST FOR CABLE PLANT	:	$37,846
ANNUAL RECURRING COST	:	$9,462
MONTHLY CAPITAL COST/RESIDENCE	:	$2.53
MONTHLY OPERATION COST/RESIDENCE	:	$3.38
TOTAL MONTHLY COST/RESIDENCE	:	$5.91

COMMUNITIES	RESIDENCES	80% PENETRATION	COMMUNITIES	RESIDENCES	80% PENETRATION
BALMERTOWN	326	261	MARKSTAY	255	180
BAYSVILLE	242	194	MATACHEWAN	156	125
BONFIELD	157	126	MICHIPICOTEN R.	100	80
CALSTOCK	201	161	MOONBEAM	270	216
CARTIER	237	218	MOOSENEE	299	239
COBOCONK	310	248	NAIRN CENTRE	161	129
COCHENOUR	174	139	NAKINA	302	242
DUBREUILVILLE	311	249	OPASATIKA	136	109
ELK LAKE	250	200	RAMORE	240	192
FAUQUIER	197	158	RICHARD LAND.	158	126
FOLEYET	186	149	SPANISH	347	278
GOGAMA	245	196	ST-CHARLES	186	149
HILTON BEACH	144	115	TEMAGAMI	357	286
HUDSON	140	112	TROUT CREEK	265	212
IRON BRIDGE	280	224	VAL RITA	163	130
KAKABEKA FALLS	218	174	VERNER	351	281
KEARNS	139	111	VIRGINIATOWN	334	267
KILLALOE STA.	306	245	WABIGOON	178	142
KILLARNEY	125	100	WAHNAPITAE	354	283
KING KIRKLAND	125	100	WARREN	260	208
LATCHFORD	159	127	WEBBWOOD	209	167
MAGNETAWAN	133	106	WITHNEY	325	260
MANITOWANING	366	293			

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

DENSE

REPRESENTATIVE	:	MATTAWA
# OF RESIDENCES	:	925
TOTAL CAPITAL COST FOR CABLE PLANT	:	$148,096
ANNUAL RECURRING COST	:	$37,024
MONTHLY CAPITAL COST/RESIDENCE	:	$2.50
MONTHLY OPERATION COST/RESIDENCE	:	$3.34
TOTAL MONTHLY COST/RESIDENCE	:	$5.84

COMMUNITIES	RESIDENCES	80% PENETRATION
BANCROFT	1220	976
BARRY'S BAY	1010	808
BURK'S FALLS	608	486
CALLANDER	573	458
CHALK RIVER	425	340
COBALT	806	645
EAR FALLS	634	507
EARLTON	406	325
ENGLEHART	896	717
LARDER LAKE	444	355
MATTAWA	925	740
LITTLE CURRENT	646	517
LONGLAC	875	700
MASSEY	609	487
MATHESON	488	390
POWASSAN	495	396
RAINY RIVER	443	354
RED LAKE	895	716
SOUTH RIVER	629	503
SUNDRIDGE	570	456
THESSALON	512	410

LIST OF COMMUNITIES BY LAYOUT PATTERN
AND CABLE PLANT COST

DISPERSED DEVELOPMENT

REPRESENTATIVE	: CARAMAT
# OF RESIDENCES	: 136
TOTAL CAPITAL COST FOR CABLE PLANT	: $41,317
ANNUAL RECURRING COST	: $10,330
MONTHLY CAPITAL COST/RESIDENCE	: $4.74
MONTHLY OPERATION COST/RESIDENCE	: $6.33
TOTAL MONTHLY COST/RESIDENCE	: $11.07

COMMUNITIES	RESIDENCES	80% PENETRATION
CARAMAT	136	109
CENTRAL PAT. PICKLE LAKE	216	173
REDDIT	129	103

CABLE TELEVISION OPERATING STATISTICS

SELECTED SMALL CABLE SYSTEMS

	1979	1978	1977	1976	1975
DIRECT SUBSCRIBERS	3,039	2,491	2,305	2,233	2,095
INDIRECT SUBSCRIBERS	87	45	39	28	30
MIXED TOTAL	3,126	2,536	2,344	2,261	2,125
TOTAL CABLE MILES	63	43	42	40	40
DENSITY (SUBS/MILE)	49.05	58.51	55.81	56.10	52.94
HOUSEHOLD WIRED	4,203	3,054	2,916	2,846	2,823
HOUSEHOLD LIC. AREA	4,797	3,565	3,490	3,385	3,294
PENETRATION MARKET (%)	74.38	83.04	80.38	79.44	75.27
PENETRATION FRANCHISE (%)	87.62	85.67	83.55	84.08	85.70
TOTAL REVENUE	178,379	147,717	135,059	123,646	107,977
TECHNICAL EXPENSE	54,920	46,120	55,118	42,038	29,246
PROGRAM EXPENSE	3,691	250	0	0	0
SALES EXPENSE	10,848	4,500	4,300	3,950	2,900
ADMINISTRATION EXPENSES	53,229	38,216	27,716	27,204	24,948
TOTAL EXPENSES	122,688	89,086	87,134	73,192	57,094
GROSS FIXED ASSETS ($)	426,301	285,349	284,065	278,836	266,604

Source: CRTC Industry Statistics

CABLE TELEVISION OPERATING STATISTICS

SELECTED LARGE CABLE SYSTEMS

	1979	1978	1977	1976	1975
DIRECT SUBSCRIBERS	113,133	101,871	61,267	56,567	52,971
INDIRECT SUBSCRIBERS	3,552	11,194	3,958	3,640	3,213
MIXED TOTAL	116,685	113,065	65,225	60,207	56,184
TOTAL CABLE MILES	1,777	1,635	899	837	795
DENSITY (SUBS/MILE)	64.86	63.60	70.33	70.45	68.71
HOUSEHOLD WIRED	150,090	147,119	85,607	80,578	78,534
HOUSEHOLD LIC. AREA	152,829	150,912	86,158	81,601	79,701
PENETRATION MARKET (%)	77.74	76.85	76.19	74.72	71.54
PENETRATION FRANCHISE (%)	98.21	97.49	99.36	98.75	98.54
TOTAL REVENUE	11,028,978	8,606,624	4,294,367	3,730,895	3,236,071
TECHNICAL EXPENSE	3,458,160	2,613,446	1,102,072	851,094	688,266
PROGRAM EXPENSE	530,678	438,279	215,165	103,193	73,999
SALES EXPENSE	285,323	310,720	39,924	35,523	29,868
ADMINISTRATION EXPENSES	2,118,914	1,738,892	945,005	841,791	712,416
TOTAL EXPENSE	6,393,075	5,101,337	2,302,166	1,831,601	1,504,549
GROSS FIXED ASSETS ($)	17,998,051	16,157,536	7,330,819	5,964,689	5,360,524

Source: CRTC Industry Statistics

PENETRATION HYPOTHESIS

The 80% penetration hypothesis is based on the market penetration ratio of the number of subscribers compared to the number of household passed by the cable (wired).

Refering to 1978 Statistics Canada Cable Television annual report (56,205) we derived the following:

- The Ontario average market penetration was 74% in 1978 compared to the Canadian average of 68%

- In general systems with less than 1,000 subscribers have higher average market penetration (74 %) than systems with more than 1,000 susbcribers (68 %) that heavily weigh the lower overall average.

And concluded that average market penetration for small systems in Ontario could reach 80%.

We further checked our reasoning with CRTC Industry Statistics for selected systems in Northern Ontario and found that market penetration level reached 83% in 1978 sustained by a steady growth in the previous years. The 1979 figure dropped considerably due to a 38% market expansion (households wired).

CABLE TELEVISION SUBSCRIBERS AND HOUSEHOLDS IN CANADA 1978

	CANADA	SYSTEMS WITH	
		LESS THAN 1,000 SUBS.	MORE THAN 1,000 SUBS.
1 TOTAL SUBSCRIBERS	3,775,633	48,340	3,727,293
2 HOUSEHOLDS SERVED BY CABLE	5,535,559	64,849	5,470,710
3 HOUSEHOLDS IN LICENCE AREA	5,866,336	73,887	5,792,449
MARKET PENETRATION (1-2) (%)	68.21	74.54	68.13
FRANCHISE PENETRATION (2-3) (%)	94.36	87.77	94.44

Source: Statistics Canada Cable Television 1978 (56-205) Table 1

HOUSEHOLDS SERVED BY CABLE TELEVISION LICENCES WITH MORE THAN 1000 SUBSCRIBERS
BY AREA IN CANADA 1978

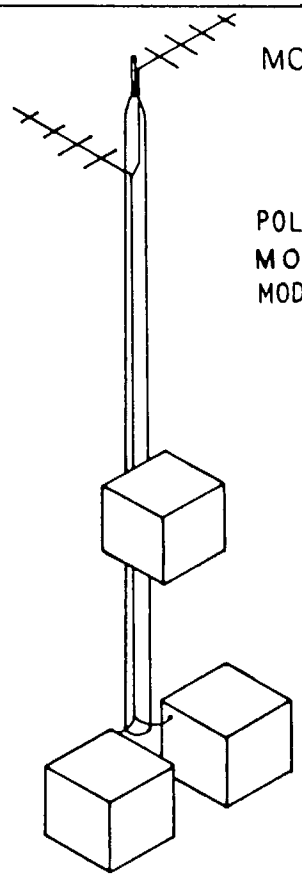
	ATLANTIC PROVINCES	QUEBEC	ONTARIO	MANITOBA AND SASKATCHEWAN	ALBERTA	B. COLUMBIA N.W.TERRITORIES YUKON	TOTAL
1. TOTAL SUBSCRIBERS	175,883	708,796	1,646,538	223,417	285,640	687,019	3,727,293
2. HOUSEHOLDS SERVED BY CABLE	258,026	1,432,131	2,228,258	298,059	466,664	787,572	5,470,710
3. HOUSEHOLDS IN LICENCE AREA	308,154	1,575,865	2,287,614	340,639	469,509	810,668	5,792,449
MARKET PENETRATION (1-2) (%)	68.16	49.49	73.89	74.95	61.20	87.23	68.13
FRANCHISE PENETRATION (2-3) (%)	83.73	90.88	97.40	87.50	99.39	97.15	94.44

Source: Statistics Canada Cable Television 1978 56-205 Table 6

ILLUSTRATION OF REBROADCAST STATION MODELS

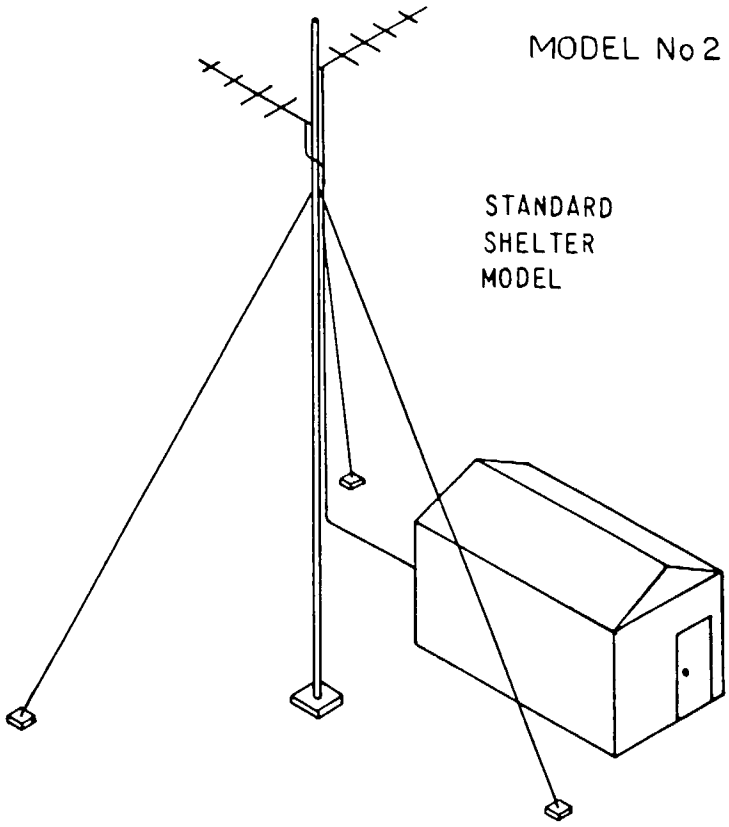
MODEL No 1

POLE MOUNTED MODEL



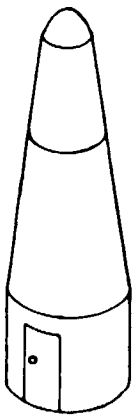
MODEL No 2

STANDARD SHELTER MODEL



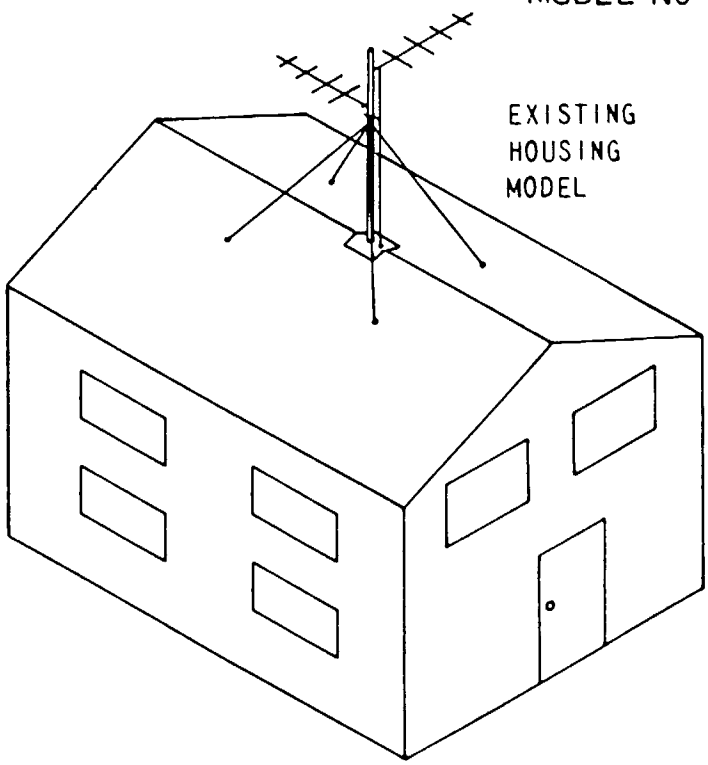
MODEL No 3

SPECIALIZED SHELTER MODEL



MODEL No 4

EXISTING HOUSING MODEL



COST SUMMARY: 1-WATT EXISTING HOUSING MODEL - UHF BAND

APPENDIX 5.2.2

COST ELEMENTS	1 TV Channel	2 TV Channels	3 TV Channels	4 TV Channels	4 TV Channels + 2 FM Channels	5 TV Channels	6 TV Channels	7 TV Channels	8 TV Channels	8 TV Channel + 2 FM Channel
Capital Costs										
- Civil Electrical and Mechanical works	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
- Engineering, & Site Supervision	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
- Electronic Equipment	14,860	29,320	39,940	49,340	57,410	64,200	78,660	89,280	98,680	106,75(
- Engineering, Site Supervision plus Installation of the Electronics	10,000	10,600	11,200	11,800	14,000	13,000	15,000	16,000	17,000	18,000
- Total Capital Cost	32,000	47,000	58,000	68,000	78,000	84,000	100,000	112,000	123,000	132,000
- Equivalent annual cost (factor is 0.142)	4,544	6,674	8,236	9,656	11,076	11,928	14,200	15,904	17,466	18,744
- % of Total annual cost	68	76	79	81	82	83	85	86	86	87
Recurring costs										
- Operation	200	200	200	200	300	300	300	300	300	30(
- Maintenance, civil, electrical, mechanical	300	300	300	300	300	300	300	300	300	30(
Maintenance, electronics	1,600	1,650	1,700	1,750	1,850	1,900	2,000	2,100	2,200	2,30(
- Total annual recurring costs	2,100	2,150	2,200	2,250	2,450	2,500	2,600	2,700	2,800	2,90(
- % of total annual cost	32	24	21	19	18	17	15	14	14	13
TOTAL ANNUAL COST	6,644	8,824	10,436	11,906	13,526	14,428	16,800	18,604	20,266	21,644

REBROADCAST STATION AND CABLE DISTRIBUTION
COST PER RESIDENCE CURVES