THE CLUSTERING OF HOUSEHOLDS IN RURAL CANADA

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Rural Communications Program,

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ABSTRACT

The cost of new communication facilities for rural Canada depends upon where people live. This report summarizes and interprets the results recently obtained by four university researchers on this subject. The location of households throughout rural Canada is given through a set of maps of typical cells and appropriate scale-up factors that permit generalization to the whole of rural Canada. The data could be considered as an extension of present Statistics Canada information on population of settlements. The extension is to small communities definable only by the fact that two or more households are close together. The coverage also extends down to the single isolated household level. For example, the interested reader can use the information to deduce the number of isolated households or the number of three-household communities in the rural portion of the province of Nova Scotia.

Rank-size curves are given for all portions of Rural Canada and examples of the use of the data are given; first to cost the ground segment for a direct broadcast satellite distribution system and secondly to provide the distribution functions for the linear density of households in the rural portion of each province.

Chapter 1

INTRODUCTION

The four reports [1-4] submitted by university professors working under contracts with the Department of Communications have provided the members of the Rural Communications Program with maps that show the spatial distribution of households throughout rural Canada. Although the immediate requirement that is satisfied by these maps is the providing of information essential for costing various communication system alternatives, it is also recognized that the results obtained by the four contractors are unique and may find use among a much wider audience, comprising, for example, geographers, rural development agencies, Statistics Canada personnel and demographers. Since the four contracts were completed in relative isolation, are valid for different regions of Canada and involved differing methodologies, one of the purposes of the present report is to provide a unified, simplified presentation of the results from the four reports. It is believed that the detailed treatment of small settlements, even embracing single - household settlements, that is presented in this and the four supporting reports is unique and a substantive contribution to the storehouse of knowledge on Canada's demography. A summary of each of the four reports is provided in Chapter 2 followed by two chapters on unification of the reports. Chapter 3 brings the results of the four reports together into a comprehensive model. Chapter 4 provides a simplified version of this model and chapter 5 concludes with a presentation and discussion of the more interesting results and of various methods of data presentation. This chapter is concerned with various interpretations of the primary data supplied by the contractors (the maps showing household locations in typical cells and the scale-up factors) as secondary data (for example linear household densities, dispersed vs settlement percentages, satellite ground segment costing, etc.).

All four contractors were instructed to adopt the following definition for rural Canada:

"The definition of rural Canada as employed by Statistics Canada in the 1976 census with two changes: i) deletion of all people residing in enumeration areas having a population density less than one person per square mile and ii) addition of all people residing in urban* Canada living in incorporated settlements with population up to 2500 persons. (Note: the asterisk denotes the 1976 census definition of the word urban)."

Henceforth the term rural Canada in this report will mean the above definition.

The four contractors were instructed to provide, for their region (i) BC, ii) Prairie Provinces, iii) Ontario and Quebec or iv) Atlantic Provinces):

1. A separation of the rural portion into large tracts having similar patterns of household distribution. For example, a typical agricultural area will have dispersed farm-homes whereas a coastal area will usually have agglomerations of homes into towns or villages. Of course mapping of all of the household locations in the regions would be impossible since there are some 1.7 million households in rural Canada. Therefore, the contractors were expected to

use various data that each was already familiar with (work activities of rural residents, provincial publications, demographic data, agricultural information, 1976 census data, etc.) along with the high level of judgement and knowledge that each already possessed (each had already authored reports or books of direct relevance to the present work). The result of this stage of work was usually a map showing the areal extent of each large tract having a similar distribution of households.

2. A small cell was then to be chosen to be typical of each large tract and the contractor was requested to provide a very accurate map showing the location of every household in that cell. Thus if the contractor had chosen ten tracts, at this stage he would provide ten household distribution maps. Usually close cooperation was required between each contractor, DRCP and Statistics Canada personnel to access the best maps available - which usually turned out to be those that were prepared by enumerators as they made their door-to-door visits for the 1976 census. Alternatively, aerial photographs, local government sources and Department of the Environment maps were also used. Each contractor used the best available data in the mapping of the household distribution in the typical cells in his region.

3. Finally, each contractor was requested to supply a scale-up technique to permit the generalization of typical cell data to the corresponding regional tract. Differing methods ranging from a simple area scaling to a matrix method (incorporating household density and E.A. area) were used by the contractors.

Statistics Canada could not provide data on the number of households per EA until about half-way through the contractural period. Since it is known that household density is well-correlated with population density (for example, one of the contractors, Prof. Fairbairn, obtained a rank-difference correlation of 0.9866 for the Prairie rural E.A. data), it was decided that the numerical portion of each final report (the scale-up portion) would be acceptable whether it dealt with population densities or with household densities.

Additional information that may be of interest to the reader of this report include series G-76 maps from Statistics Canada, that show the location, shape and size of the approximately 40,000 enumeration areas in Canada. Also, valuable information is available in the four demographic studies [5-8] on rural Canada completed by various professors working under contract for the Rural Communications Program. These four compendia can be regarded as giving a comprehensive overview of the various demographic factors that affect communications in rural Canada, whereas the present report and four household distribution studies [1-4] are involved with an in-depth determination of the location of the households in rural Canada.

Chapter 2

SUMMARIES OF REGIONAL REPORTS

2.1 British Columbia

Professor Denike[1] provided maps of the ten types of typical cell shown in Table 1. He also provided a 3' x 6' map of the province, color-coded to show the cell type for each rural E.A. He then concluded that redundancy existed in his ten cell types and proceeded to show that four basic types were adequate. These were:

i) Population density per enumeration area between 1 and 30 persons per square mile, which he designated "Development".

ii) Population density greater than 30 and up to 300, which he designated "Clusters".

iii) Population density over 300 persons per square mile but still designated as rural according to the 1976 Census definition, which he designated as "Settlements".

iv) All incorporated settlements having a population less than 2,500 that were considered as belonging to urban enumeration areas (using the 1976 Census definition of urban). Note that this is the second special group that was mentioned in the Introduction as being a group recognized as having rural attributes in the Rural Communications Program. Professor Denike designates this group as "Urban Centers".

TABLE 1

TYPICAL CELLS - BRITISH COLUMBIA

Cell Type	Location	Population Density (av. over E.A.)
1, agricultural, urban fringe	Langley	616 persons/sq. mile
2, meandering road pattern very low density	Cariboo	1.14
3, Indian reserves	Bella Coola	109*
4, subdivision, urban fringe	Warfield	~7000
5, rectangular road pattern agricultural, low density	Peace River	3.45
6, rural community	Valemount	570*
7, river valley	Central Kootenay	2.07*
8, isolated industrial community	Tahsis	532*
9, coastal community	Tofino	551*
10, urbanizing area with high linear density	North Okanagan	572*

* denotes those cells having large unsettled areas. Peak population density in these cells is thus much higher than the average figures given.

The frequency of occurrence of the four basic cells and their relation to the original ten cells, are given in Table 2. The total number of households covered by this table is 177,573, from 1,320 EA's. An additional 38 E.A.'s are within the rural study area but were excluded from consideration because of technical problems.

TABLE 2

BASIC CELLS - BRITISH COLUMBIA

Basic Cell	Significant Defining Criteria	Includes Cell Types	Frequency of Occurrence	Total No. of Households
Development	$1 \leq \rho \leq 30$, rural*	2,5,7	420	44,843
Clusters	$30 < \rho \leq 300$, rural*	3	497	63,088
Settlements	$300 < \rho$, rural*	1,6,9,10	286	47,358
Urban Centers	$N < 2500$, urban*	4,8	117	22,284

* refers to the 1976 Census definition. ρ is population density, persons per square mile and N is population.

2.2 Alberta, Saskatchewan and Manitoba

Professor Fairbairn[2] described the rural portion of the Prairie Provinces using nine typical cells, the most populated and largest in area being that which he calls "Typical Sections". A description of the typical cells is given in Table 3 along with area data that can be used to scale-up cell information to the Prairie-wide level. Scale-up data for the Prairie town and urban sprawl cells were lacking in the report but Professor Fairbairn supplied ancilliary data that could be used for scaling of the Prairie town cell, for Alberta.

TABLE 3

TYPICAL CELLS - PRAIRIE PROVINCES

Name of Cell	Description	Area	
		for cell	for rural study area
Prairie town	incorporated settlement	0.54 sq.m	-
Typical sections	sectional farming	69	137,000 sq. m
Pioneer fringe	vacant + inhabited, edge of ecumene	625	56,960
Dryland farming	very low density	214.5	25,900
Mennonite colonies	settlements only	133	1,045
Irrigation districts	dense sectional farming	66	750
French longlot system	linear development on roads	112	300
Indian reserves	scattered, low density	134	5,665
Urban sprawl	urbanizing area	23	-

It should be noted that the selection of cell type for each E.A. was based primarily on actual distribution of households as determined from large scale maps (enumerator maps) and aerial photographs and secondarily on the history of Prairie settlement and land surveying. The initial concept for selecting cells, based on a density sorting of the EA's followed by a finer division by agricultural type, proved to be less acceptable than the method finally adopted.

The quality of the maps supplied by Professor Fairbairn was excellent.

2.3 Ontario and Quebec

Since over 50% of rural Canadians live in the provinces of Ontario and Quebec, Dr. Lacasse's report [3] is of considerable importance to the Rural Communications Program. Three of the five cell types he has chosen occur in both Ontario and Quebec. An abbreviated description of these cells is given in Table 4 and the original report contains excellent maps showing household locations throughout each of the five typical cells.

Dr. Lacasse has put considerable effort into providing data that can be used for accurately scaling-up the typical cell information. He has adopted a matrix type of representation for the scale-up parameters and provides a three by three matrix of data for each of the eight large tracts that he has defined with the five cell types. His scale-up parameters in each matrix are three ranges of household density and three ranges of area per unit (he adopts the term unit to mean a collection of EA's that can be modeled by the typical cell). The scale-up technique described in his report is too simplistic when compared with the voluminous and useful data given in his matrices and a scale-up example to be given in section 3.4 of this report will hopefully clarify this subject.

TABLE 4

TYPICAL CELLS - ONTARIO AND QUEBEC

Name of Cell	Description	Location Ont	Location Que	Population Density (av. over cell)
village	underbounded settlement	x	x	413.25
township municipality	agriculture+ small groupings	x	-	42.28
dispersed rural	non-agricultural, rough terrain	x	x	27.23
linear rural	linear development on roads, agricultural	-	x	23.23
semi-rural	high density	x	x	162.07

Dr. Lacasse has not provided a map of the rural tracts corresponding to each type of cell but has supplied a listing of the EA's belonging to each cell type. Notwithstanding this, his report contains an excellent critique of his allocation of units to cell types by a test that involves sampling his final list. It is considered that his methods are very accurate and that they will provide the type of data that is needed in the Rural Communications Program.

2.4 New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland

Professors MacLean and Weldon[4] have used a uniquely different method for choosing the typical cells that characterize the household distribution throughout the rural portions of the Atlantic Provinces. Their method involves consideration of population density and economic activity (farming, fishing, forestry and industry). After considering examples of all combinations of these activities with three ranges of population density, removal of ambiguities and consideration of road structure and household distribution in the environs led to the adoption of a typical cell comprising a central community having a population in one of three ranges (50 - 250, 250 - 1000 and 1000 - 2500) and having one of the following characteristics: 1. an accessible by road coastal area without inland farming, 2. an accessible by road coastal area with inland farming, 3. an inland area with medium density (i.e. farming), 4. an inland area with a low density, or 5. an isolated coastal community. The areal extent of each typical cell was determined by a set of somewhat complicated, yet logical, rules for allocation of surrounding area to each community. The above process resulted in the identification of 15 different types of cells (all combinations of three population ranges and five geographical situations).

The final choice of typical cells is given in Table 5. The contractors supplied thirteen maps of typical cells showing household locations and geographical limits of the cells. Maps were not provided for cells T_5 and T_6 but users were advised that the T_8 map can represent T_5 and T_9 can represent T_6.

TABLE 5

TYPICAL CELLS - ATLANTIC PROVINCES

Central Community Population	REGION				
	1 Coastal on Roads, no Farming	2 Coastal on Roads, Farming	3 Inland, Medium Density	4 Inland, Low Density	5 Isolated Coastal
50 - 250	T_1,4	T_4,7	T_7,8	T_{10},11	T_{13}
250 - 1000	T_2,5	T_5,9	T_8,9	T_{11},12	T_{14}
1000 - 2500	T_3,6	T_6,10	T_9,10	T_{12},13	T_{15}

Note: The designation T_6,9 means "cell type 6" which is described on "map 9".

Professors MacLean and Weldon supplied scale-up factors for each of the 15 cell types, based on counts of communities in the three size ranges and the five geographical situations. Additionally, their report contains a color-coded map of the Atlantic Provinces that shows the region designation they have ascribed to every enumeration area. A test of the validity of their methods is given in the final section of their report where it is shown that the scale-up techniques predict a rural population of 921,917 whereas the 1976 census count, using the DOC definition for rural Canada provided in the Introduction, is 1,105,948. Their prediction is 17% low, nominally acceptable considering the ultimate uses for the data in the Rural Communications Program.

Chapter 3

THE HOUSEHOLD DISTRIBUTION FOR ALL OF RURAL CANADA - COMPREHENSIVE MODEL

3.1 Introduction

Submission of the four reports and DOC acceptance of same has meant that the Professors have completed their contractural obligations. Notwithstanding this fact, there does remain the problem for any user of these reports of how does he use the results without days or weeks of study? The present chapter is concerned with this problem and will provide the potential user with a highly accurate methodology that makes maximum use of the information contained in the four reports. Although portions of this chapter, and the next, may seem to be overly-critical of certain reports, it must be remembered that each report contains not only portions evidently backed up by much competence and effort but also somewhat weaker portions. Chapter 3 provides a highly accurate, but lengthy, methodology whereas Chapter 4 presents a simplified but less accurate methodology. The highly accurate, but lengthy, methodology is described in detail in Sections 3.2 to 3.5 and a summary is given in Section 3.6. The potential user can proceed directly to Section 3.6 should he wish to avoid spending time on following the rationale behind the 32-cell comprehensive model.

3.2 British Columbia

Professor Denike's ten maps of household locations are accurate and appear to be very useful for modelling and scale-up purposes. However, the map of Valemount is of very questionable validity because a comparison of various maps and data shows too many inconsistencies (see Appendix A). Of a somewhat more serious nature, the scale-up factors to be used, if the 10-cell model were adopted, can only be obtained by a tedious count of each color-coded region on Professor Denike's color-coded map of British Columbia rural E.A.'s. An attempt to do this for cell type 2 gave 89 E.A.'s, for cell type 5 34 E.A.'s, for cell type 7 209 E.A.'s for a total of all three of 332 E.A.'s. The number given on Page 58 of Prof. Denike's report for the E.A.'s in the "Development, 2" pattern is 430. Obviously 332 ≠ 420, yet the two methods should be totally compatible. We can only conclude that any attempt to use the 10-cell model and to deduce 10 scale-up factors is of questionable accuracy. Thus, it would appear that Professor Denike's recommendation to use a four-cell model is valid, even though the 10-cell model could have provided greater accuracy if he had supplied credible scale-up factors. The following maps and scale-up factors are considered to provide the highest accuracy modeling for B.C.:

i) Peace River, scale-up = 28, 4,375 households
Valuable low household-density information would be omitted if Prof. Denike's "development" model was adopted. The higher accuracy alternative is to determine appropriate scale-up factors for E.A.'s belonging to the Peace River, Cariboo and Central Kootenay cells. The number 4375 is the 1976 census household count for all E.A.'s colored in yellow on Prof. Denike's map and since the Peace River cell contains 156 households, the appropriate scale-up factor is 4375 ÷ 156 = 28.

ii) Cariboo, scale-up = 67.9, 12,086 households. Prof. Denike's total for all households in the "development" model is 44,843. Accepting i) above means 40,468 are in the Cariboo and Kootenay type of areas. From Prof. Denike's colored map, 29.87 % of these are in Cariboo type areas (i.e. (.2987) x 40468 = 12086).

iii) Central Kootenay, scale-up = 68.6, 28,382 households.

From the information on the preceeding page it follows that (209) / (209 + 89) = 0.7013 of the households in the Cariboo plus Kootenay areas is one approximation for the fraction that are actually in a Kootenay type of cell. Thus 0.7013 x 40468 = 28,382 households are in Kootenay type areas. Also since the typical cell map supplied for this type of area contains 414 households, it follows that the scale-up factor is 28,382/414 = 68.6.

iv) Bella Coola, scale-up = 618.5, 63,088 households.

It is indeed unfortunate that there has been only one map provided for this type of cell. This cell, representing the most populous cell-type in British Columbia, has been selected by Professor Denike solely using the density criterion $30 < \rho \leq 300$ people per square mile. The one example provided, Bella Coola, is an extremely compact settlement and although Professor Denike considers it to be typical of the E.A.'s in this density range, the present authors question this choice. The Bella Coola enumeration area occupies five square miles and contains 102 households. Thus the household density is 20.4 households per square mile. The majority of this enumeration area is totally unoccupied and the built-up portion occupies 0.07 sq. mi. and has a household density of 1,450 households per sq. mi. (or, using the 3.209 people per household figure given in Table 16, 4,650 people per sq. mi.!) Use of the Bella Coola map to model <u>all</u> enumeration areas with $30 < \rho \leq 300$ appears to ignore areas having a <u>dispersed</u> population having a household density in this range. However, no alternative map for modelling this type of cell is readily available!

v) North Okanagan, scale-up = 22.8, 15,786 households.

Prof. Denike provides us with a total household count for the 286 "settlements" in his Table 5.1.1 of 47,358. His colored map is not reliable for apportionment of E.A.'s to the "settlement" cell types, so we are left with a best guess that one third (or 15,786) could be apportioned to each of North Okanagan, Langley and Tofina cell types. Since the map of Valemount has already been rejected, we do not include it. The scale-up factor is given by the ratio of total households to households on the typical cell map, or 15786 ÷ 692 = 22.8.

vi) Langley, scale-up = 57.2, 15,786 households.

vii) Tofino, scale-up = 78.5, 15,786 households

viii) Warfield, scale-up = 17.4, 11,142 households.

Again, it is assumed that, since we wish to apportion the 22,284 households in the "urban centers" to two cell types exemplified by Warfield and Tahsis, one-half the total number of households are in Warfield-type communities. The scale-up is given by 11,142 ÷ 641 = 17.4.

ix) Tahsis, scale-up = 27.1, 11,142 households.

3.3 <u>Prairie Provinces</u>

Prof. Fairbairn did not supply sufficient information to permit us to scale-up his Prairie town map or his urban sprawl area (he also did not supply a household location map for the latter). Also, unfortunately, the "typical sections" household location map is not representative for the "typical sections" tract, as shown by a cursory check of population density throughout the typical section tract using Statistics Canada E.A. population data (the map supplied has too high a population density by a factor of about two). Notwithstanding these problems, accepting Prof. Fairbairn's areal scale-up method and making an assumption about the urban sprawl area gave a total rural household count in the three provinces of some 350,000. This number is far too low when compared to the most accurate count available, 382,783, given in Table 6 (following page) and in addition when it is known that the 350,000 number is spuriously high because of the too large population density in the typical section cell map. Therefore, substantial effort was expended to obtain more accurate scale-up factors. Prof. Fairbairn's Figs. 3 and 4, federal electoral district maps giving E.A. boundaries (the G-76 maps) and Statistics Canada computer lists of population densities per E.A. were scanned and every rural E.A. was allocated to the most appropriate cell type. The rural household size data per province (Manitoba: 3.397 people per household, Saskatchewan: 3.247, Alberta: 3.421, given in App. C) was then used to convert the population counts per tract per province into household counts per tract per province. The results of this tedious compilation are given in Table 6. Therefore the following are the maps and scale up factors to be used in the most accurate modelling for the Prairie Provinces:

i) Prairie Town - Rivers, Man., scale-up = 294.4, 401 households in cell, 118,069 in Prairie towns.

   An explanation for the scale-up factor is given in Appendix B.

ii) Typical Sections - Since the typical section tract occupies the largest portion of the rural area of the Prairie provinces and contains the largest number of people, considerable effort has been expended to deduce a valid scale-up factor and thus maintain overall accuracy. For example, the population and

TRACT	POPULATION				HOUSEHOLDS			
	Manitoba	Saskatchewan	Alberta	Totals	Manitoba	Saskatchewan	Alberta	Totals
Prairie Town	80,329	176,820	136,724	393,873	23,647	54,456	39,966	118,069
Typ. Sec.	146,742	188,776	161,020	496,538	43,198	58,139	47,068	148,405
Pioneer F.	51,548	30,646	120,723	202,917	15,175	9,438	35,289	59,902
Dryland	0	24,659	33,543	58,202	0	7,594	9,805	17,399
Mennonite	6,014	2,606	0	8,620	1,770	803	0	2,573
Irrigation	0	0	8,508	8,508	0	0	2,487	2,487
French Longlot	10,492	0	0	10,492	3,089	0	0	3,089
Indian Res'n	27,290	25,453	22,774	75,517	8,034	7,839	6,657	22,530
Urban Sprawl	11,500	943	15,922	28,365	3,385	290	4,654	8,329
TOTALS	333,915	449,903	499,214	1,283,032	98,297	138,560	145,926	382,783

TABLE 6

POPULATION AND HOUSEHOLDS PER RURAL TRACT IN THE PRAIRIE PROVINCES areas of the rural EA's designated as "typical section" in Table 6 comes to 496,538 people and 128,904 sq. miles (these figures do not include the people in, and areas of, EA's that are considered as parts of incorporated rural towns and villages, which would be included in i) above). From the data in Appendix C, there are 3.342 people per household in the rural portions of the Prairie Provinces. Therefore, the household density, excluding incorporated towns and villages, is 1.126 households per sq. mile. The map provided by Prof. Fairbairn shows 2.2 households/sq. mile excluding only Stettler and nearby environs. If Prof. Fairbairn's map is considered unacceptable because of the high density, a totally new area should be chosen and mapped, a non-trivial problem! An alternative course of action has been chosen; specifically to synthesize a composite map by determining an applicable mix of dryland map (low density) and two versions of the typical section map provided by Prof. Fairbairn. The maps are:

A. The typical section map excluding Stettler and environs.

B. The dryland farming map excluding the 58 households in Consul.

C. The typical section map including the environs of Stettler but not Stettler itself.

The following assumptions were made:

a) the tract area is 128,904 sq. miles, comprised of 23,863.4 sq. miles in Manitoba, 72,284.6 sq. miles in Saskatchewan and 32,756 sq. miles in Alberta.

b) a farm city area should encompass close to 2,400 sq. miles.

c) Stettler is a representative farm city

and

d) the household counts for this tract are to be as given in Table 6.

Calculations based on the above assumptions and the data given in columns 2 and 3 of Table 7 provide the scale-up factors shown in columns 4 to 7.

TABLE 7

TYPICAL SECTION MAP COMPONENTS

Map	Area of All (sq. miles)	Households	Scale-up				Total Households
			Alta	Sask	Man	Total	
A	62.22	141	261.2	168.3	270.3	699.8	98,672
B	220.76	104	70.1	270	28.6	368.7	38,345
C	73.72	211	14	30	10	54	11,394
							148,411

iii) Pioneer Fringe, scale-up = 334.6, 179 households in cell, 59,902 households in total.

iv) Dryland Farm, scale-up = 167.3, 104 households in cell, 17,399 households in total.

The map supplied by Prof. Fairbairn contains the incorporated village of Consul. Appendix B indicates that a more accurate modelling should be obtained by including Consul, and other incorporated villages, into the "Prairie Town" type of cell ((i) above). Thus the modified map deletes the 58 household village of Consul.

v) Mennonite, scale-up = 3.91, 658 households in cell, 2,573 households in total.

vi) Irrigation District, scale-up = 6.13 (including periphery modification), 406 households in cell (including periphery modification), 2,487 households in total.

The difficulty of predicting the most likely layout of household distributions just outside the periphery of this typical cell is described in detail in Appendix D. A modified map is required, for accurate modelling.

vii) French Longlot, scale-up = 2.145, 1440 households in cell, 3,089 households in total.

viii) Indian Reservations, scale-up = 136.5, 165 households in cell, 22,530 households in total.

ix) Urban Sprawl, scale-up = 17.5, 476 households in cell, 8,329 households in total.

The most accurate household location map available for the urban sprawl tract is the type 5 "Semi-Rural" map given by Prof. Lacasse in the Ontario/Quebec study. The household count of 8,329 was obtained from Table 6.

3.4 Quebec and Ontario

Professor Lacasse has supplied excellent maps and eight pages of very detailed scale-up data. Various methods of using his voluminous scale-up data have been tried and the conclusion has been reached that a simple scale-up that preserves the correct total household count is an excellent compromise between accuracy and simplicity. The following maps and scale-up parameters are to be used:

i) Village of Warren, scale-up = 869.6, households in village = 191, households in total = 166,100.

ii) Type 2, Township/Municipality, scale-up = 193.28, 1230 households in cell, 237,729 households in total.

The difficulty in grouping households together that lie on the periphery of this cell is of sufficient importance (since this cell type represents 237,729 households) to justify a very accurate modelling. This modelling is described in Appendix E and results in a modified map and a doubled area.

iii) Type 3, Dispersed Rural, scale-up = 1153, 204 households in cell, 235,215 households in total.

The map for this cell contains several groups of households that are extensions of the town of Richmond. Since Richmond has a total population of 4021 and is an incorporated town, it is not a part of the rural study area. Obviously a modified map for this cell is required so that the Richmond extensions of 15, 37 and 92 households are excluded and other periphery communities are correctly interpreted. (See Appendix F).

iv) Type 4, Linear Rural, scale-up = 529.6, 212 households in cell, 112,273 households in total.

Again the map supplied contains a portion of an incorporated settlement, the town of Baieville which contains 443 persons. A modified map excluding the 32 household extension of Baieville is required.

v) Type 5, Semi Rural, scale-up = 258.5, 476 households in cell, 123,048 households in total.

The map as given in Professor Lacasse's report is excellent. Periphery settlements are too few in number to necessitate any modification.

3.5 Atlantic Provinces

The most accurate modelling is obtained using the maps listed in the following table.

TABLE 8

ACCURATE MODELLING - ATLANTIC PROVINCES

Map (Town & Environs)	cells	Scale-up	Households per cell	Households Total
New Melbourne	T_1, T_{13}, T_{14}, T_{15}	406.5*	36	14,635*
Cape Broyle	T_2	160	181	28,960
Pouch Cove	T_3	26	414	10,764
Avondale Stn	T_4	463	30	13,890
Clinton	T_7	751	37	27,787
Abrams Village	T_8	222**	98	21,756**
Tignish	T_9	35**	368	12,880**
Hatfield Pt	T_{10}	274	126	34,524
Brookfield	T_5, T_{11}	230**	359	82,570**
Chipman	T_6, T_{12}	43**	771	33,153

The scale-up factor, 406.5* and total households, 14,635*, for settlements to be modelled with the New Melbourne map is a composite for all towns in the following groups:

i) T_1, New Melbourne, 36 households, 340 towns, 12,240 households in total;

ii) T_{13}, Mose Ambrose, 15 households, 44 towns, 660 households in total;

iii) T_{14}, Gaultois, 119 households, 8 towns, 952 households in total;

iv) T_{15}, Ramea, 261 households, 3 towns, 783 households in total.

It should be noted that the household distribution map for New Melbourne shows it to be a fairly closely-grouped community of homes that gives the appearance of a small village. Furthermore, when we group the T_{13}, T_{14} and T_{15} typical cells together we arrive at an "average" village having 43 households. This "average" village is closer, in number of households, to New Melbourne than to any of the other typical cells (excepting Clinton which is not a closely-grouped community of households) and it is for this reason that these four cells are grouped together in the above table.

All entries in the preceeding table with the ** superscript are entries determined by modelling the T_5 cell with the T_{11} map rather than T8 and by modelling the T_6 cell with the T_{12} map rather than the T_9 map. This change in modelling was agreed upon by the authors and Professor MacLean as a suitable solution to the problem of population underestimation described on the last few pages of Profs. MacLean and Weldon's report. The basic cause for the underestimate was ascertained to be due to the small size of the central community on the T_8 and T_9 maps relative to the size range that they were supposed to represent. Since the distribution of households on maps T_8 and T_{11} is very similar as also for maps T_9 and T_{12}, the joint decision was made that the best compromise to obtain maximum modelling accuracy would be to use the Abrams Village map for cell T_8, Tignish for T_9, Brookfield for T_5 and T_{11} and finally Chipman for T_6 and T_{12}.

3.6 Summary

The following table is a summary of the typical cells and maps to be used for accurate modelling for all of rural Canada. The entries in the last column were calculated using the scale-up factors in the table and are thus calculated areas per tract rather than measured areas. The maps are provided after the table.

TABLE 9

MAPS TO BE USED FOR HIGH ACCURACY MODELLING OF RURAL CANADA

Fig. Nos.	Map	Modified Map*	Area/ Cell	HH/Cell	Scale-up	HH/Tract	Area/ Tract
1	Peace River, BC	No	160 sq.m.	156	28	4,375	4,480 sq.m.
2	Cariboo, BC	No	503.1	178	67.9	12,086	34,160
3	Central Kootenay, BC	No	607.8	414	68.6	28,382	41,695
4	Bella Coola, BC	No	5	102	618.5	63,088	3,093
5	N. Okanagan, BC	No	3.42	692	22.8	15,786	78
6	Langley, BC	No	1.4	276	57.2	15,786	80
7	Tofino, BC	No	1.11	201	78.5	15,786	87
8	Warfield, BC	No	~0.4	641	17.4	11,142	7
9	Tahsis, BC	No	3.13	411	27.1	11,142	85
	BC Sub-total					177,573	83,765
10	Rivers, Man	No	3.03	401	294.4	118,069	892
11 A, B, C	Typical Section A, B & C	Yes (Sec. 3.3)	(Sec. 3.3)	(Sec. 3.3)	699.8, 368.7, 54	148,411	128,917
12	Pioneer Fringe	No	140.1	179	334.6	59,902	46,877
13	Dryland Farm	Yes	220.76	104	167.3	17,399	36,933
14	Mennonite	No	133	658	3.91	2,573	520
15	Irrigation	Yes (App D)	67.4	406	6.13	2,487	413
16	French Longlot	No	112	1,440	2.145	3,089	240
17	Indian Res'n	No	134	165	136.5	22,530	18,291
22**	Urban Sprawl	No	10.23	476	17.5	8,329	179
	Prairies Sub-total					382,789	233,262

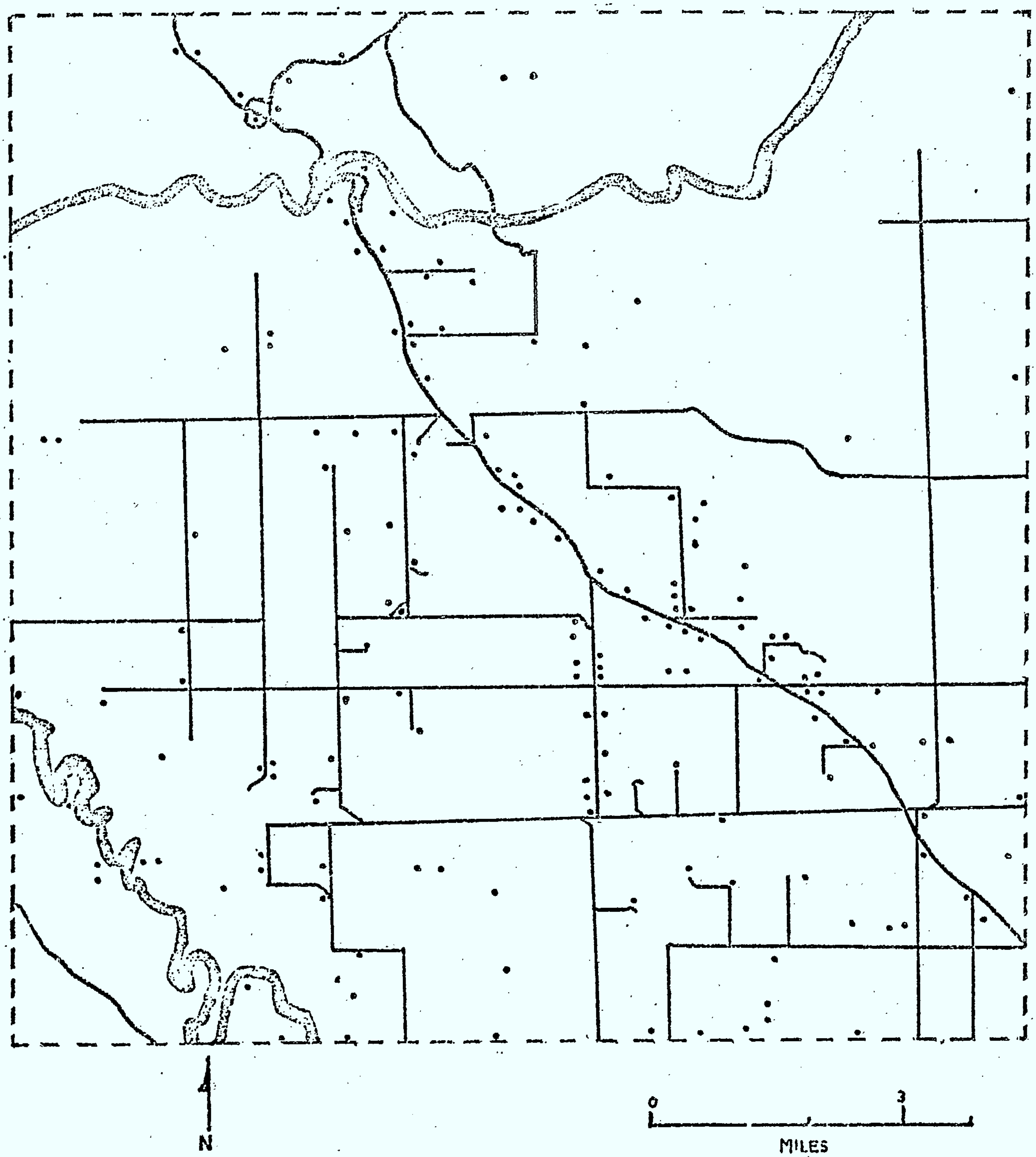
TABLE 9

MAPS TO BE USED FOR HIGH ACCURACY MODELLING OF RURAL CANADA (Cont'd)

Fig Nos	Map	Modified Map*	Area/ Cell	HH/Cell	Scale-up	HH/Tract	Area/ Tract
18	Warren	No	1.66	191	869.6	166,100	1,444
19	Type 2, Township	Yes	104.64	1230	193.28	237,729	20,225
20	Type 3, Dispersed	Yes (App F)	46.97	204	1153	235,215	54,156
21	Type 4, Linear	Yes (Sec.3.4)	41.55	212	529.6	112,273	22,005
22	Type 5, Semi-rural	No	10.23	476	258.5	123,048	2,644
	Quebec/Ontario Sub-total					874,365	100,474
23	New Melbourne	No	~ 2	36	406.5 (Sec.3.5)	14,635	813
24	Cape Broyle	Yes* (Ch.4)	5.34	181	160	28,960	854
25	Pouch Cove	No	~ 7	414	26	10,764	182
26	Avondale Stn	No	~ 5	30	463	13,890	2,315
27	Clinton	No	~ 4	37	751	27,787	3,004
28	Abrams Village	No	~ 10.6	98	222	21,756	2,353
29	Tignish	No	~ 10.2	368	35	12,880	357
30	Hatfield Pt	No	~ 26	126	274	34,524	7,124
31	Brookfield	No	~ 30	359	230 (Sec.3.5)	82,570	6,900
32	Chipman	No	~80	771	43 (Sec.3.5)	33,153	3,440
	Atlantic, Sub-total					280,919	27,342
	Rural Canada, Total					1,715,646	448,843

* indicates that the map provided in this report is a modified version of that supplied by the contractor.

** indicates that the urban sprawl area in Alta is to be modelled with the "type 5, semi-rural", map supplied in the Que/Ont. report.



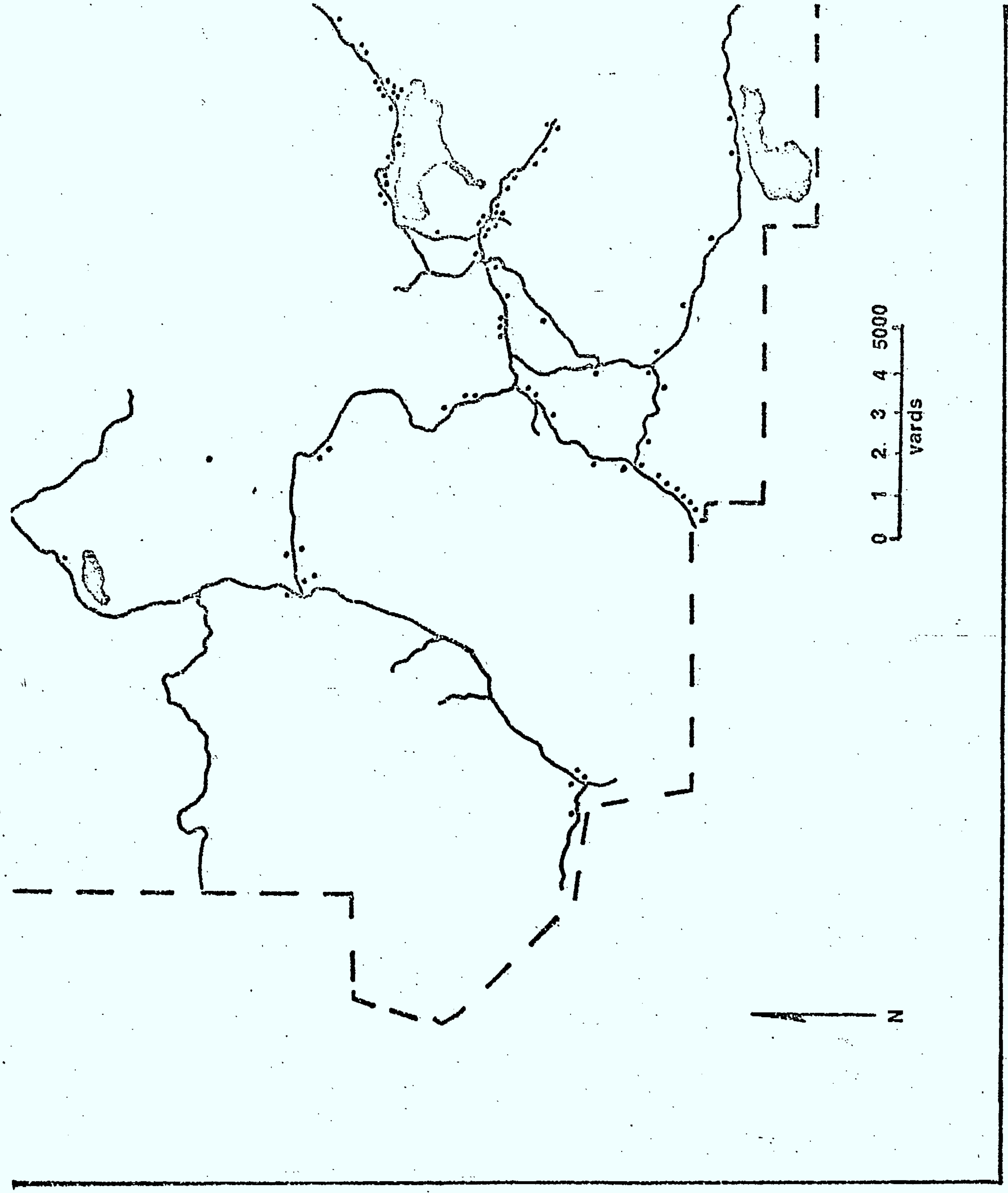
FED 59015 EA 307

CD 55 MAP 1 OF 1

CSD 188 Peace--Liard Sub B

FIGURE 1

PEACE RIVER



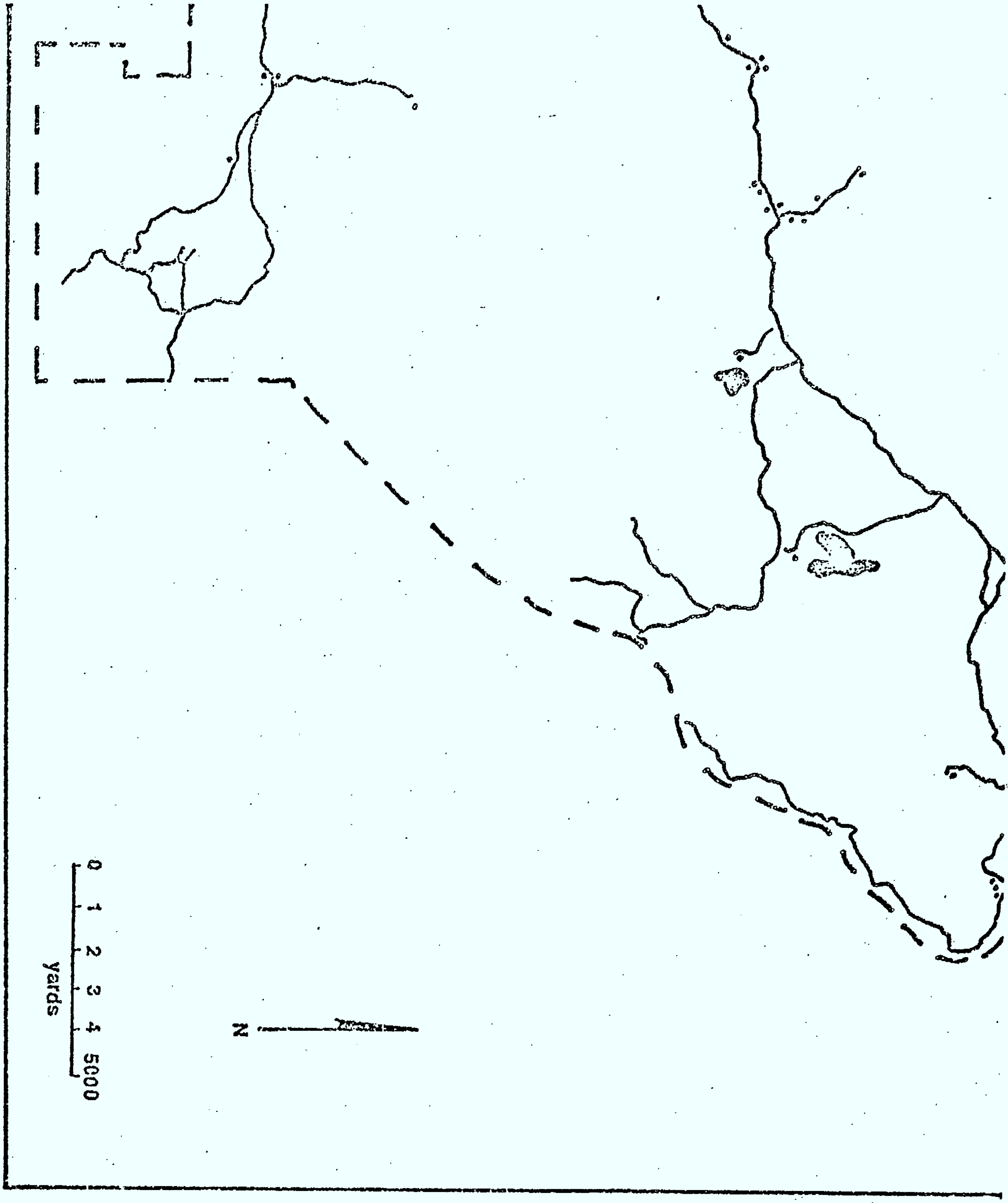
FED 59004 E A 260

CD 41 MAP 1 OF 4

CSD 28 Cariboo Sub A

FIGURE 2

CARIBOO

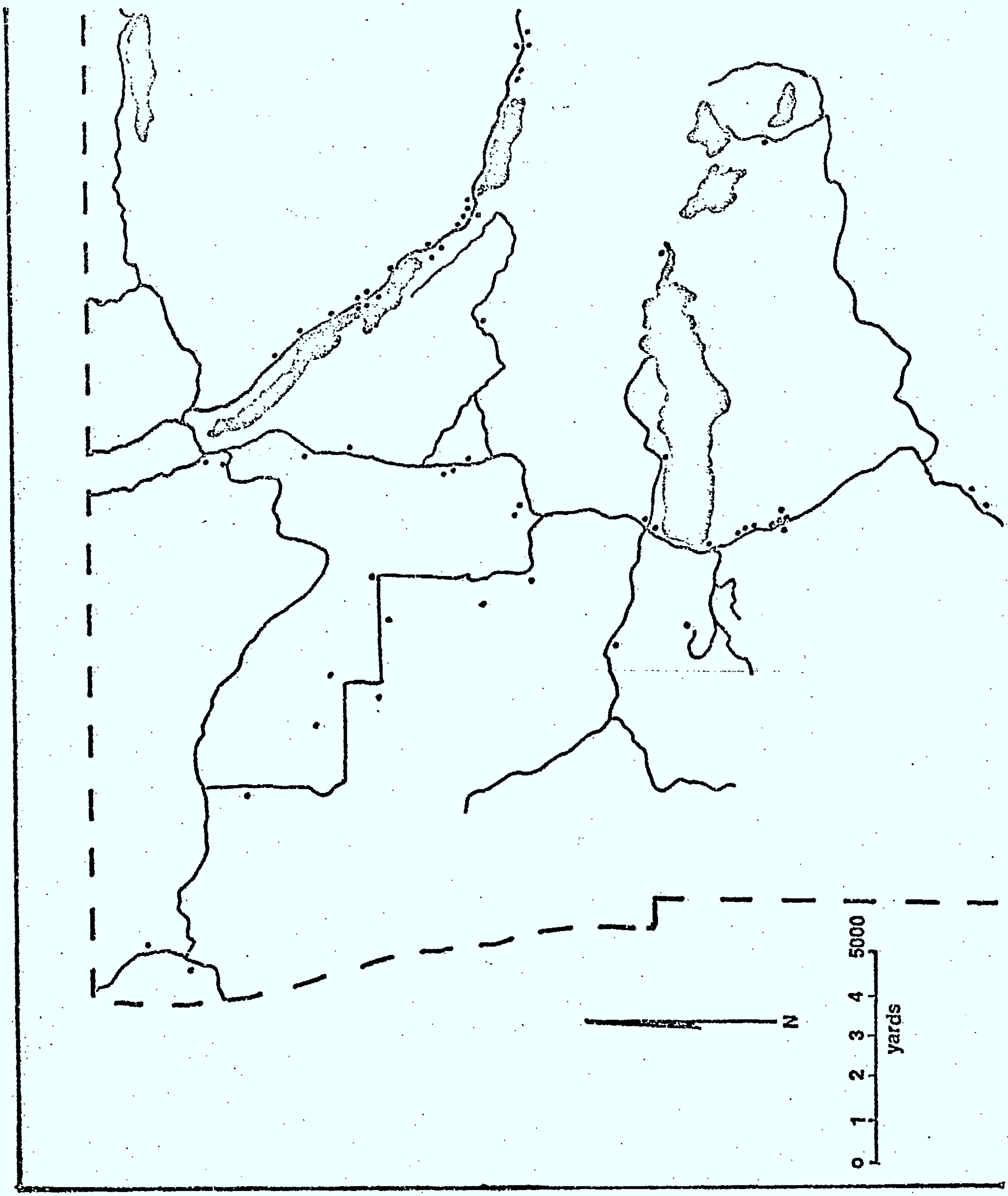


FED 59004 EA 260

CD 41 MAP 2 OF 4

CSD 28 Cariboo Sub A

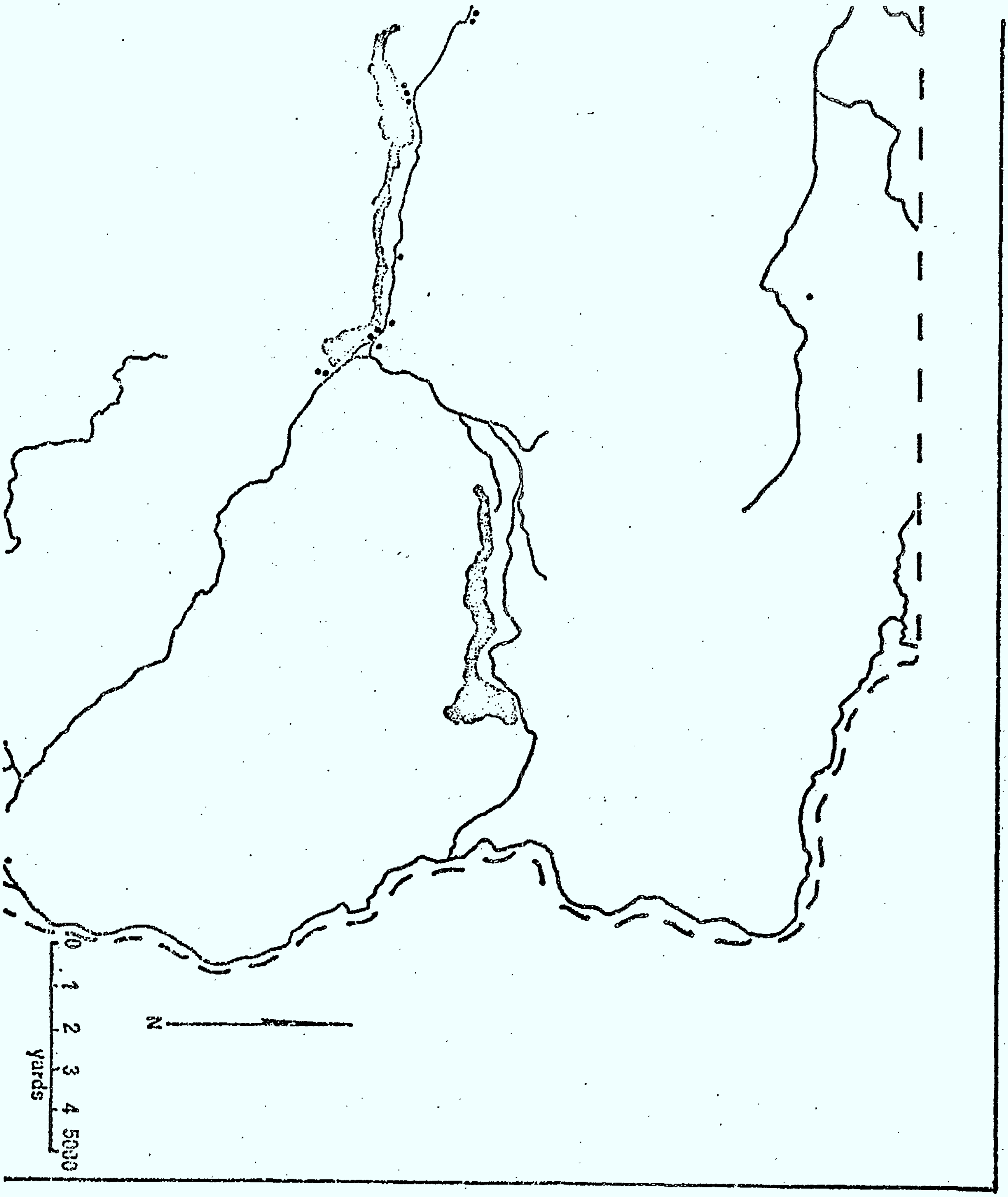
FIGURE 2 (CONT'D)



FED 59004 EA 260

CD 41 MAP 3 OF 4 FIGURE 2 (CONT'D)

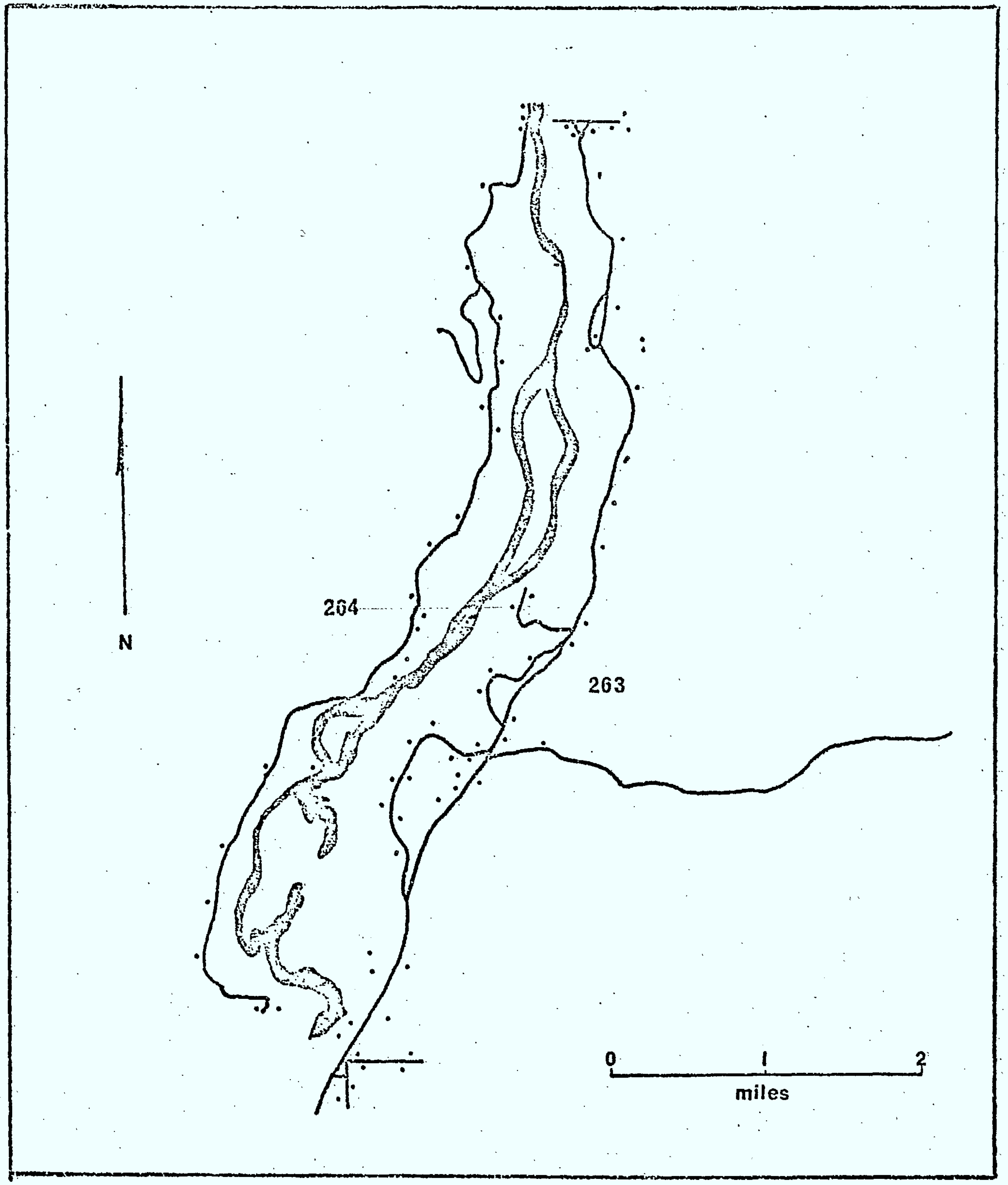
CSD 28 Cariboo, Sub A



FED 59004 EA 260

CD 41 MAP 4 OF 4 FIGURE 2 (CONT'D)

CSD 28 Cariboo Sub A



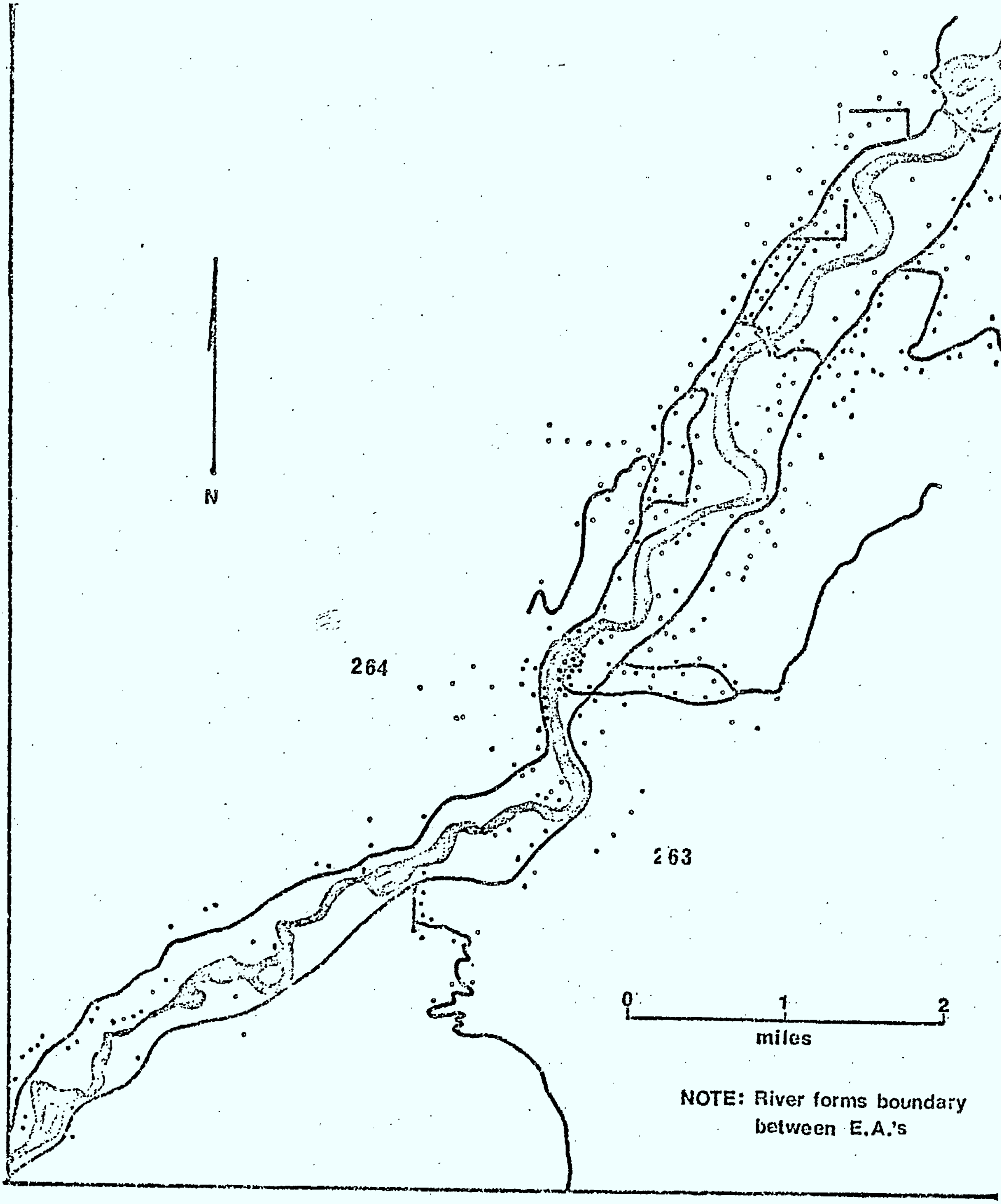
FED 59010 EA 263 264 (portions of)

CD 3 MAP 1 OF 2

CSD 42 Central Kootenay, Sub B

FIGURE 3

CENTRAL KOOTENAY

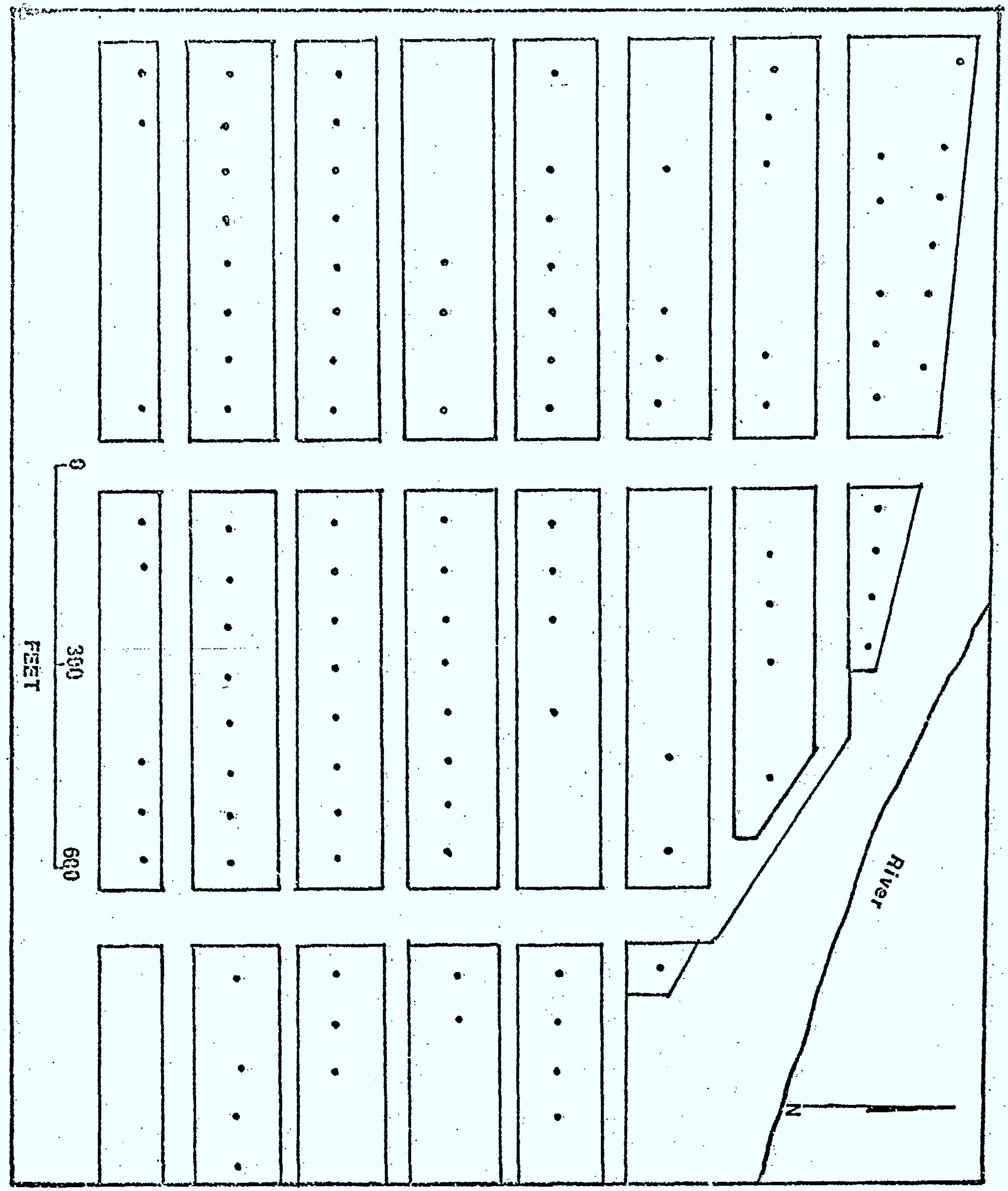


FED 59010 E A 263,264 (portions of)

CD 3 MAP 2 OF 2 FIGURE 3 (CONT'D)

CSD 42 Central Kootenay- Sub B

AH

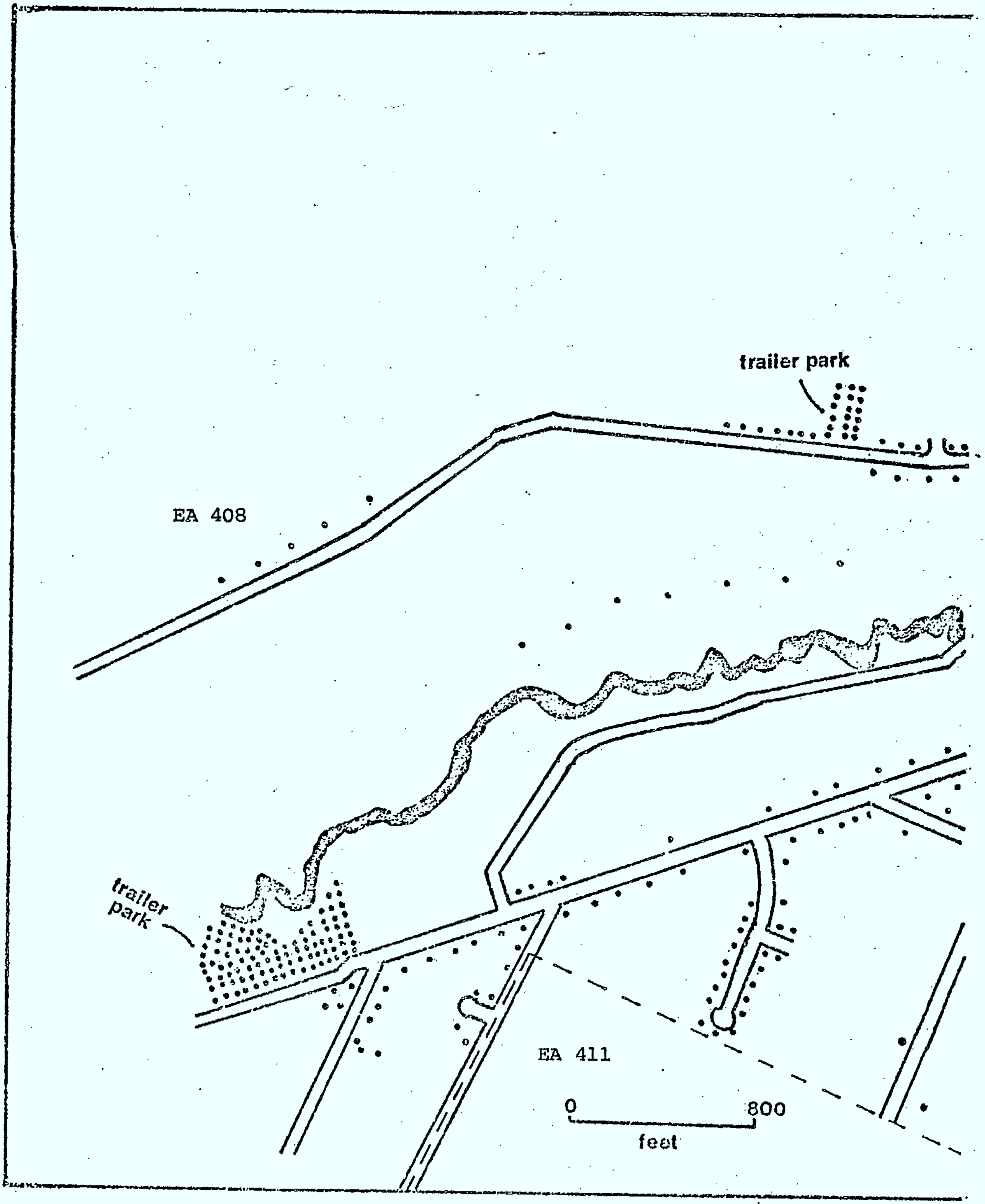


FED 59004 EA 395 (Portion of)

CD 45 MAP 1 OF 1

CSD 6085 Bella Coola

FIGURE 4
BELLA COOLA



FED 59014 EA 407 408 409 (portions of)

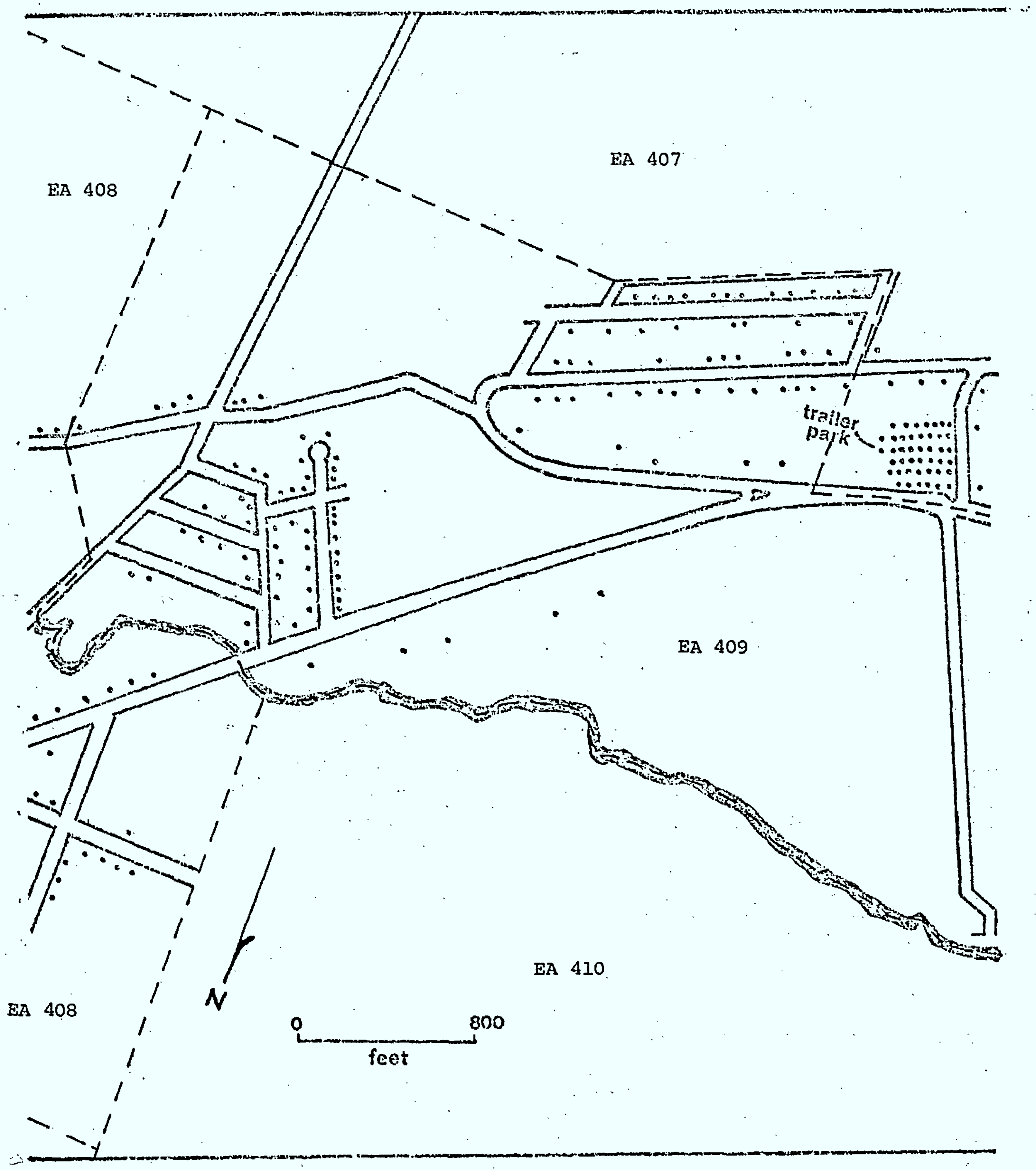
CD 37 MAP 1 OF 4

CSD 163 N. Okanagan

FIGURE 5

NORTH OKANAGAN

AH

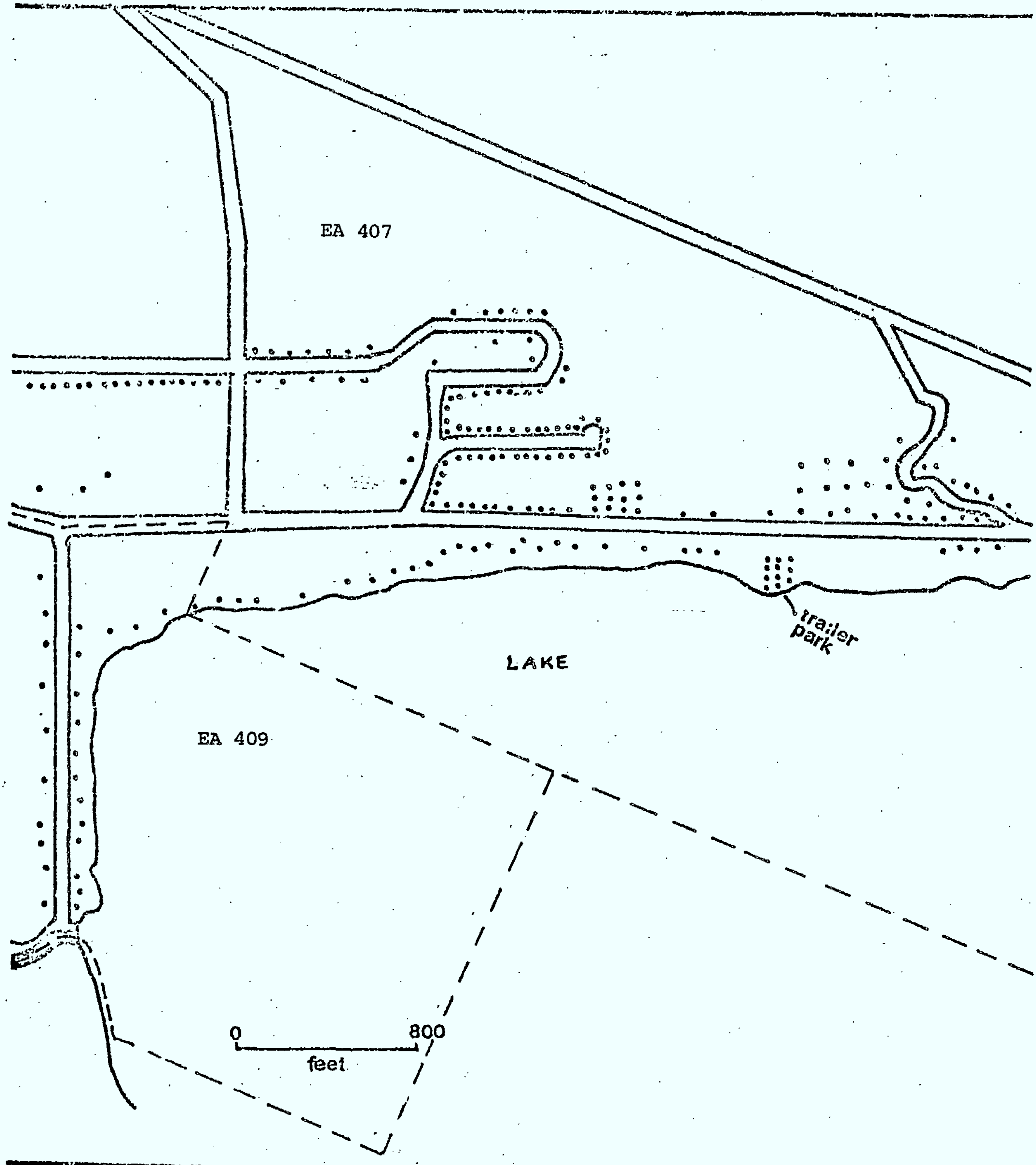


FED 59014 E A 407, 408, 409 (portions of)

CD 37 MAP 2 OF 4

CSD 103 N. Okanagan

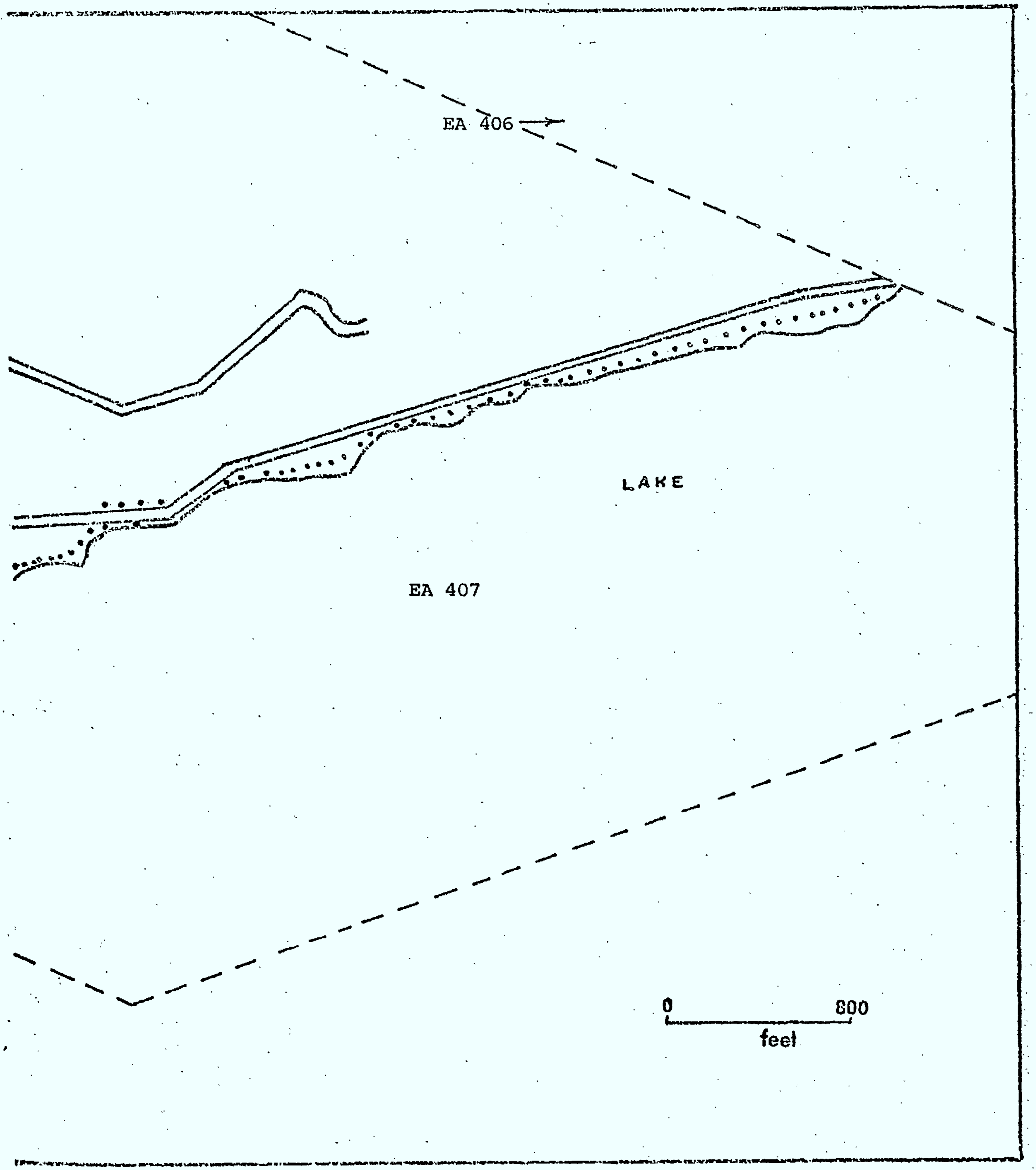
FIGURE 5 (CONT'D)



FED 59014 EA 407, 409, 408 (portions of)

CD 37 MAP 3 OF 4 FIGURE 5 (CONT'D)

CSD 108 N Okanagan

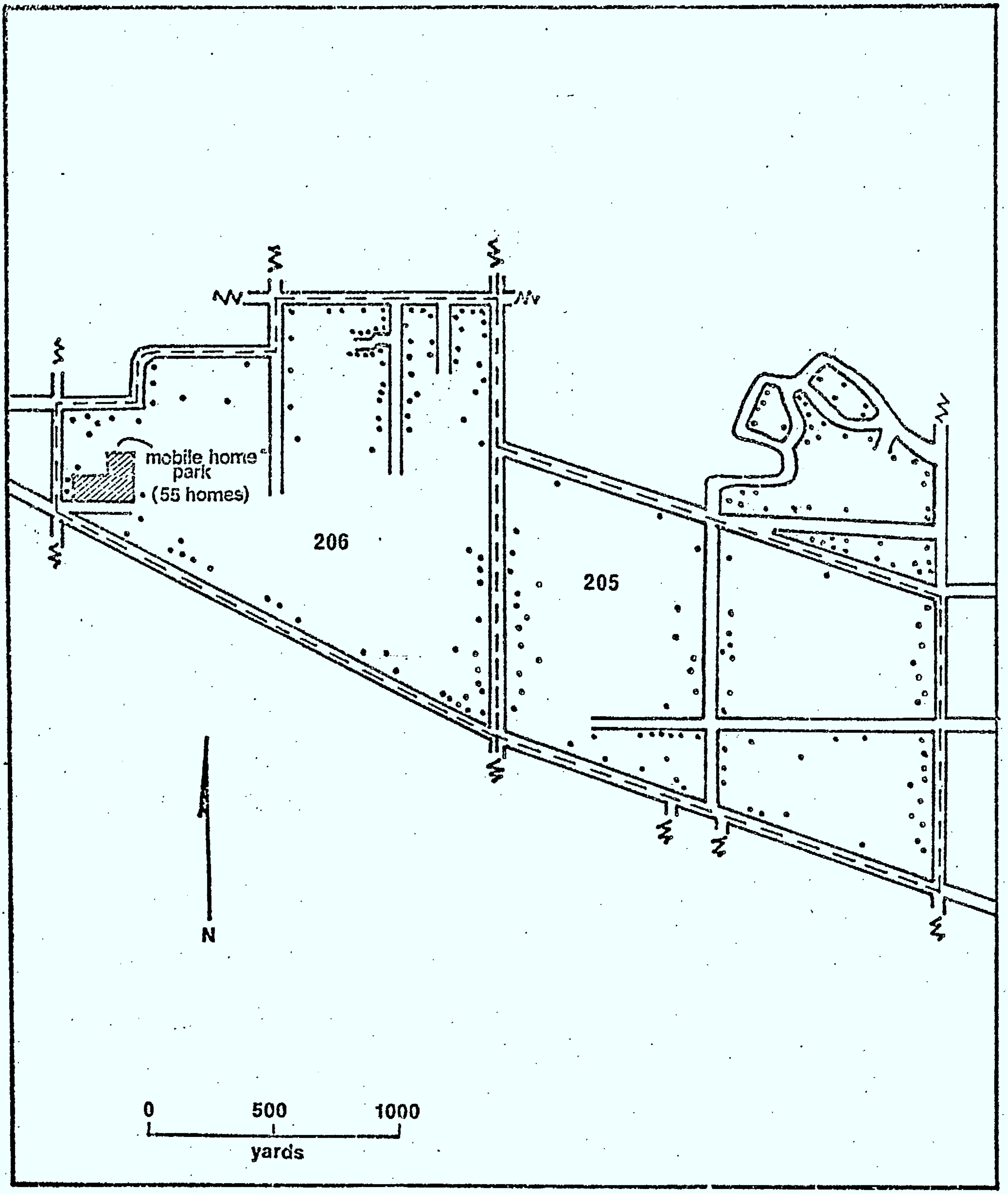


FED 59014 EA 407, 408, 409 (portions of)

CD 37 MAP 4 OF 4 FIGURE 5 (CONT'D)

CSD 168 N. Okanagan

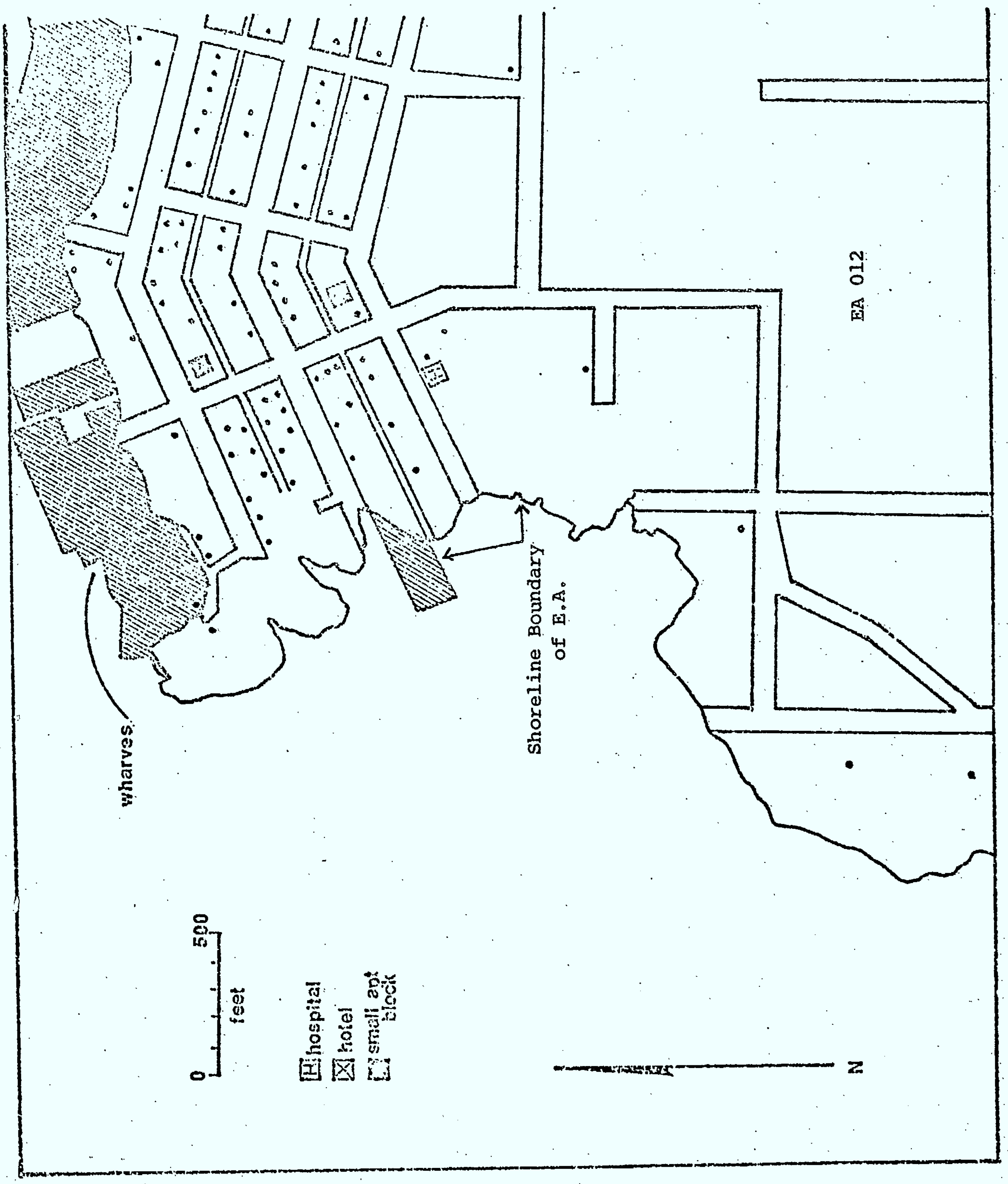
AH



FED 59008 | EA 205,206
CD 11 | MAP 1 OF 1
CSD 34 Langley

FIGURE 6
LANGLEY

ECV/DT

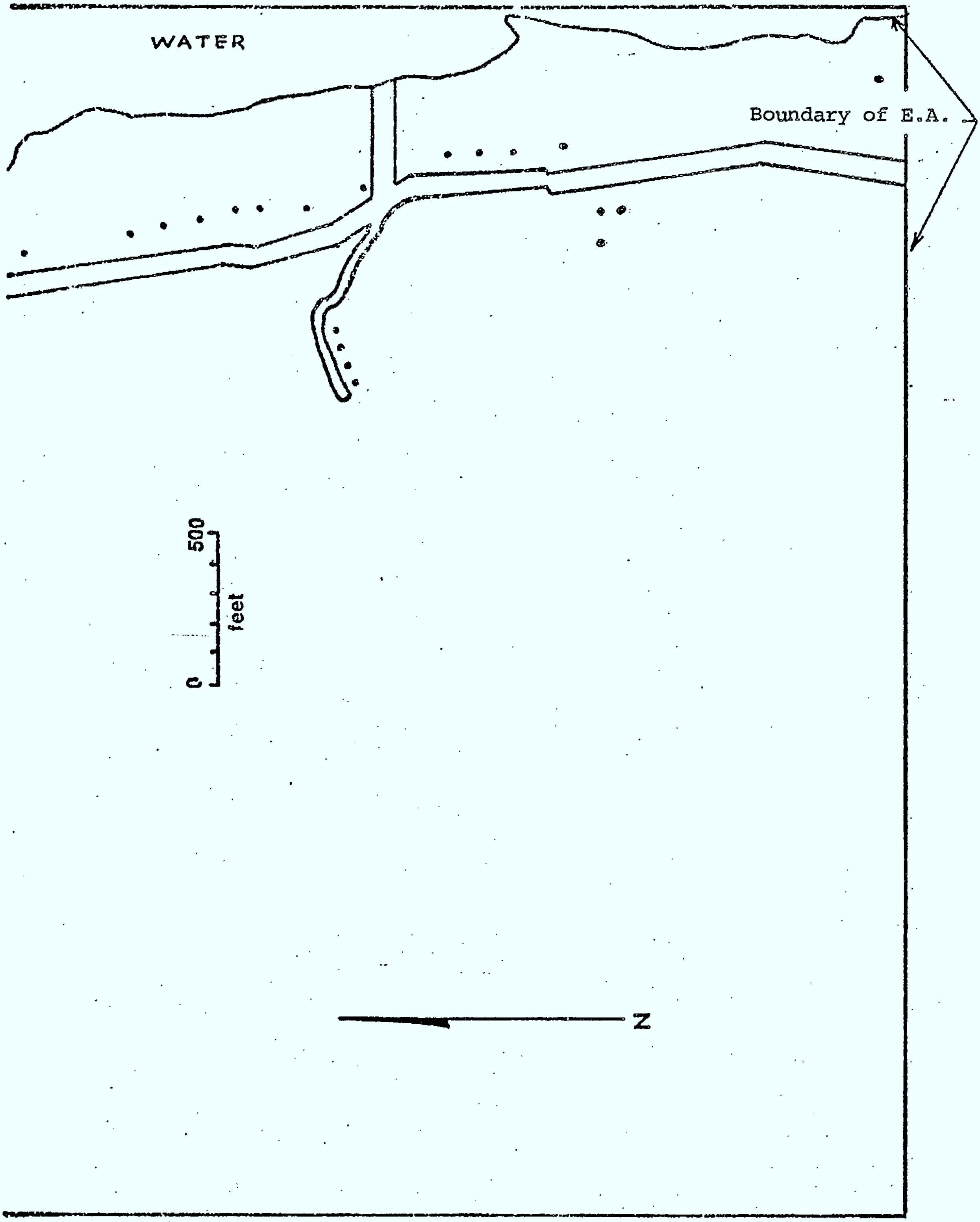


FED 59005 EA 012 (portion of)

CD 23 MAP 1 OF 3

CSD 4 Tofino

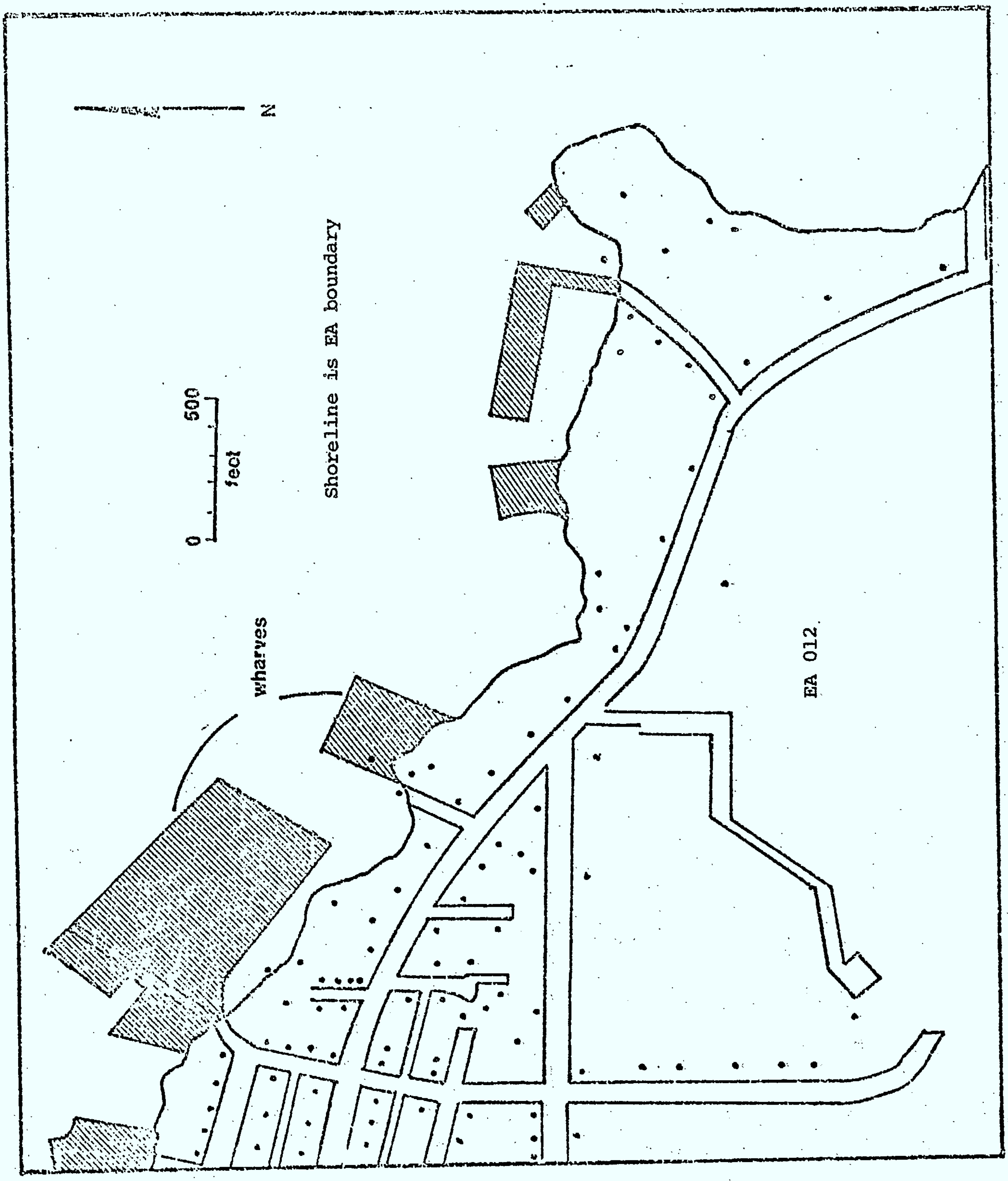
FIGURE 7
TOFINO



FED 59005 EA 012 (portion of)
CD 23 MAP 2 OF 3
CSD 4 Tofino

FIGURE 7 (CONT'D)

ECV

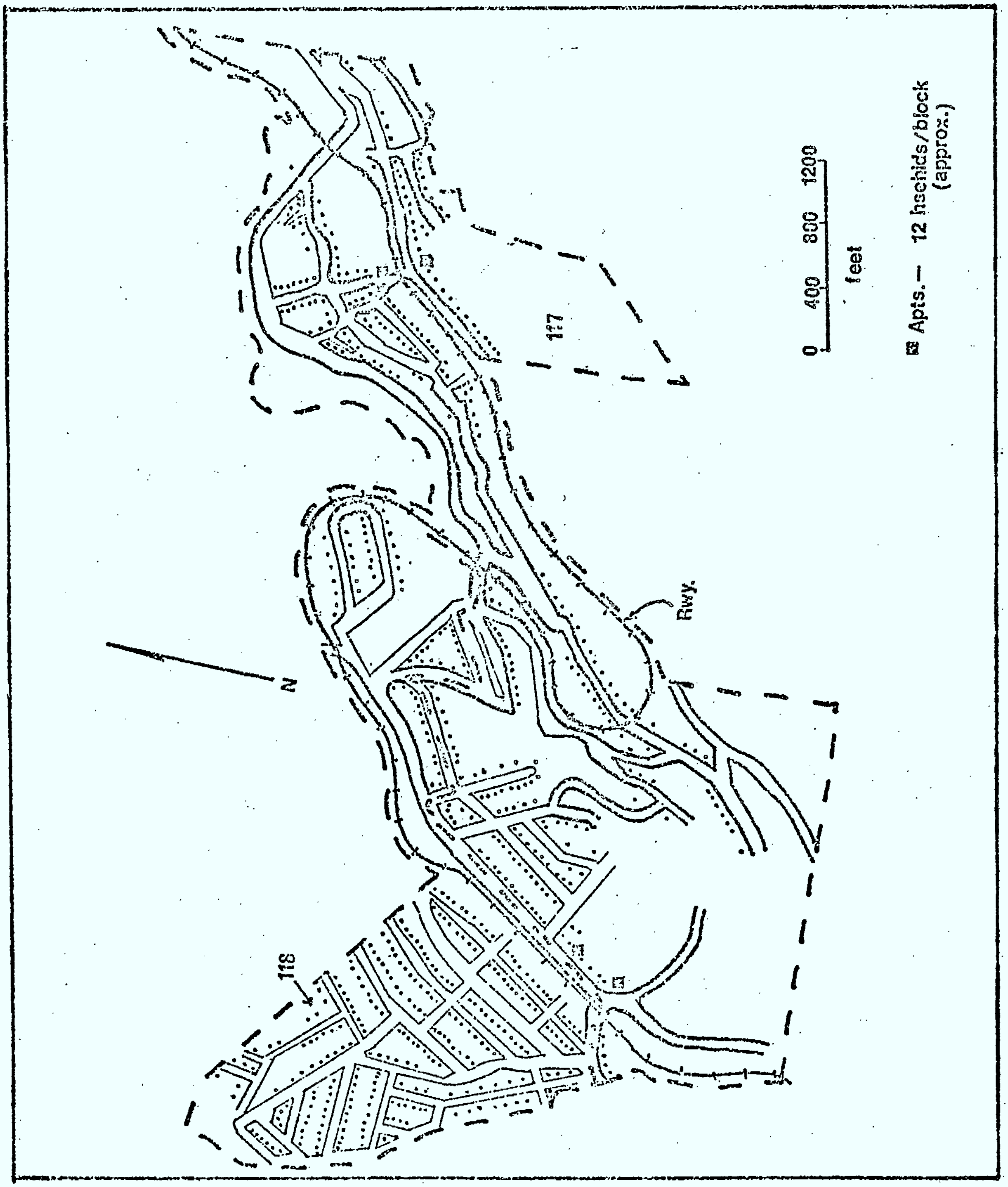


FED 59005 EA 012 (portion of)

CD 23 MAP 3 OF 3

CSD 4 Tofino

FIGURE 7 (CONT'D)

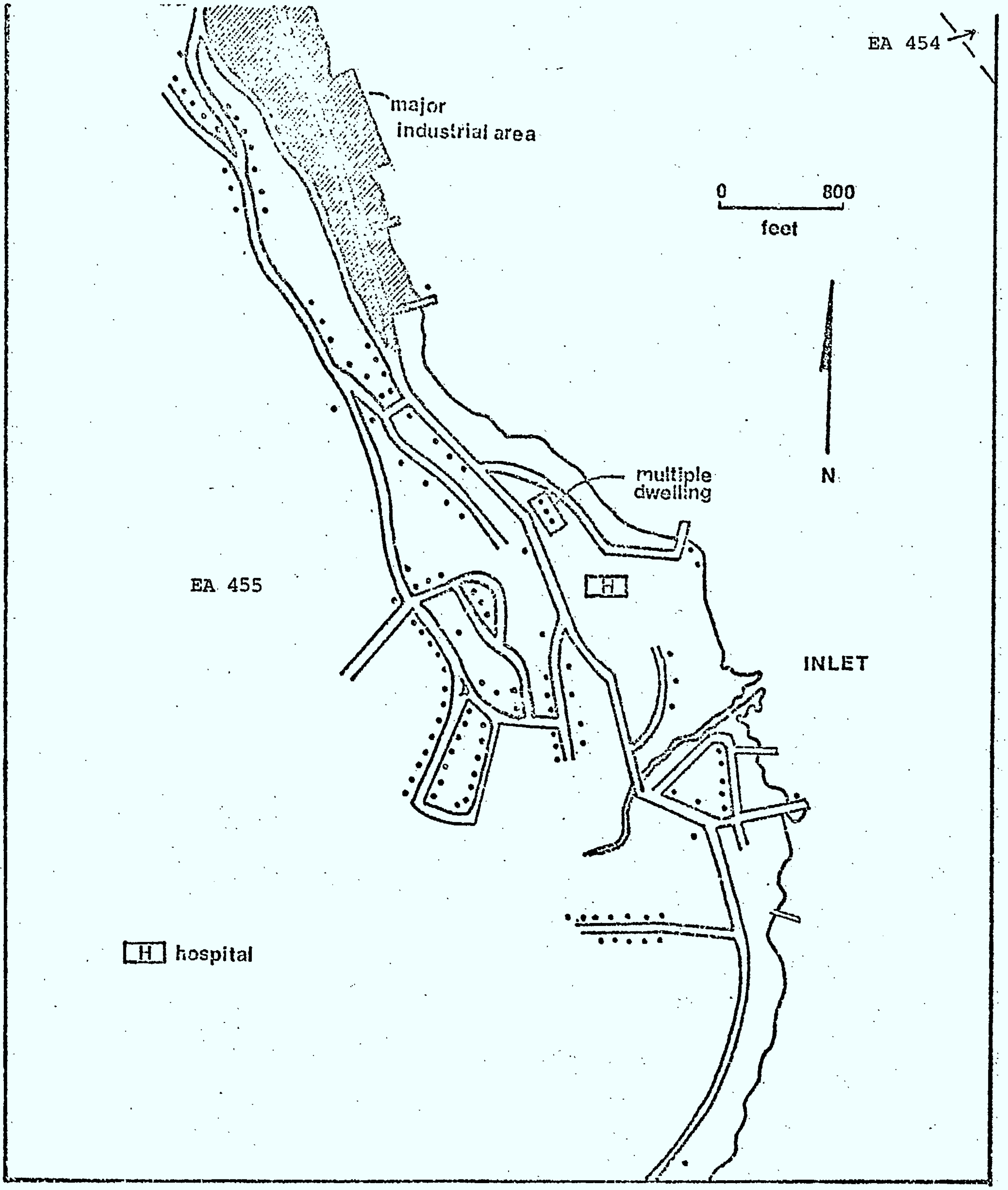


FED 59010 EA 117,118

CD 5 MAP 1 OF 1

CSD 151-Warfield

FIGURE 8
WARFIELD

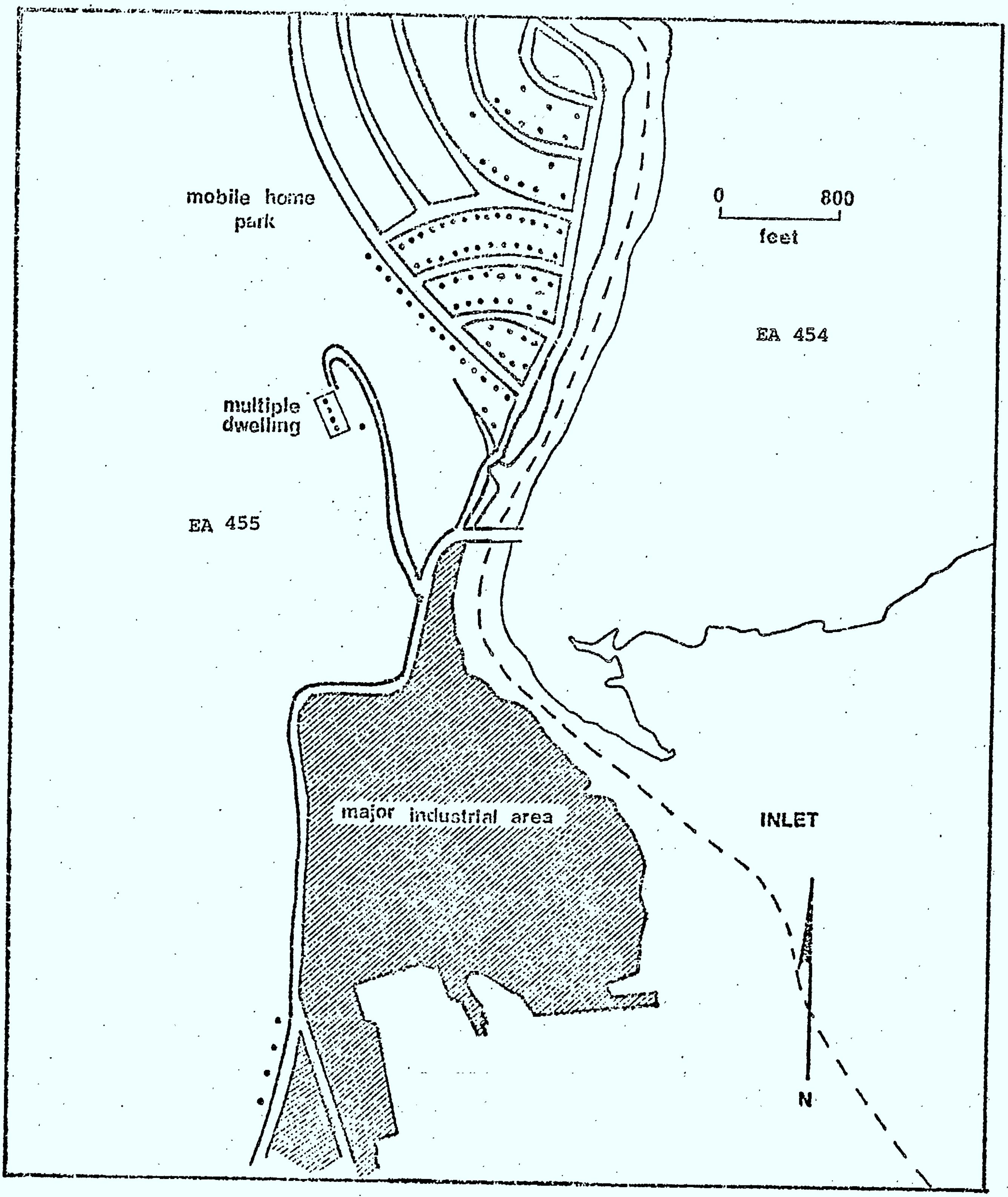


FED 59005 EA 455, 454 (portions of)

CD 25 MAP 1 OF 3

CSD 78 Tahsis

FIGURE 9
TAHSIS



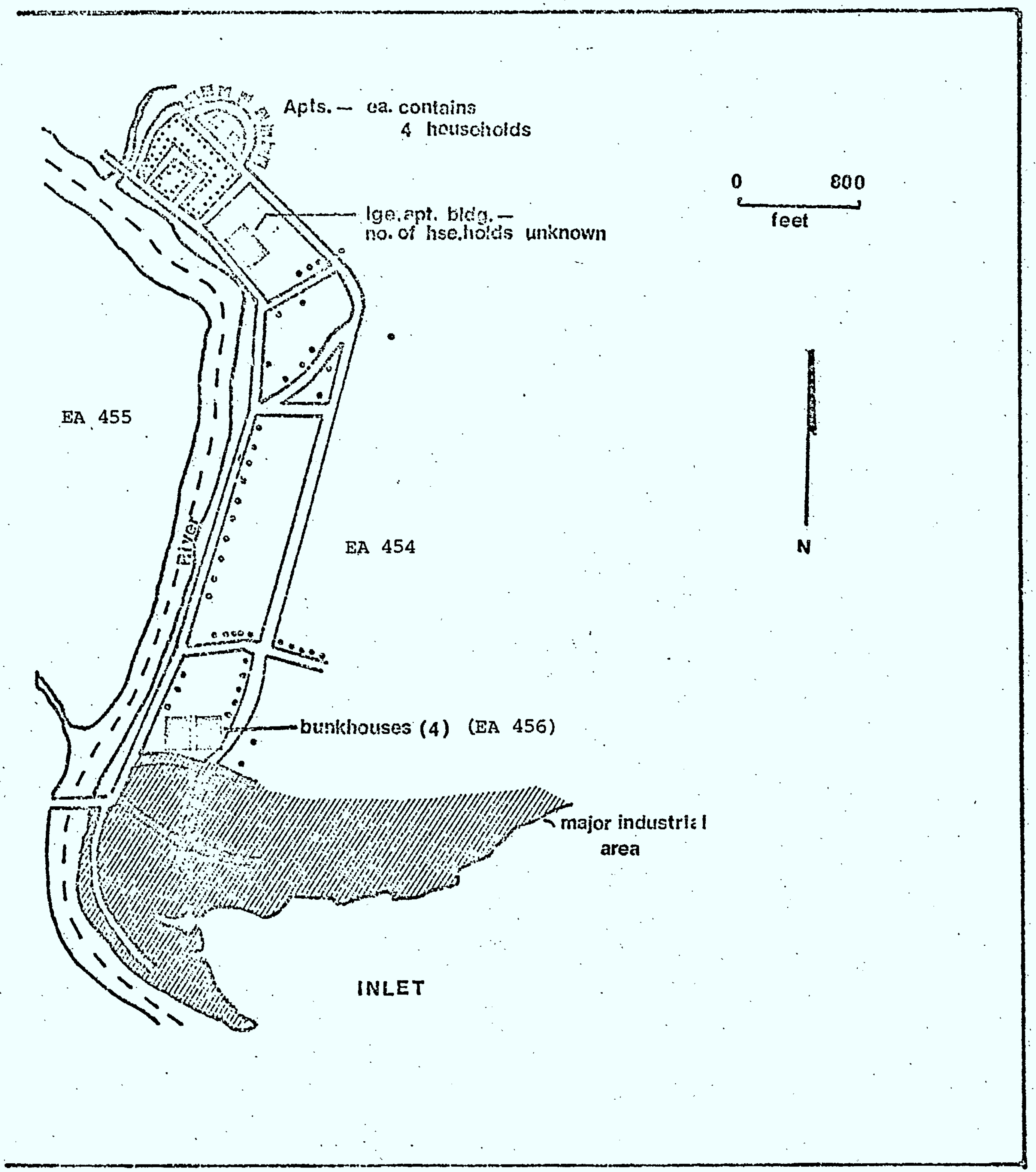
FCD 59005 EA 455, 454 (portions of)

CD 25 MAP 2 OF 3

CSD 78 Tahsis

FIGURE 9 (CONT'D)

ECV



FED 59005 EA 454 456 (portions of)

CD 25 MAP 3 OF 3 FIGURE 9 (CONT'D)

CSD 78 Tahsis

ECV

FIG. 10 PRAIRIE TOWN

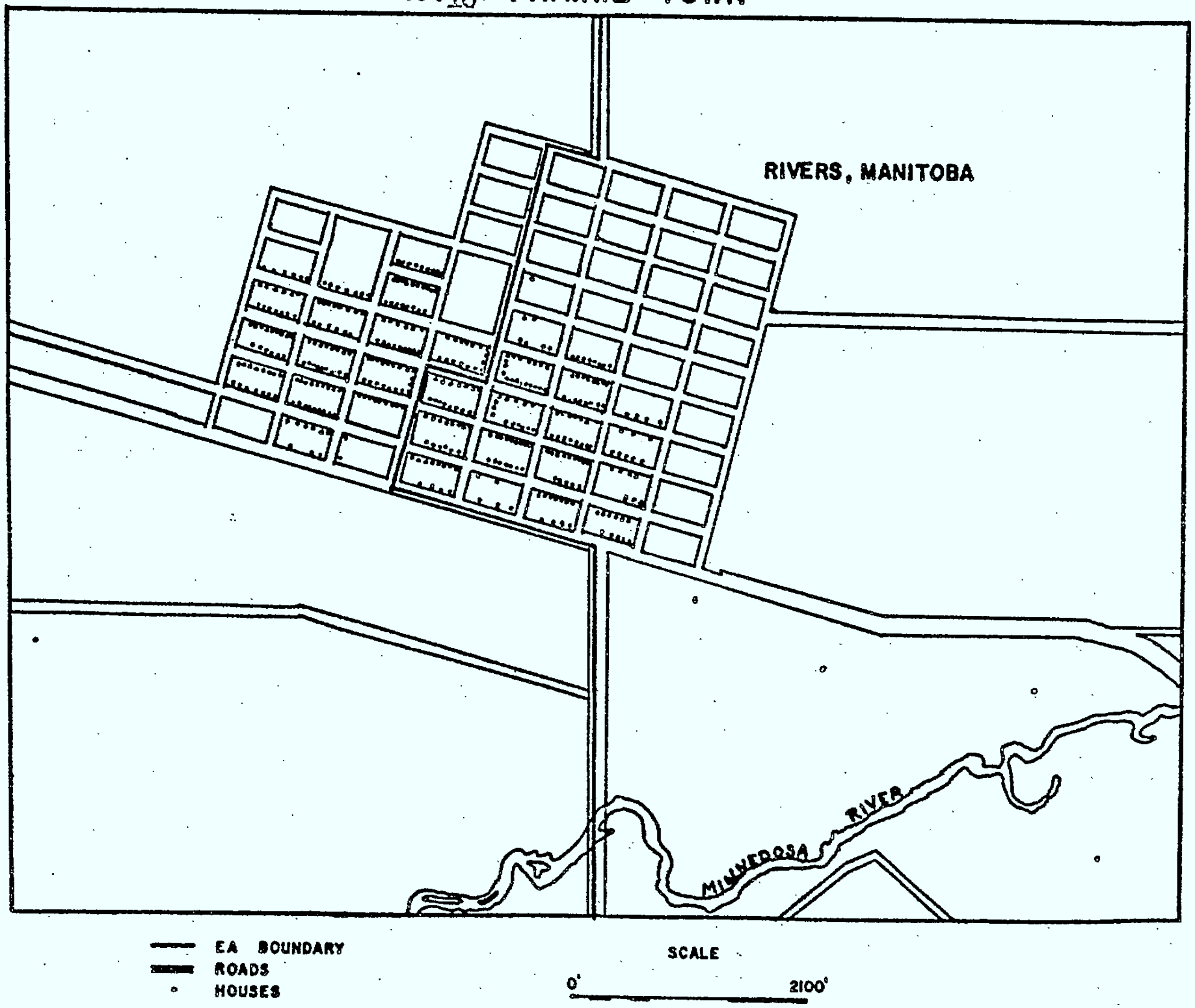


FIG. 11A, TYPICAL SECTION (STETTLER, ALTA.)

SECTIONAL SURVEY SYSTEM

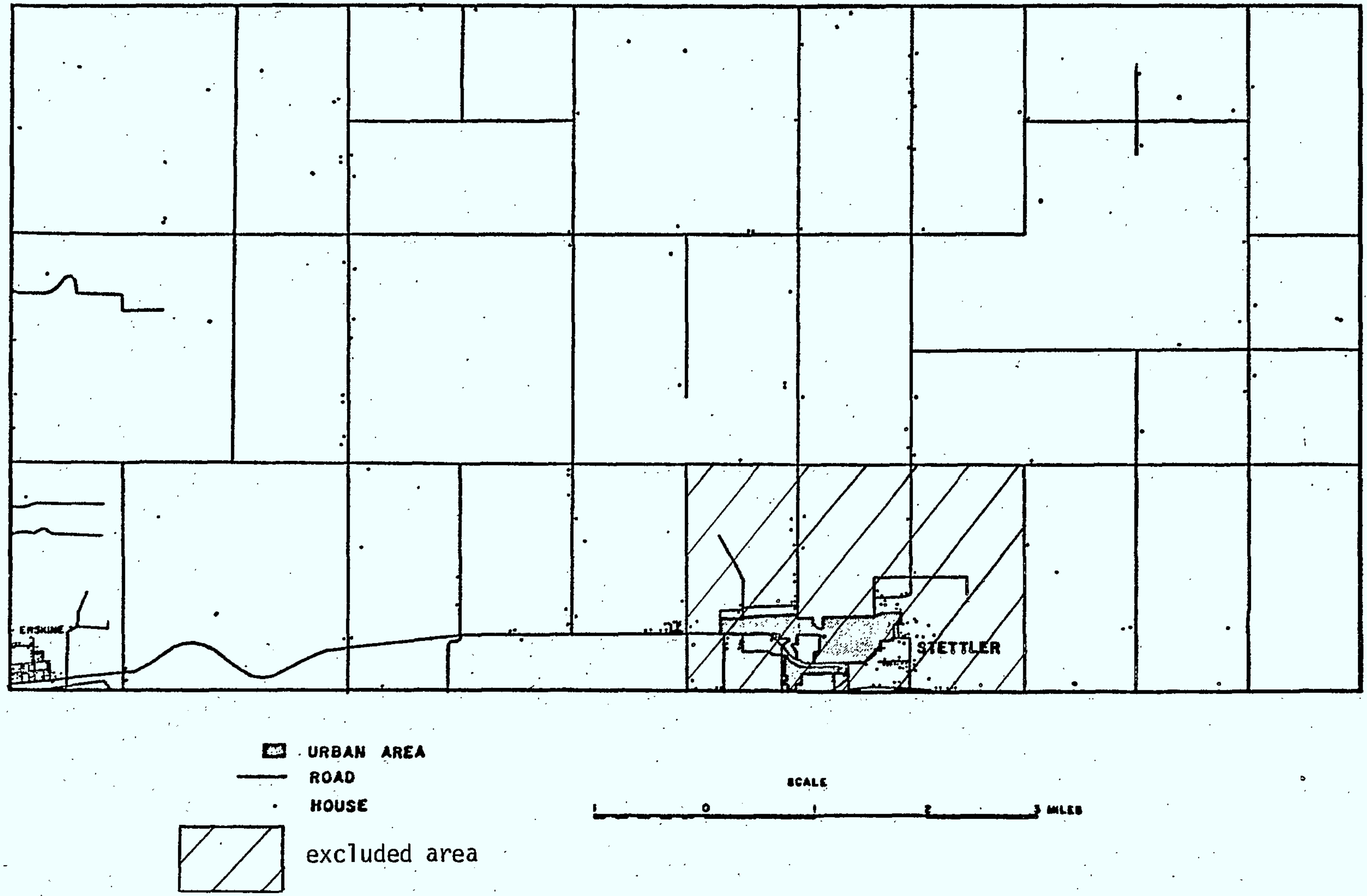


FIG. 11B, TYPICAL SECTION

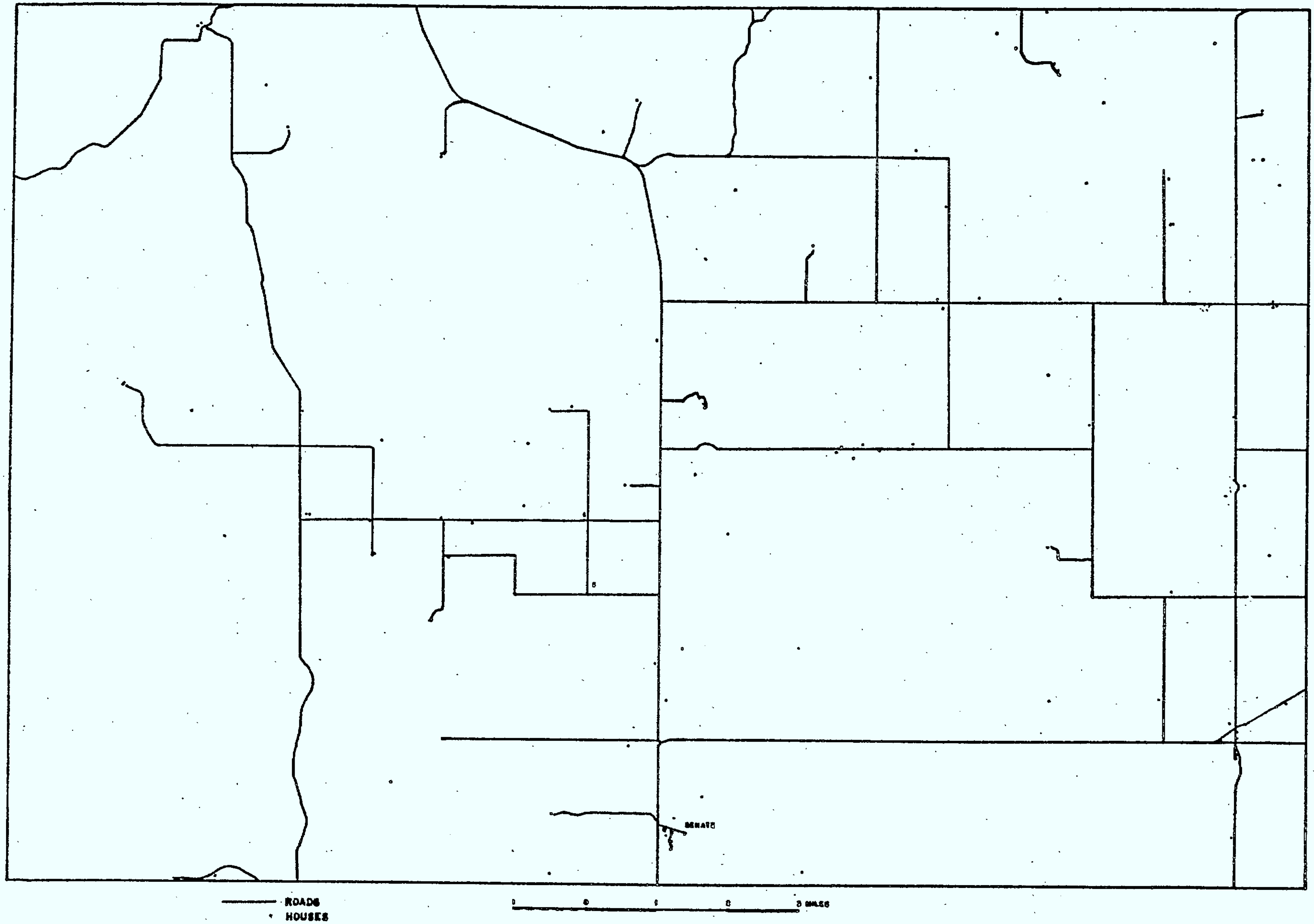


FIG. 11C, TYPICAL SECTIONS (STETTLER, ALTA.)
SECTIONAL SURVEY SYSTEM

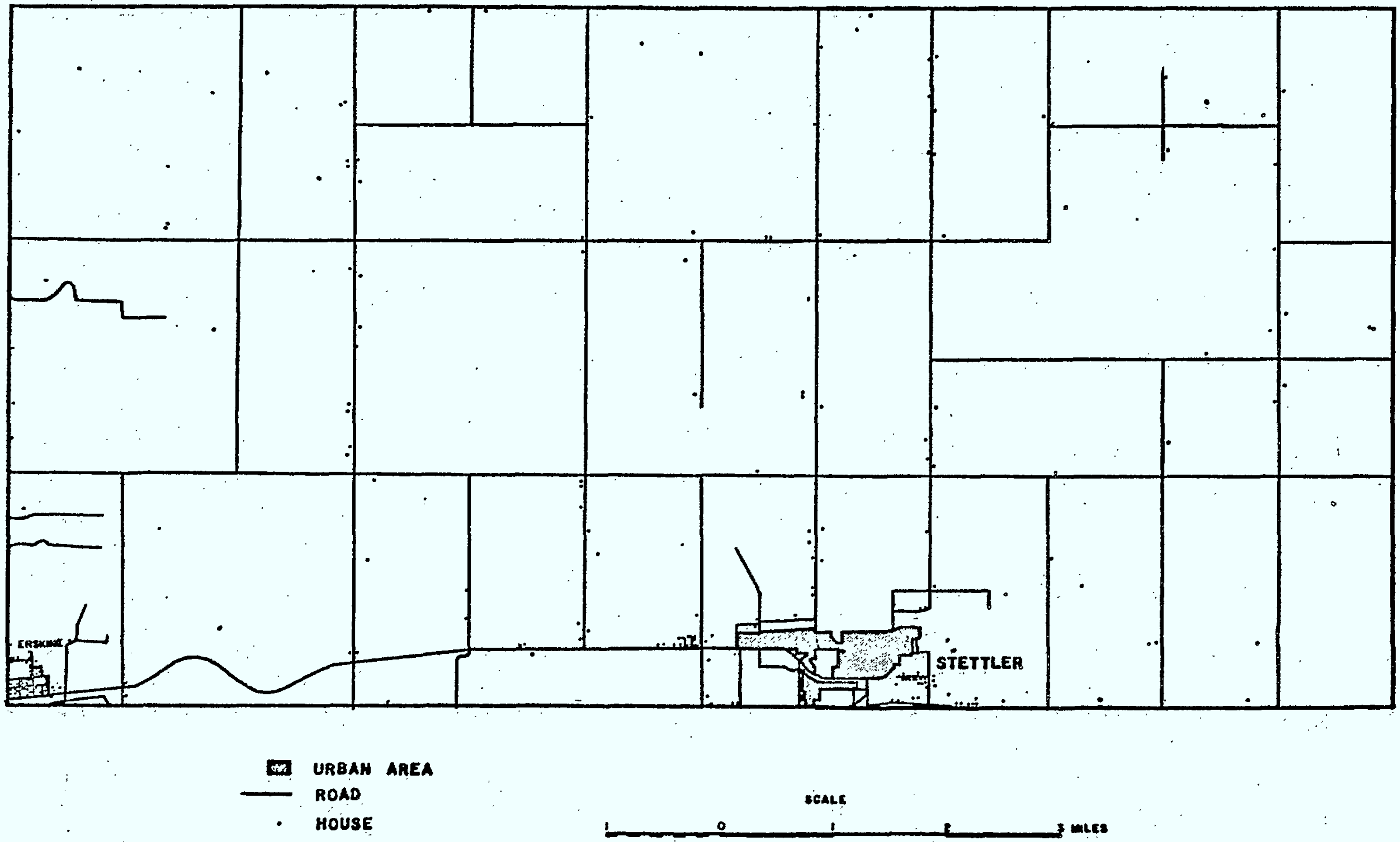


FIG. 12 PIONEER FRINGE (ATHABASCA, ALTA.)

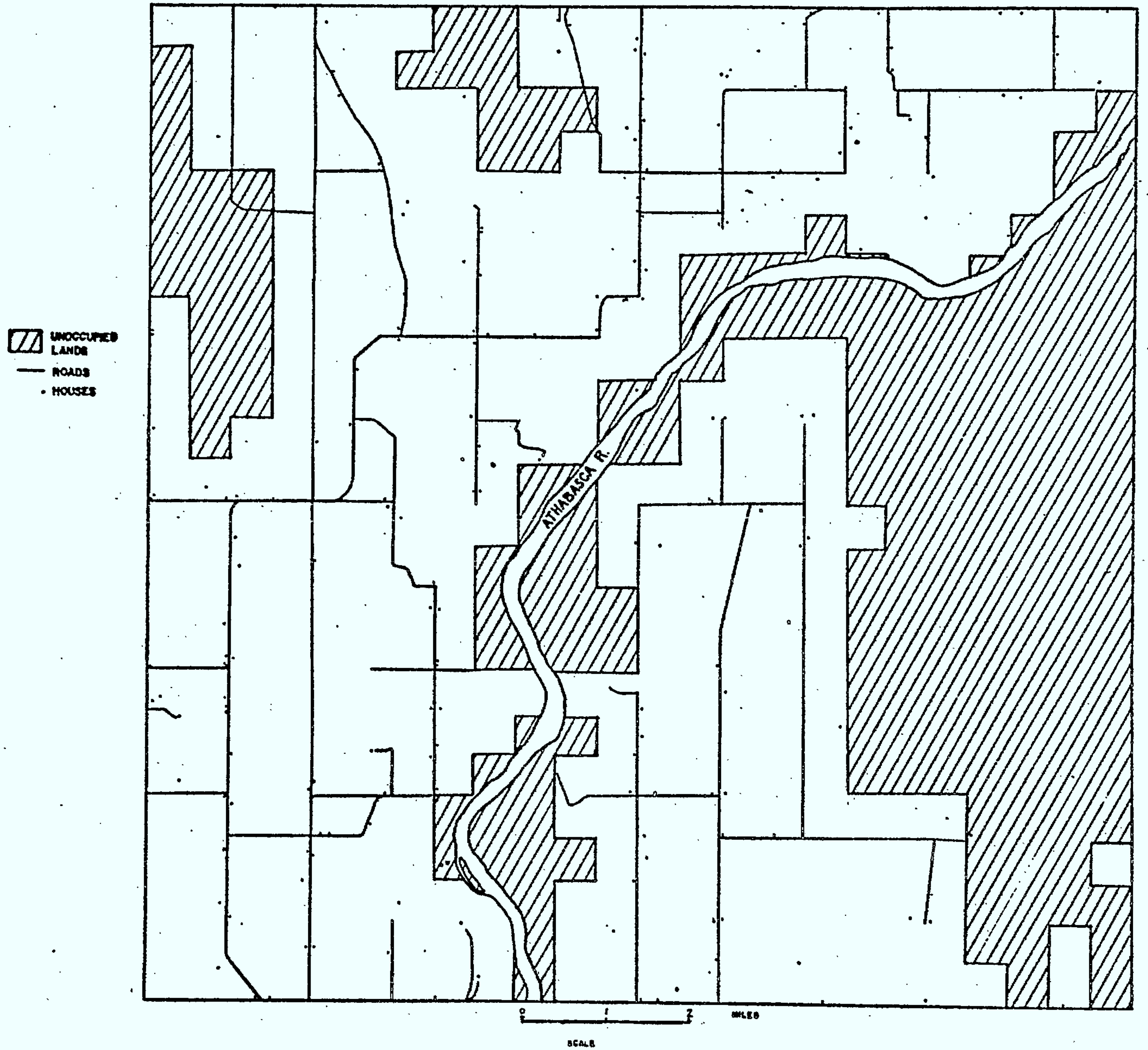


FIG. 13 DRYLAND FARMING (CONSUL, SASK)

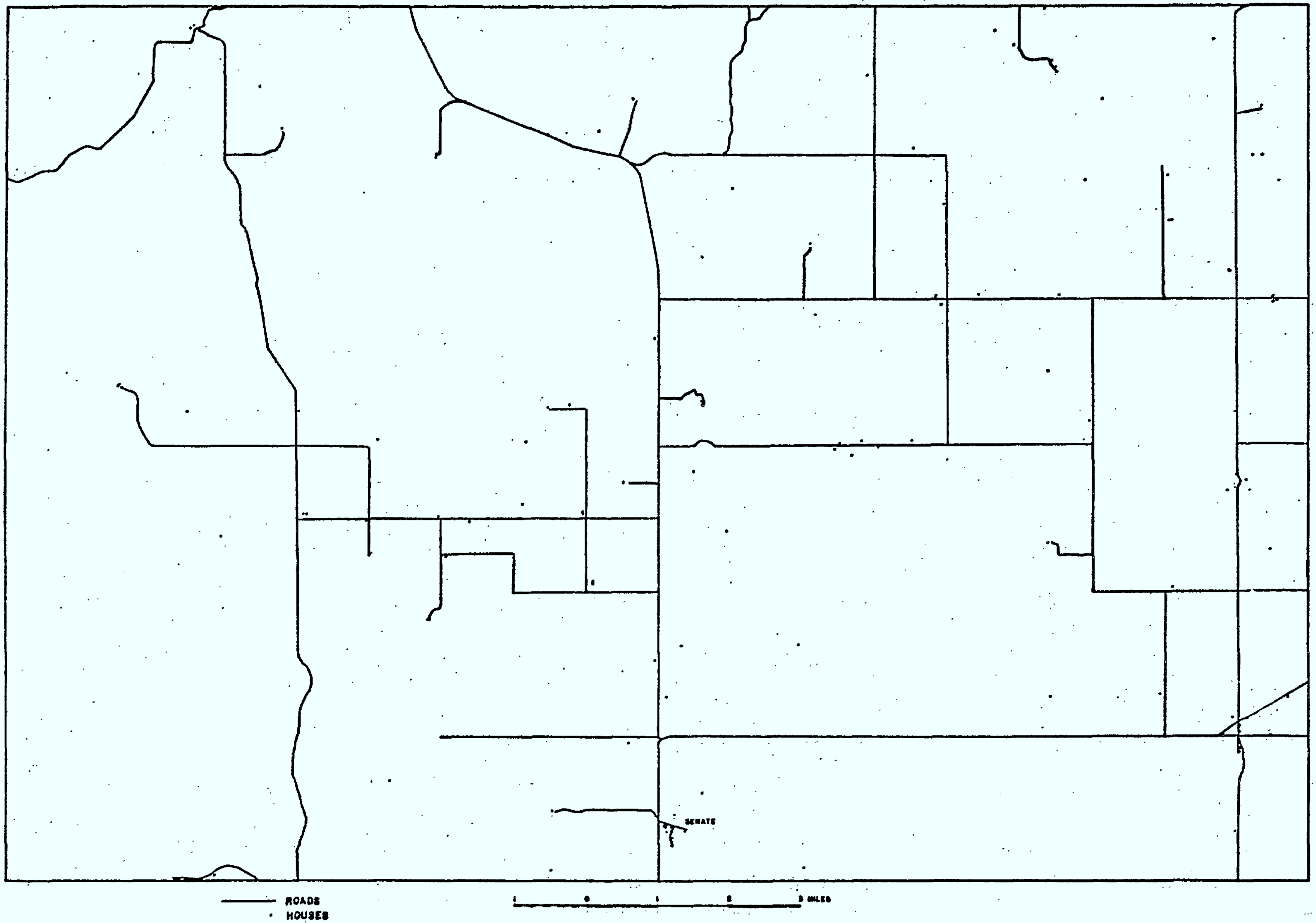


FIG. 14 MENNONITE COLONIES

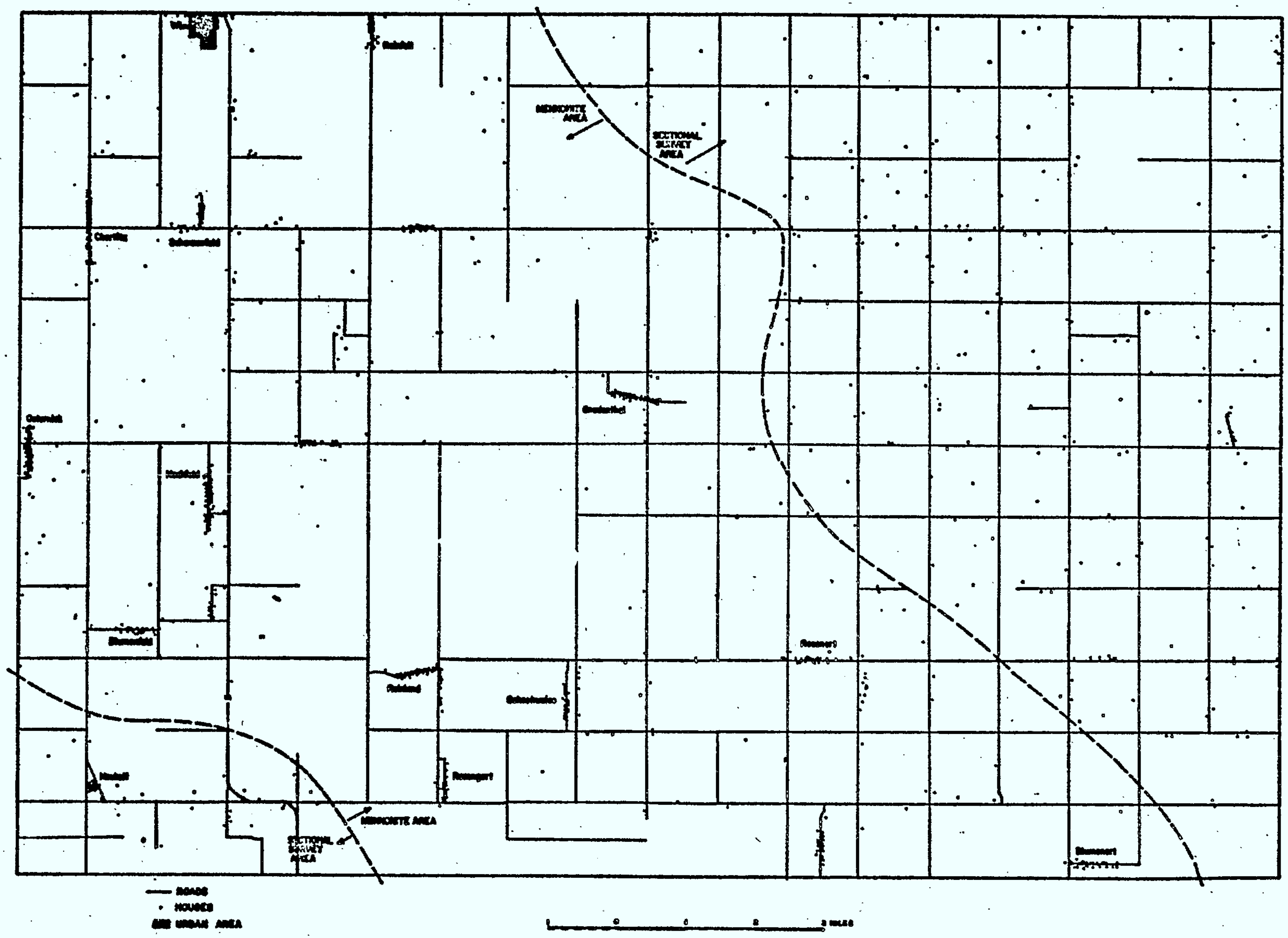


FIG. 15, IRRIGATION DISTRICTS (COALDALE, ALTA.) (INCLUDING PERIPHERY MODIFICATIONS)

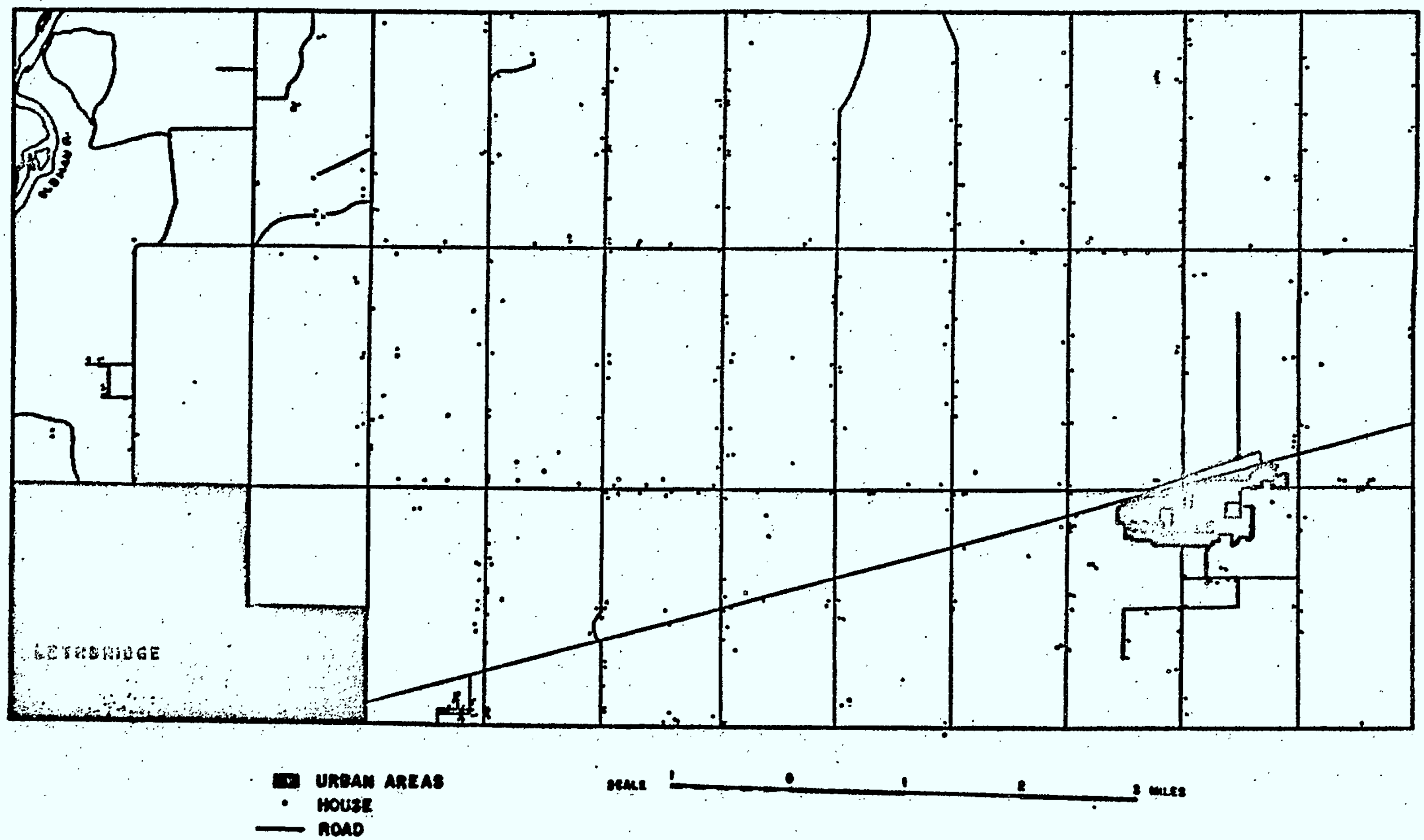
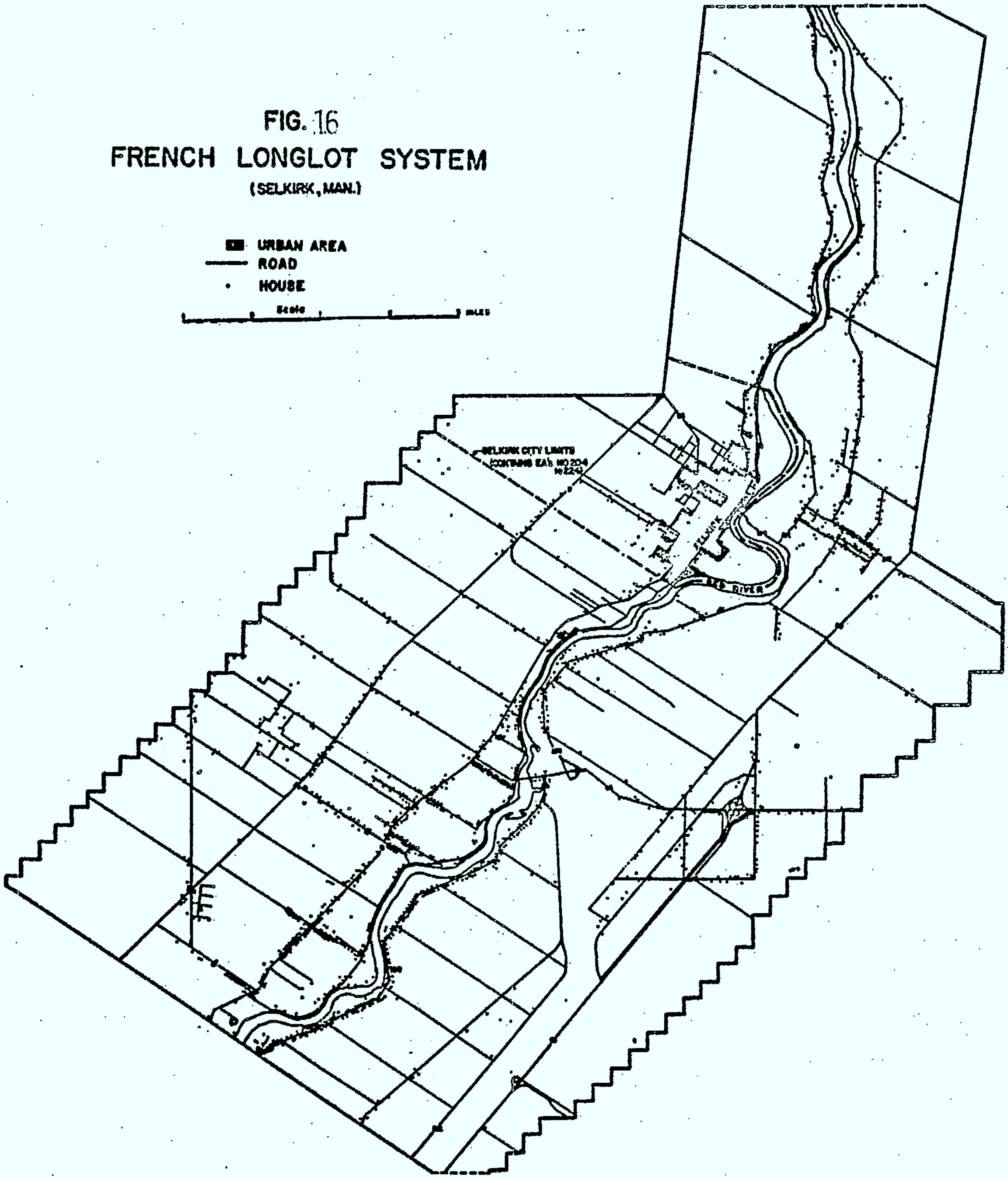


FIG. 16
FRENCH LONGLOT SYSTEM
(SELKIRK, MAN.)



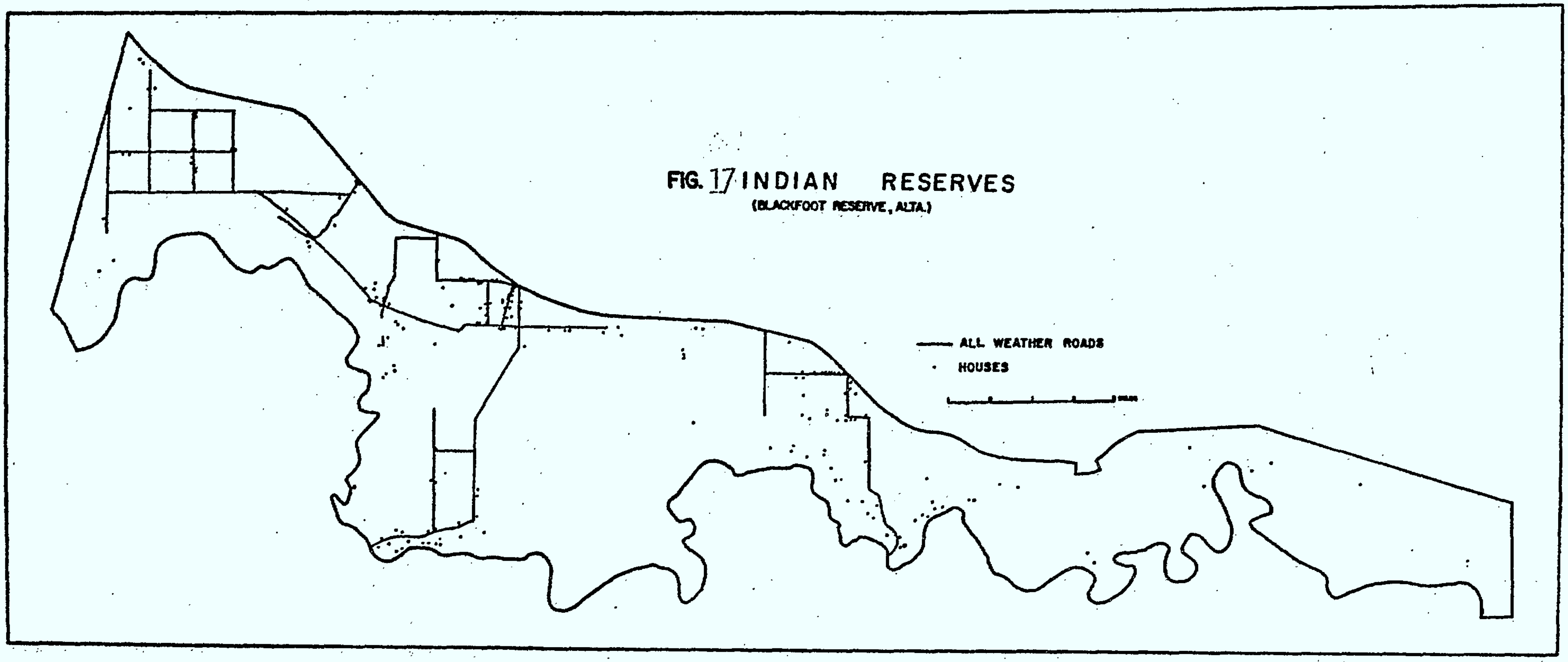
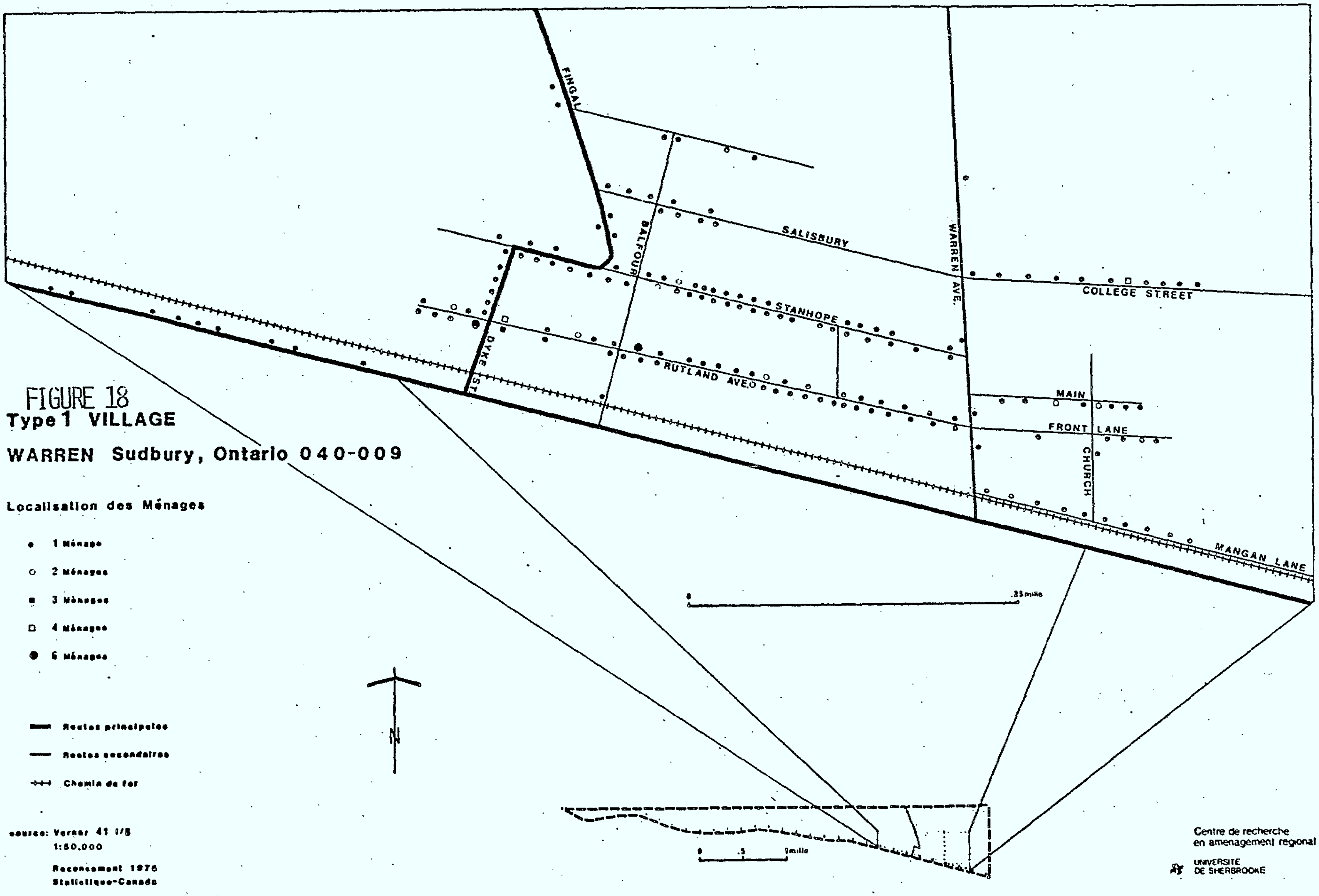


FIG. 17 INDIAN RESERVES

(BLACKFOOT RESERVE, ALTA.)

FIGURE 18
Type 1 VILLAGE
WARREN Sudbury, Ontario 040-009



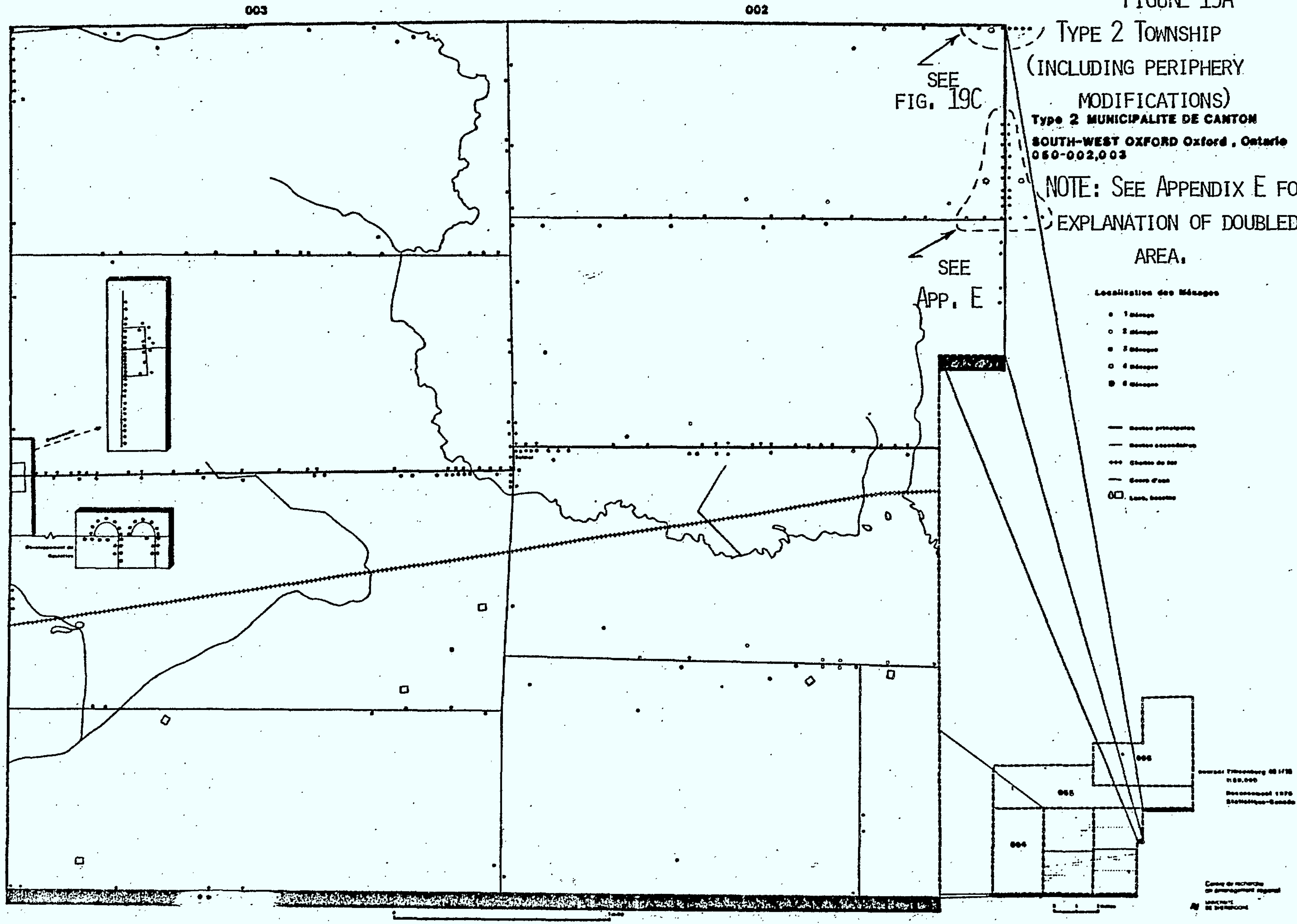


FIGURE 19A
TYPE 2 TOWNSHIP (INCLUDING PERIPHERY MODIFICATIONS)

NOTE: SEE APPENDIX E FOR EXPLANATION OF DOUBLED AREA.

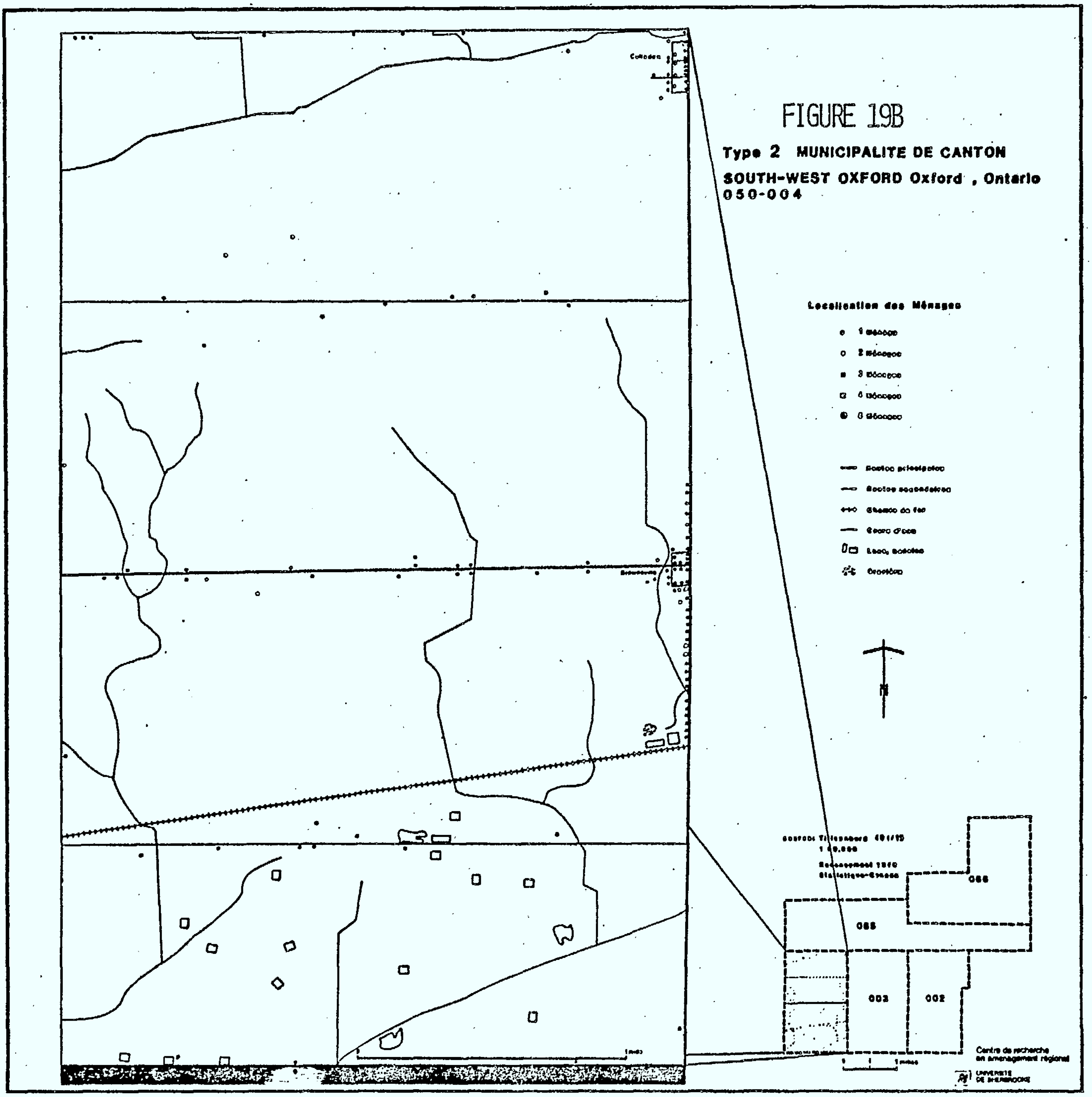
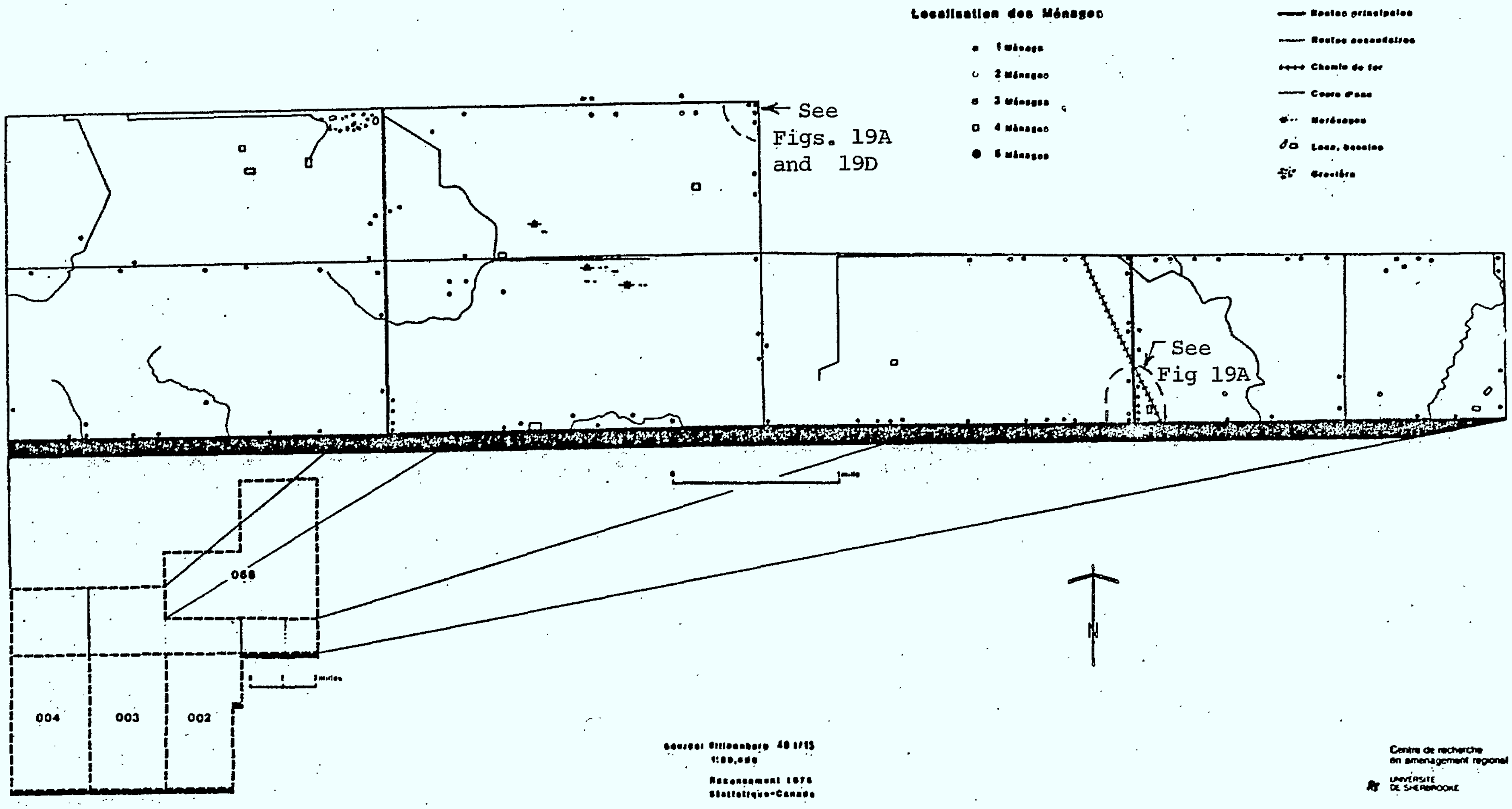


FIGURE 19B
Type 2 MUNICIPALITE DE CANTON
SOUTH-WEST OXFORD Oxford , Ontario
050-004
Localisation des Ménages
056
055
003
002
Centre de recherche en aménagement régional

FIGURE 19C

Type 2 MUNICIPALITÉ DE CANTON

SOUTH-WEST OXFORD Oxford , Ontario 050-065



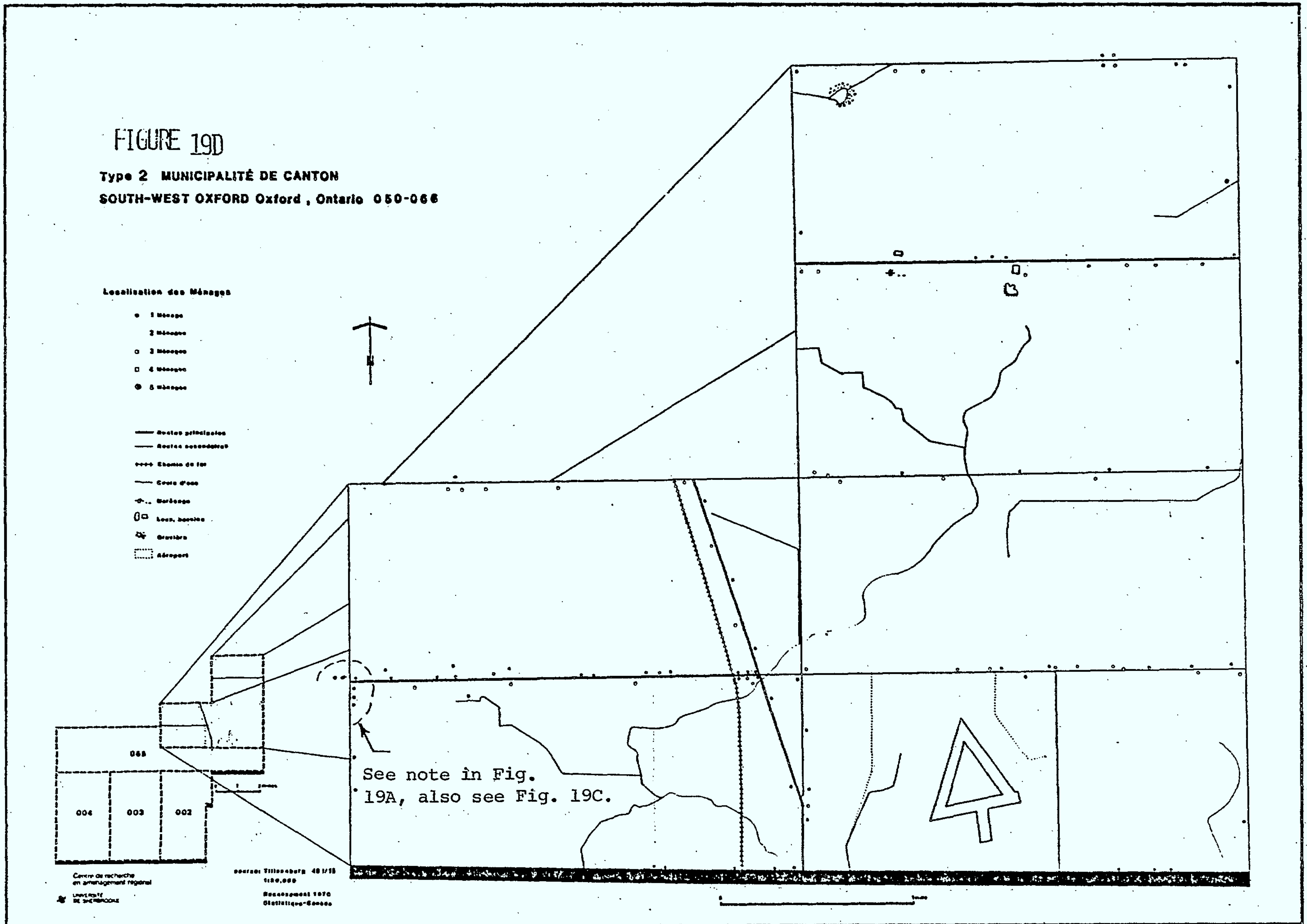


FIGURE 19D
Type 2 MUNICIPALITÉ DE CANTON
SOUTH-WEST OXFORD Oxford , Ontario 050-066
065
004
003
002
See note in Fig. 19A, also see Fig. 19C.

FIGURE 20A, TYPE 3 DISPERSED (INCLUDES PERIPHERY MODIFICATIONS)

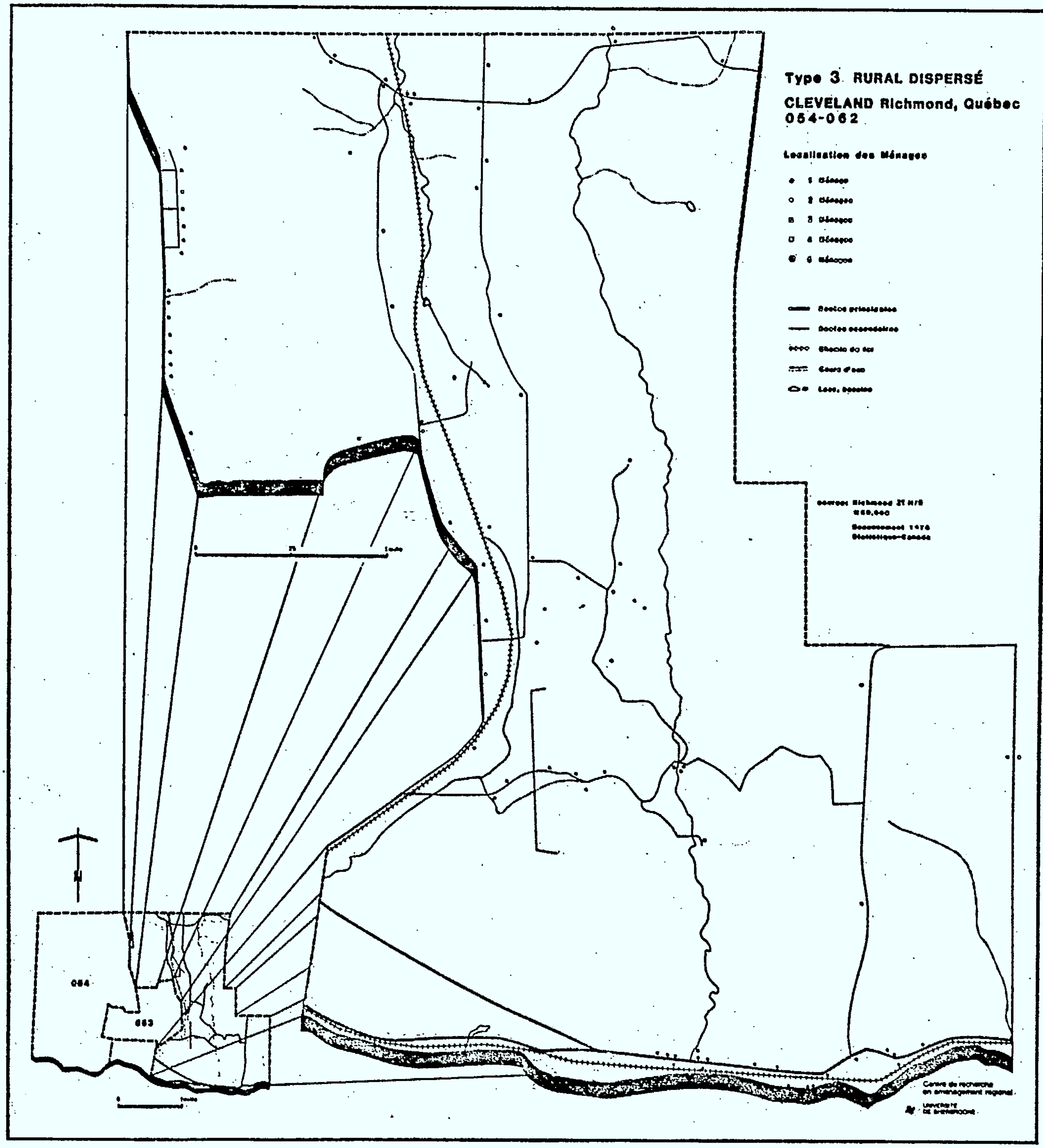
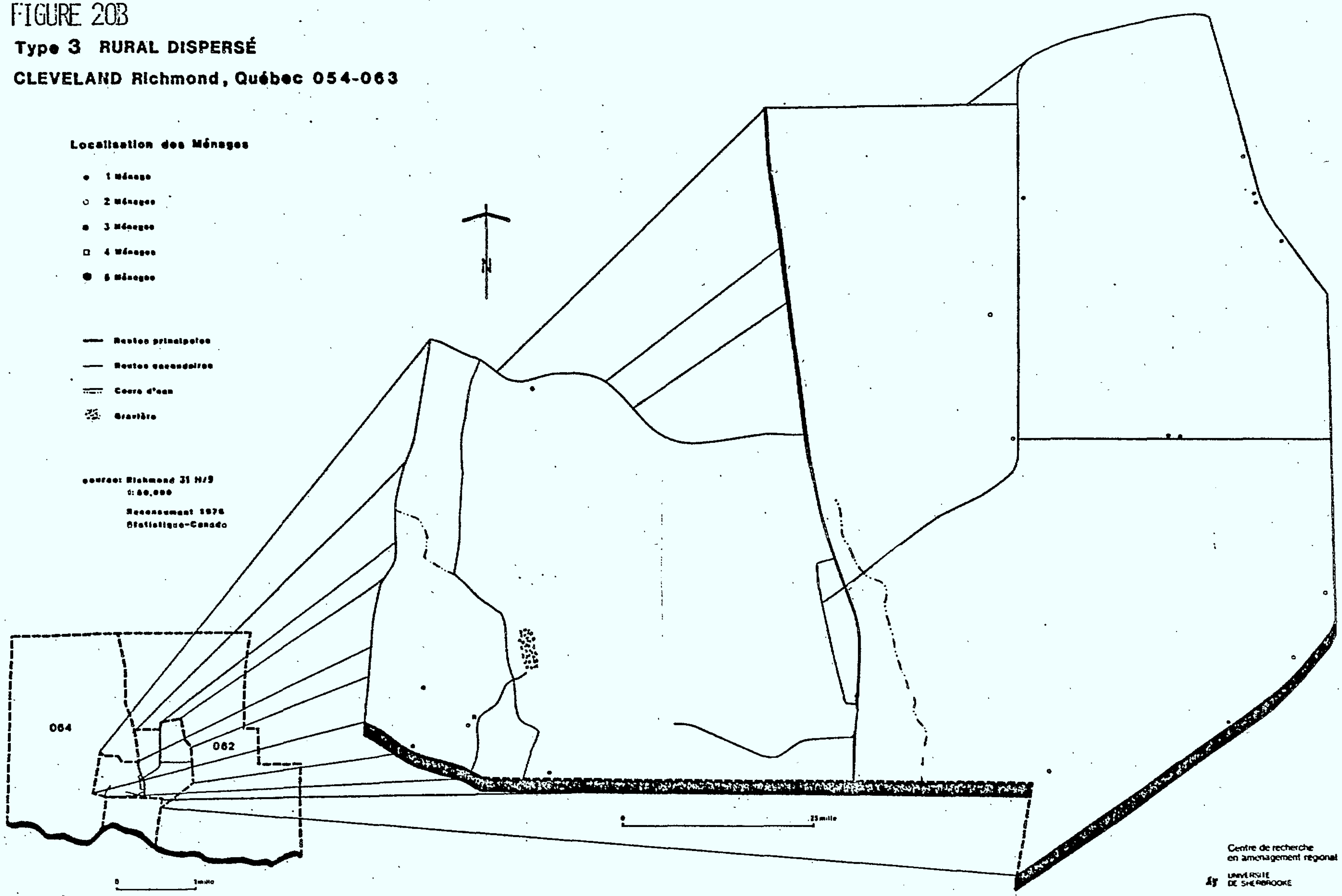


FIGURE 20B

Type 3 RURAL DISPERSÉ

CLEVELAND Richmond, Québec 054-063



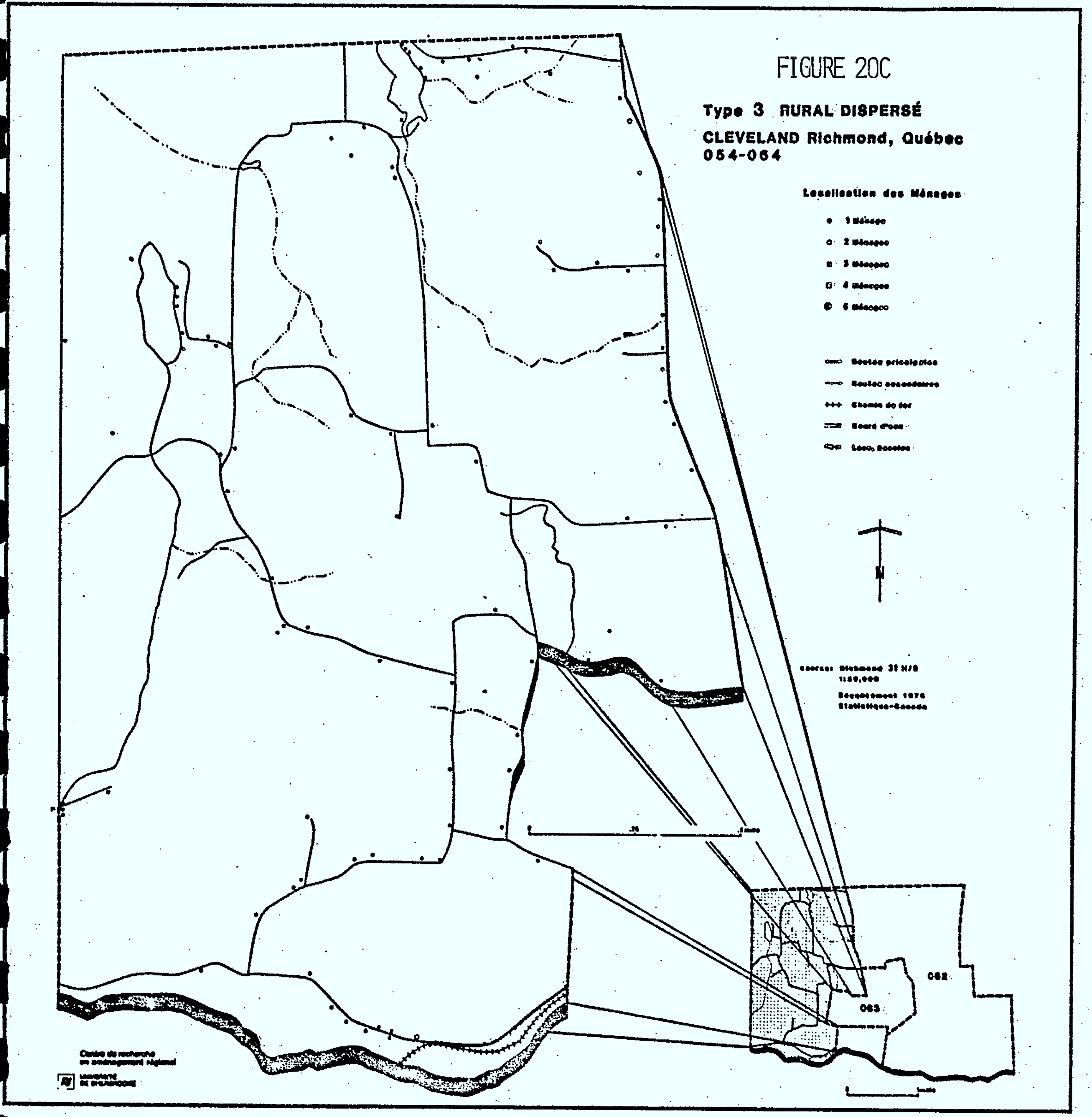


FIGURE 20C
Type 3 RURAL DISPERSÉ
CLEVELAND Richmond, Québec
054-064
N
062
063

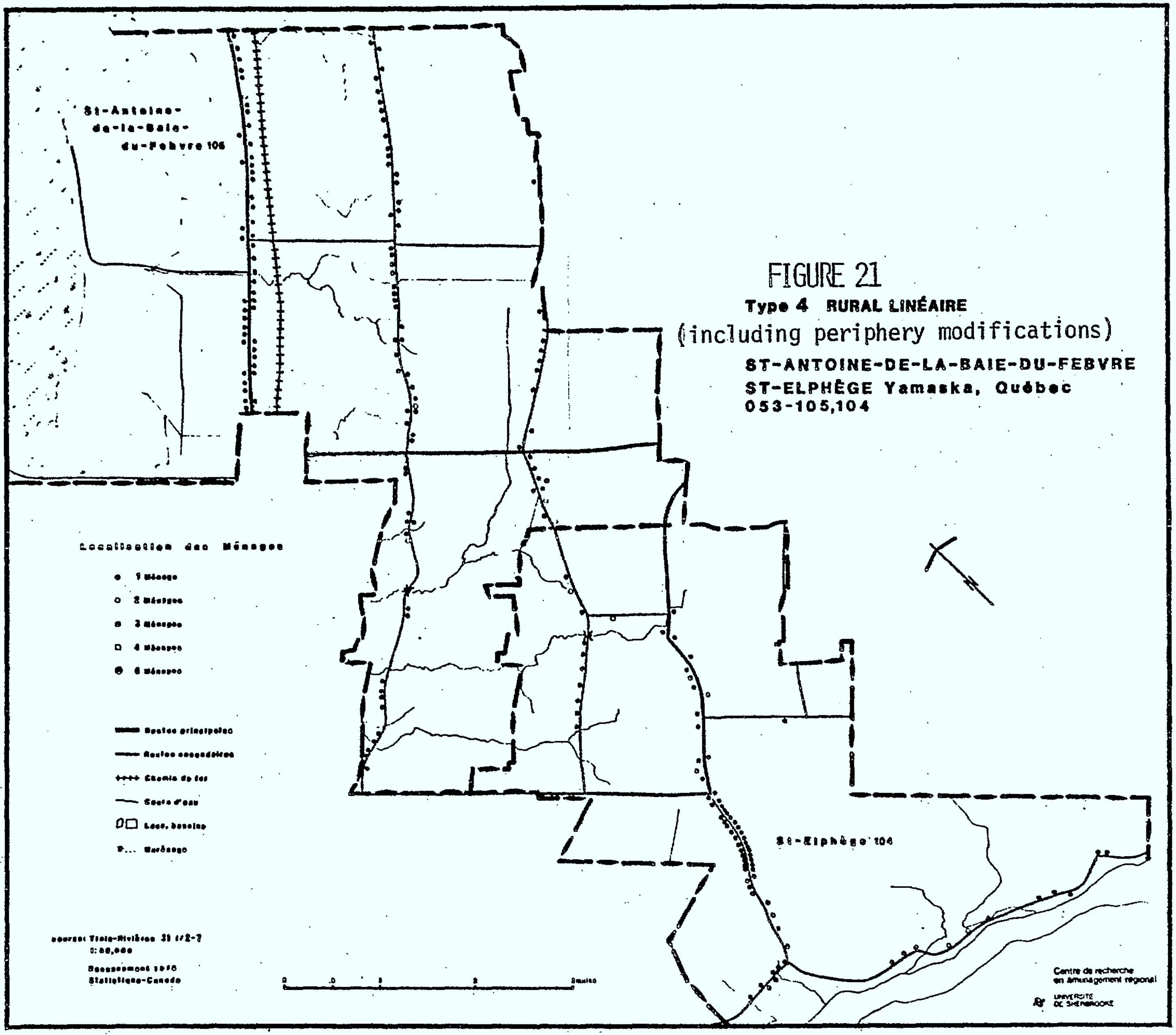


FIGURE 21

Type 4 RURAL LINÉAIRE

(including periphery modifications)

ST-ANTOINE-DE-LA-BAIE-DU-FEBVRE
ST-ELPHÈGE Yamaska, Québec
053-105,104

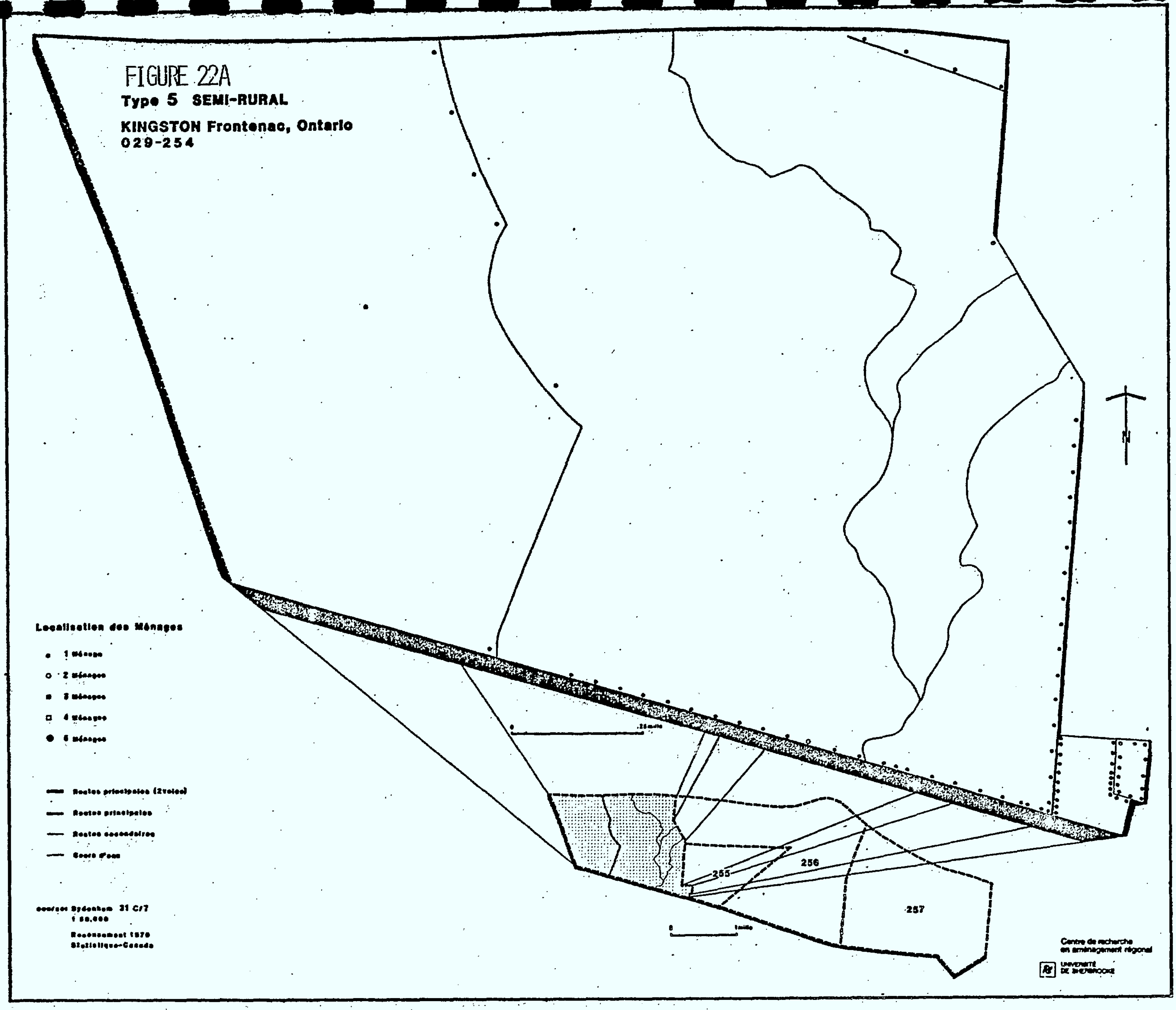


FIGURE 22A
Type 5 SEMI-RURAL
KINGSTON Frontenac, Ontario
029-254

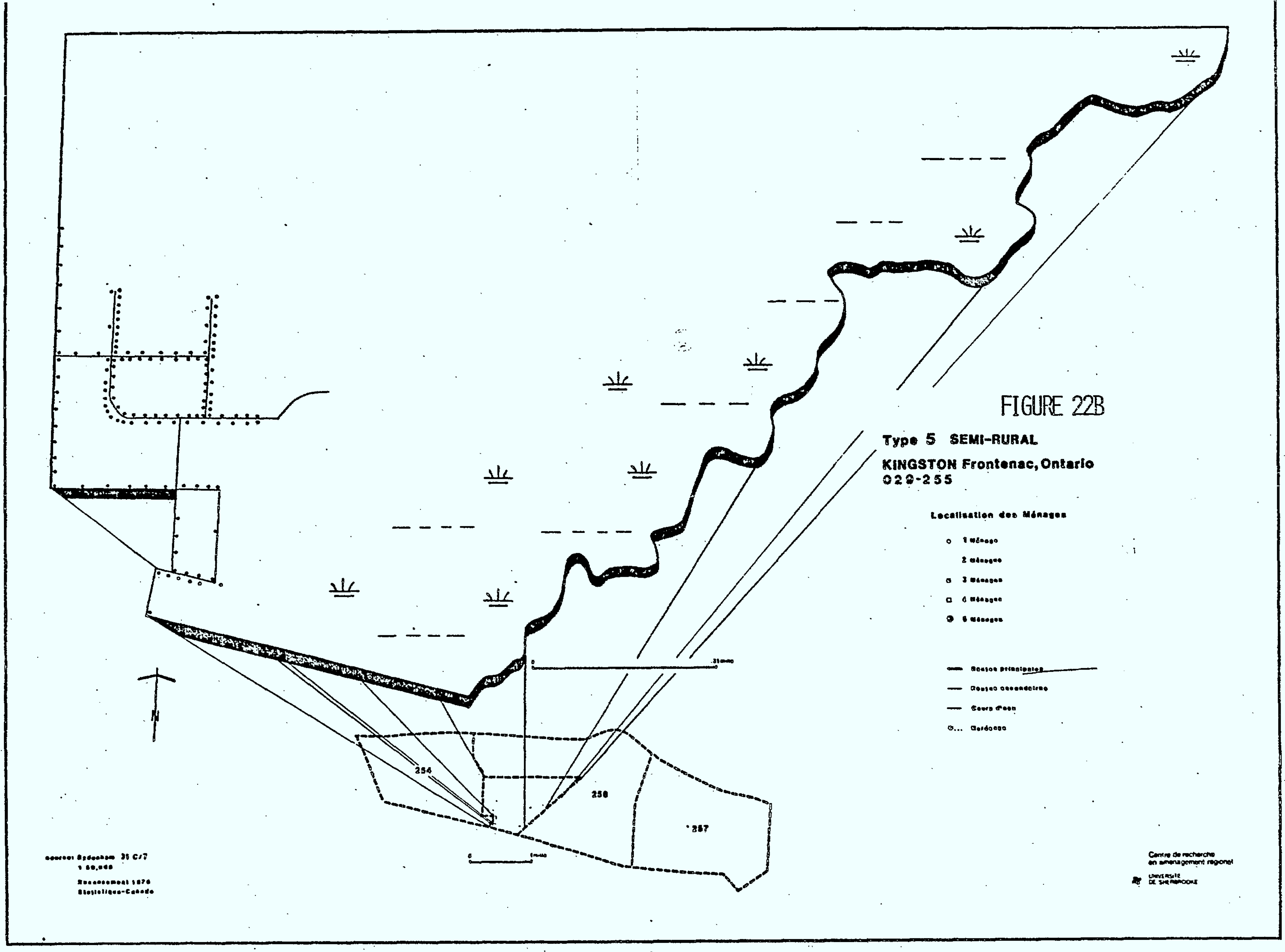


FIGURE 22B
Type 5 SEMI-RURAL
KINGSTON Frontenac, Ontario
029-255
Localisation des Ménages
1 Ménage
2 Ménages
3 Ménages
4 Ménages
5 Ménages
254
256
257
N
Centre de recherche
en aménagement régional
UNIVERSITÉ
DE SHERBROOKE

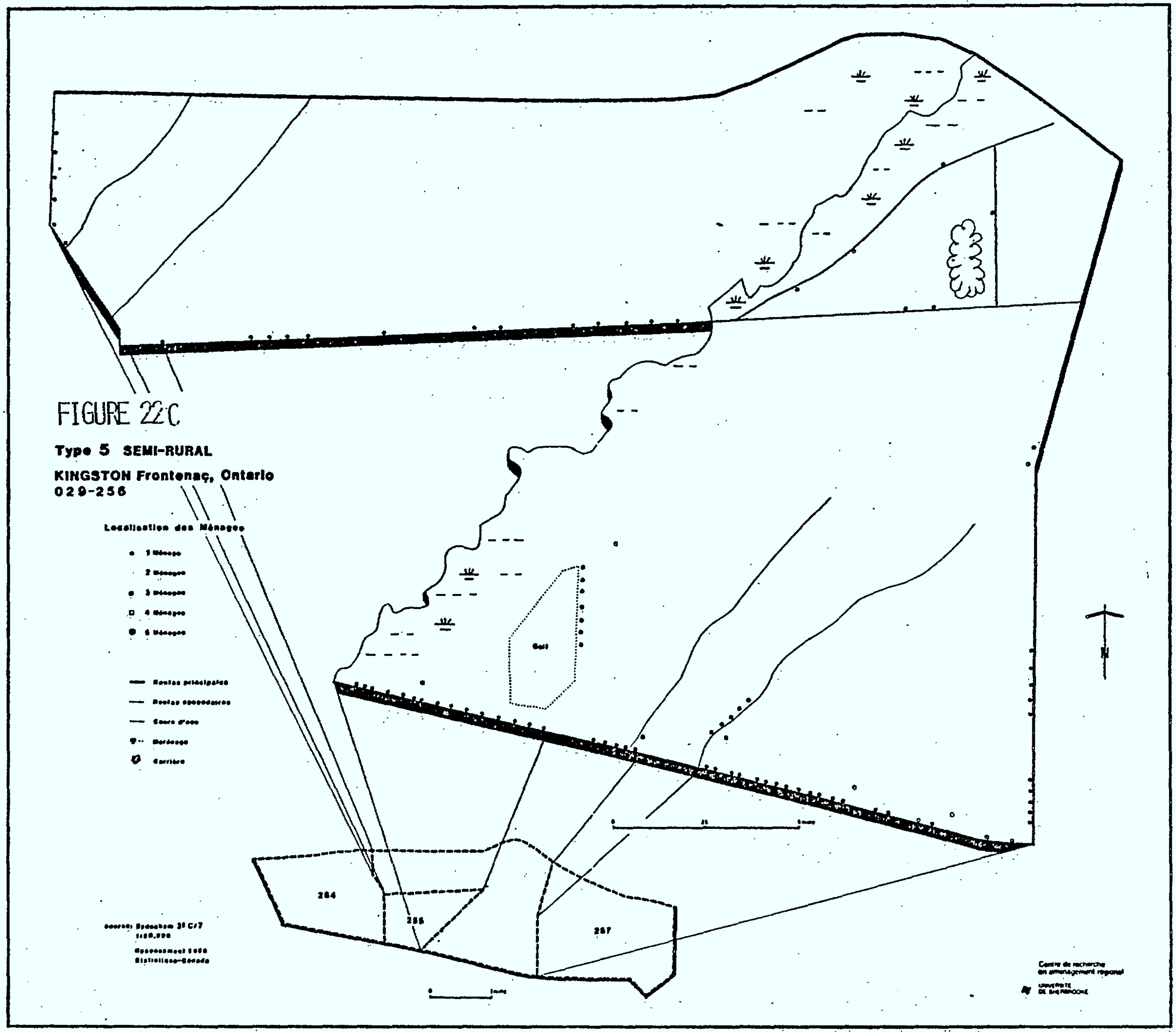


FIGURE 22C

Type 5 SEMI-RURAL

KINGSTON Frontenaç, Ontario
029-256

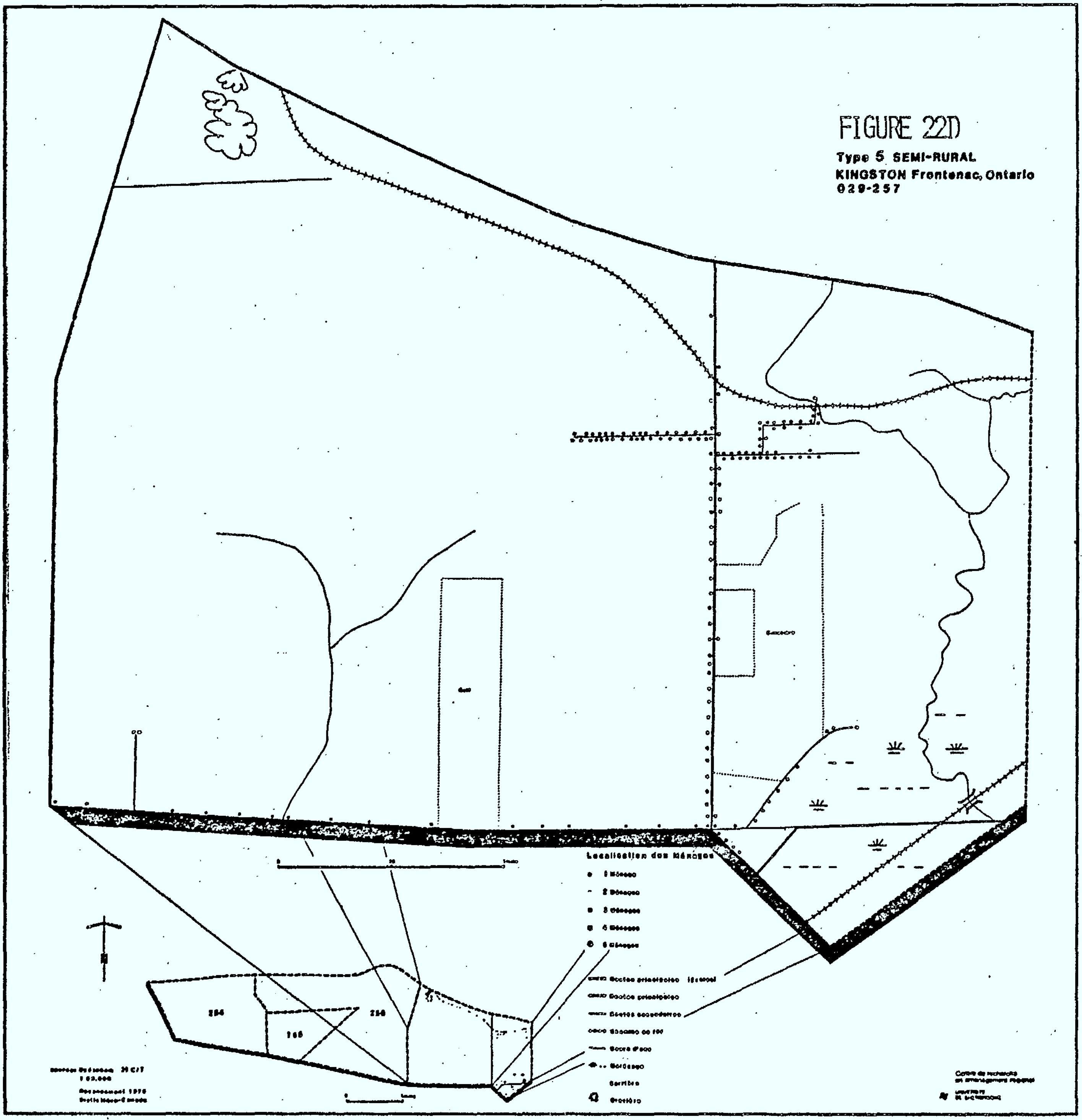


FIGURE 22D
Type 5 SEMI-RURAL
KINGSTON Frontenac, Ontario
029-257

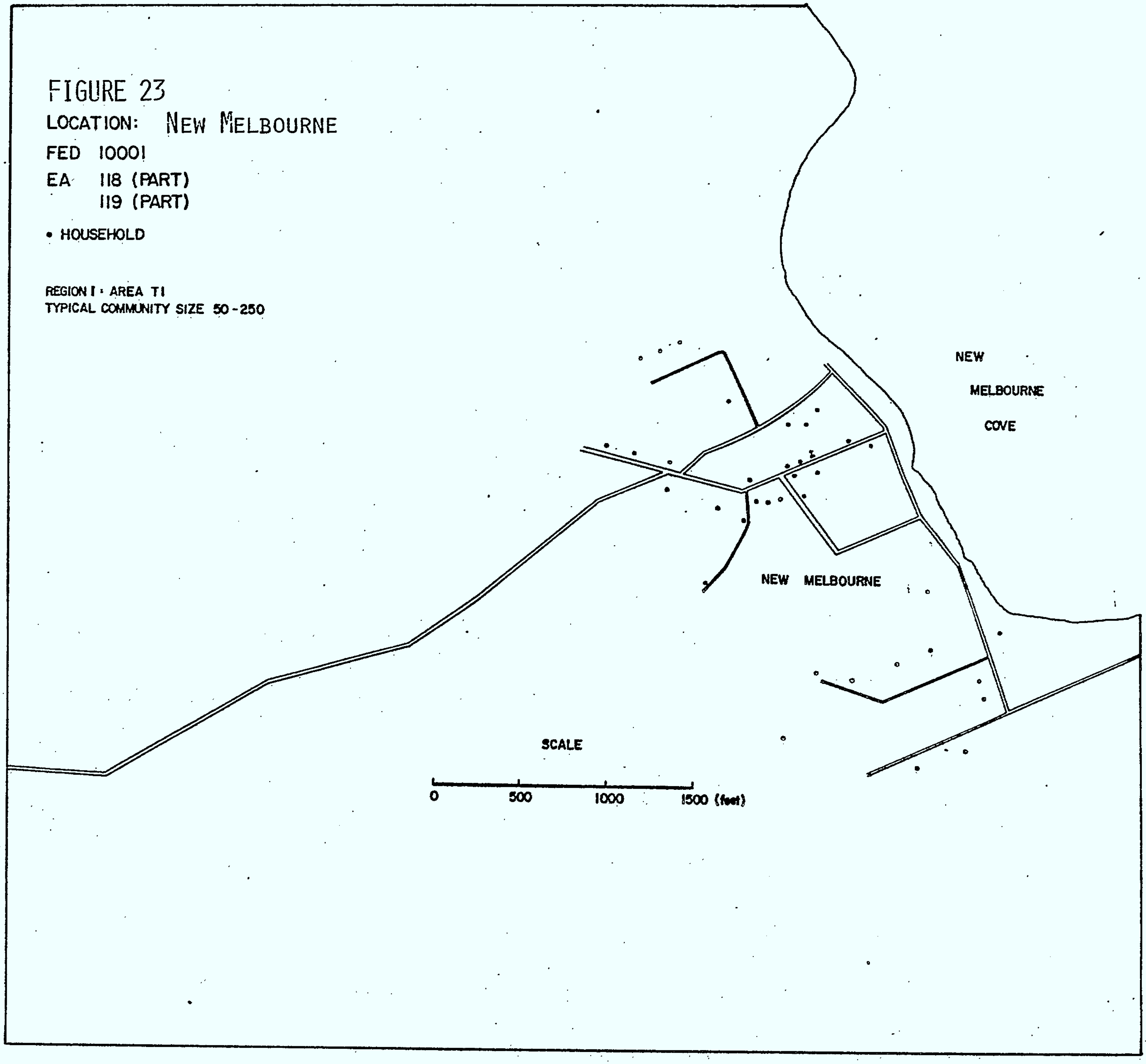


FIGURE 23
LOCATION: NEW MELBOURNE
FED 10001
EA 118 (PART)
119 (PART)
• HOUSEHOLD
REGION I : AREA T1
TYPICAL COMMUNITY SIZE 50-250
NEW
MELBOURNE
COVE
NEW MELBOURNE
SCALE
0
500
1000
1500 (feet)

FIGURE 24, CAPE BROYLE

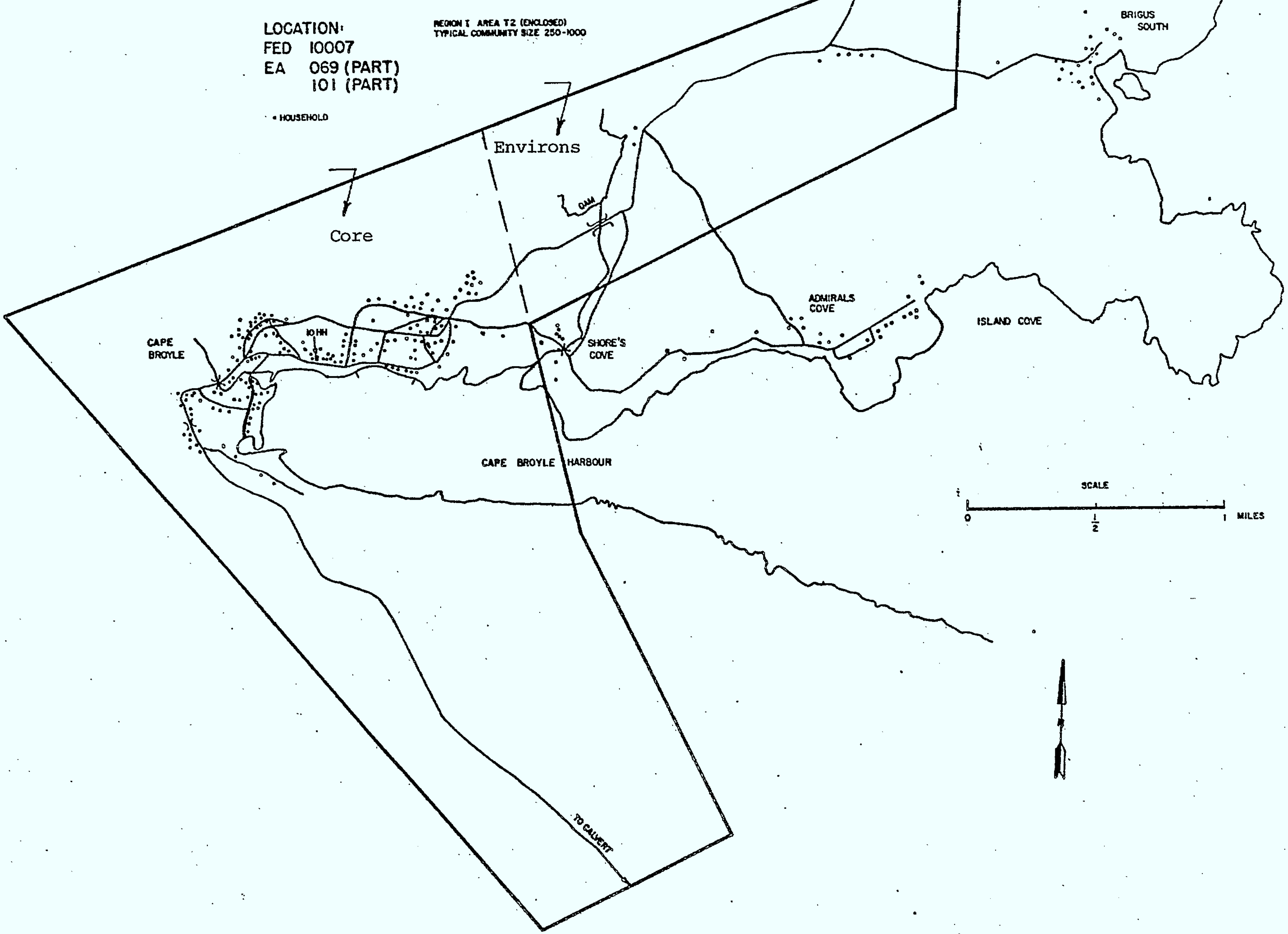


FIGURE 25

POUCH COVE (NFLD.)

LOCATION:

FED 10006

EA 203 (PART)
205 (PART)
211 - 212-213

• = HOUSEHOLD

REGION II - AREA T3 (ENCLOSED)
TYPICAL COMMUNITY SIZE 1000 - 2500

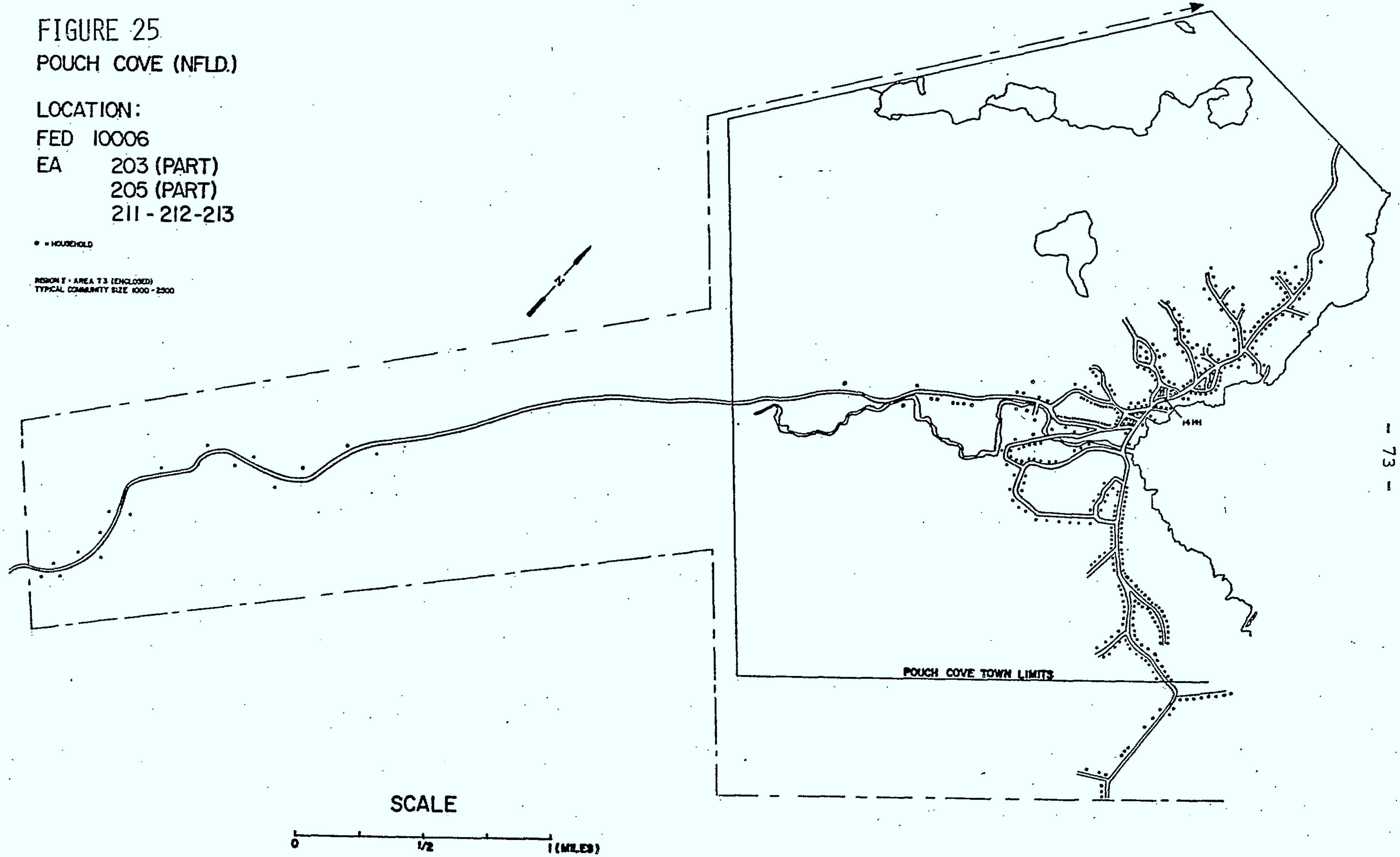


FIGURE 26

LOCATION : AVONDALE STATION

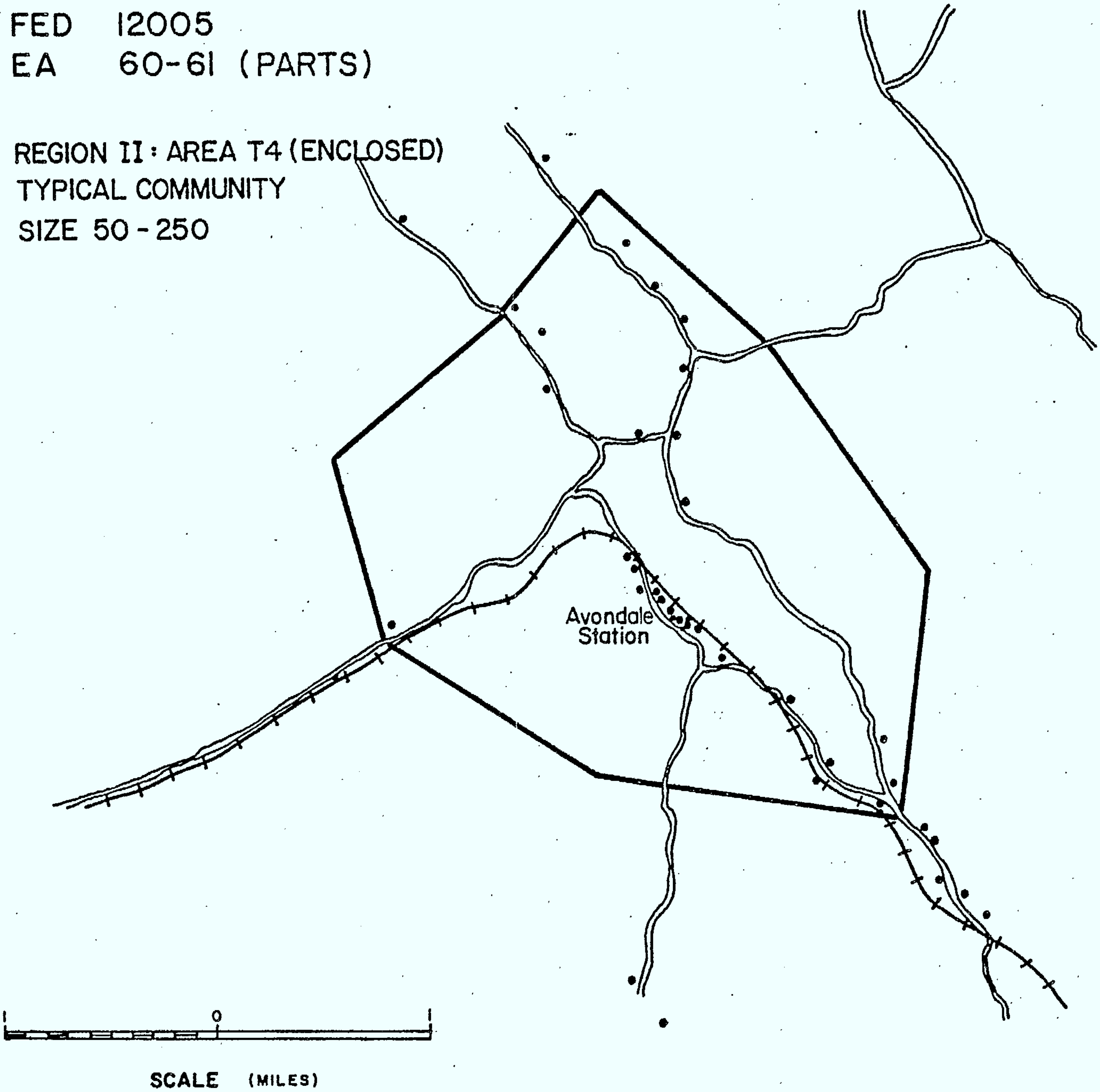
FED 12005

EA 60-61 (PARTS)

REGION II : AREA T4 (ENCLOSED)

TYPICAL COMMUNITY

SIZE 50 - 250



• = HOUSEHOLD

FIGURE 27

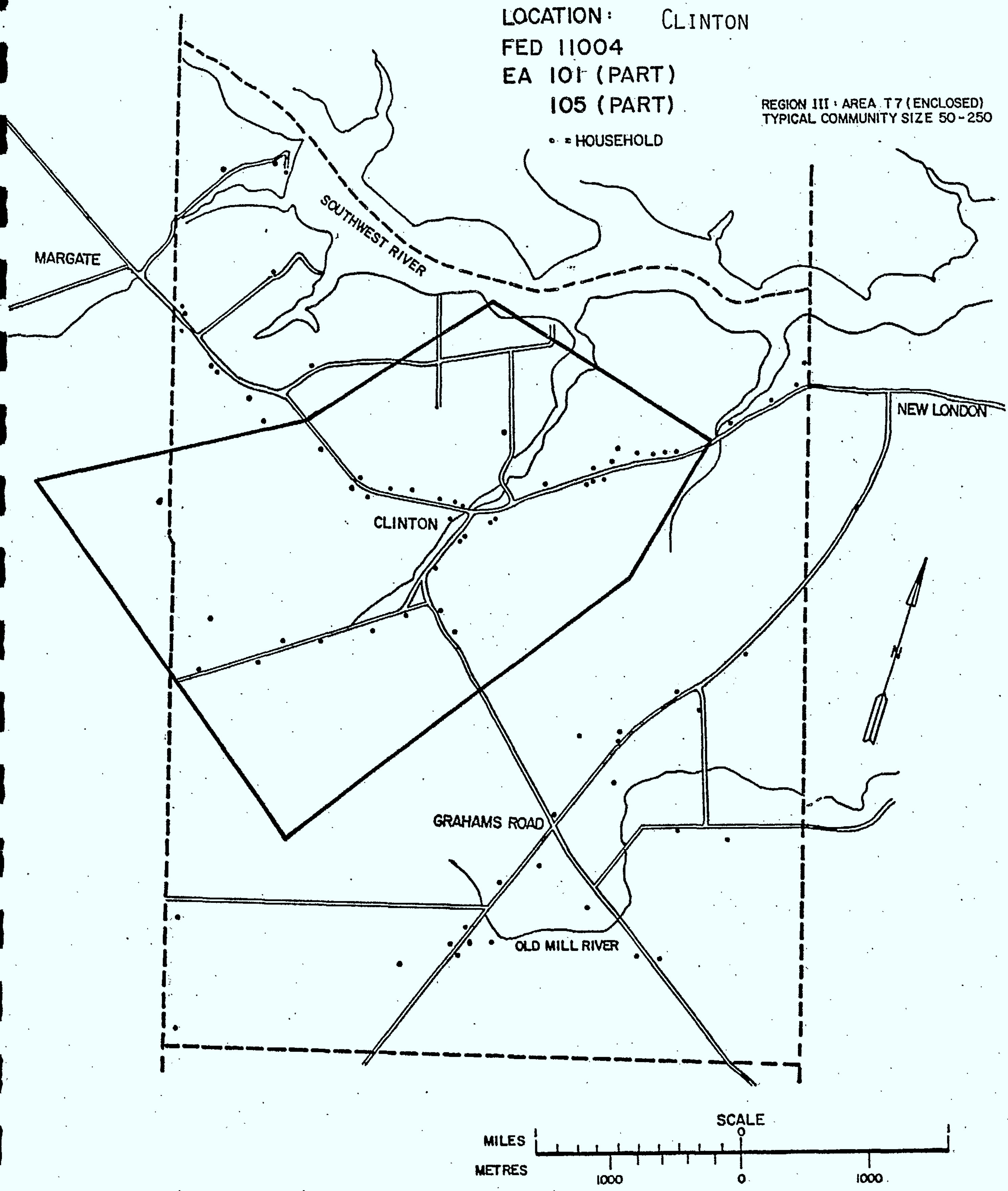
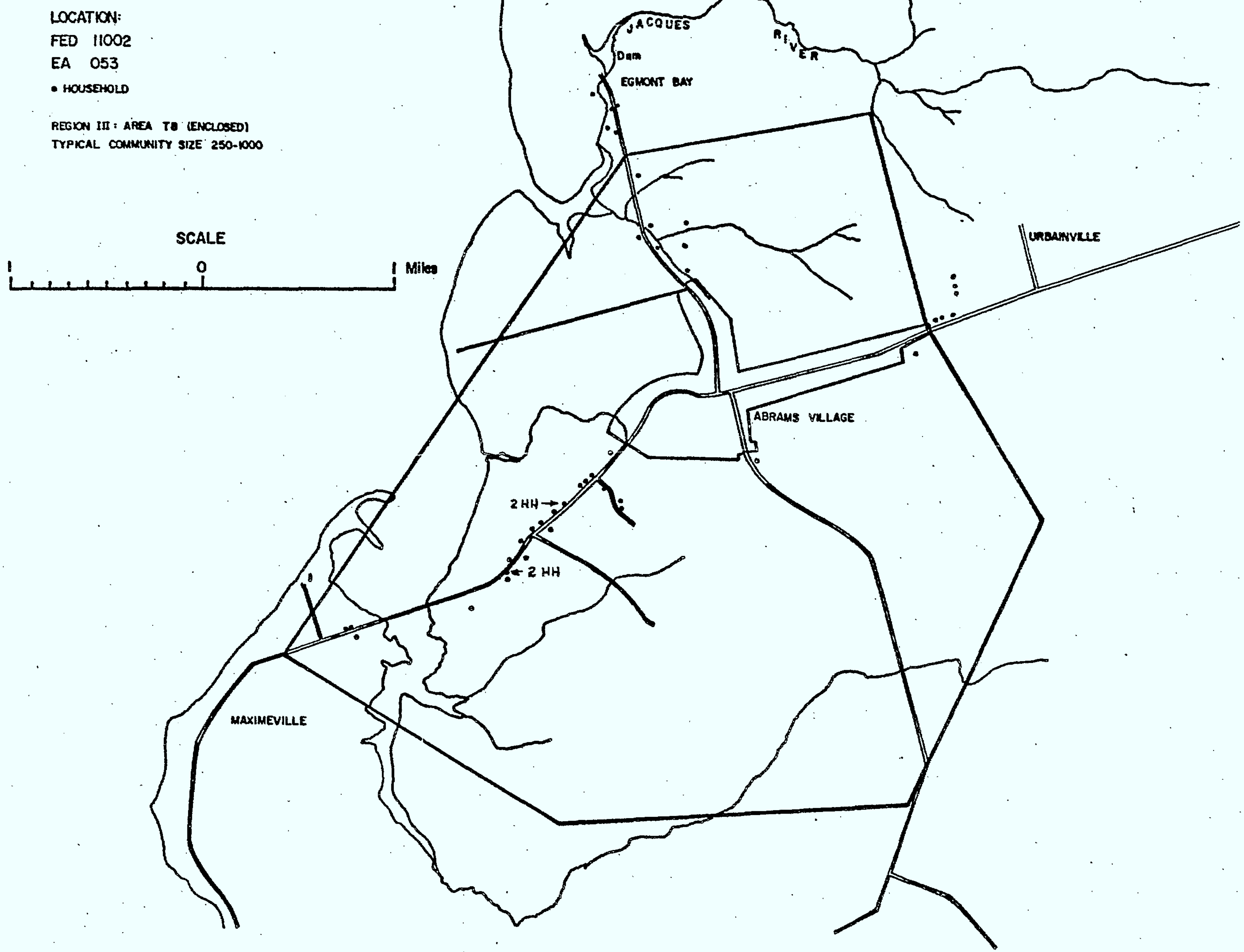

LOCATION: CLINTON
FED 11004
EA 101 (PART)
105 (PART)
REGION III : AREA T7 (ENCLOSED)
TYPICAL COMMUNITY SIZE 50-250
• = HOUSEHOLD
SOUTHWEST RIVER
MARGATE
NEW LONDON
CLINTON
N
GRAHAMS ROAD
OLD MILL RIVER
SCALE
MILES
METRES
1000
0
1000

FIGURE 28 (PART 1), ABRAMS VILLAGE ENVIRONS



MAP 28 (PART 2) ABRAMS VILLAGE

LOCATION:
FED 11002
EA 073

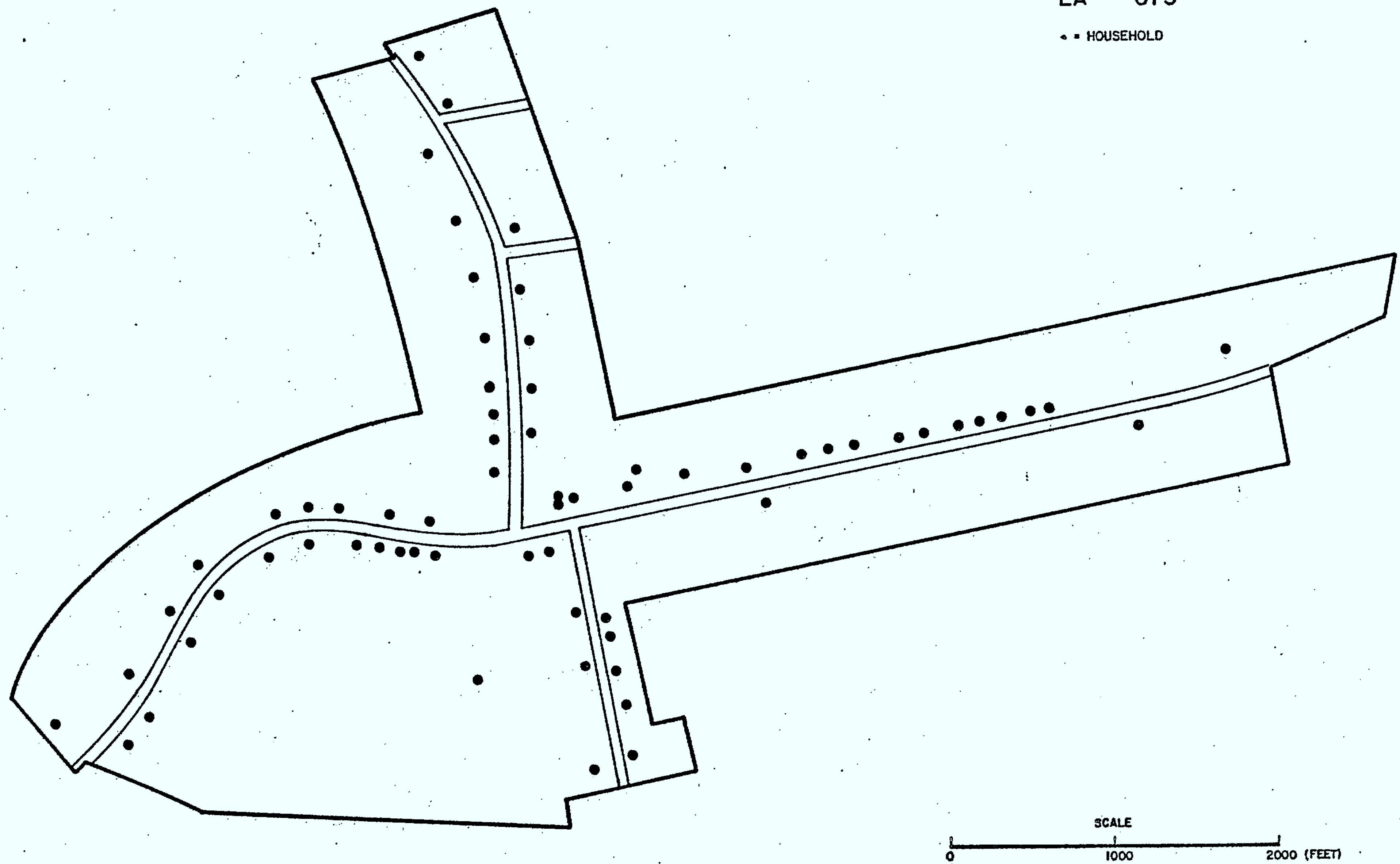
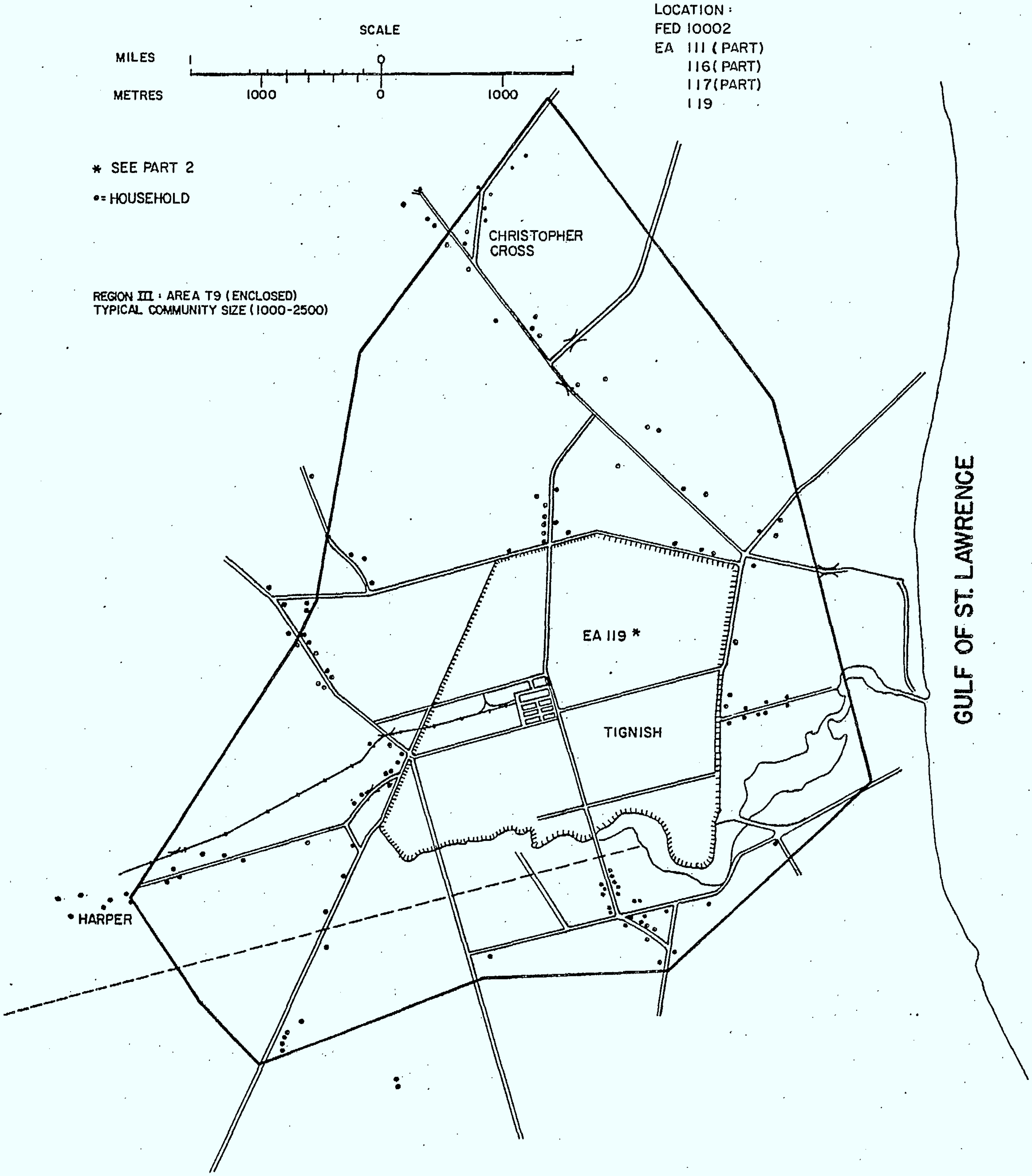


FIGURE 29 (PART 1), TIGNISH ENVIRONS



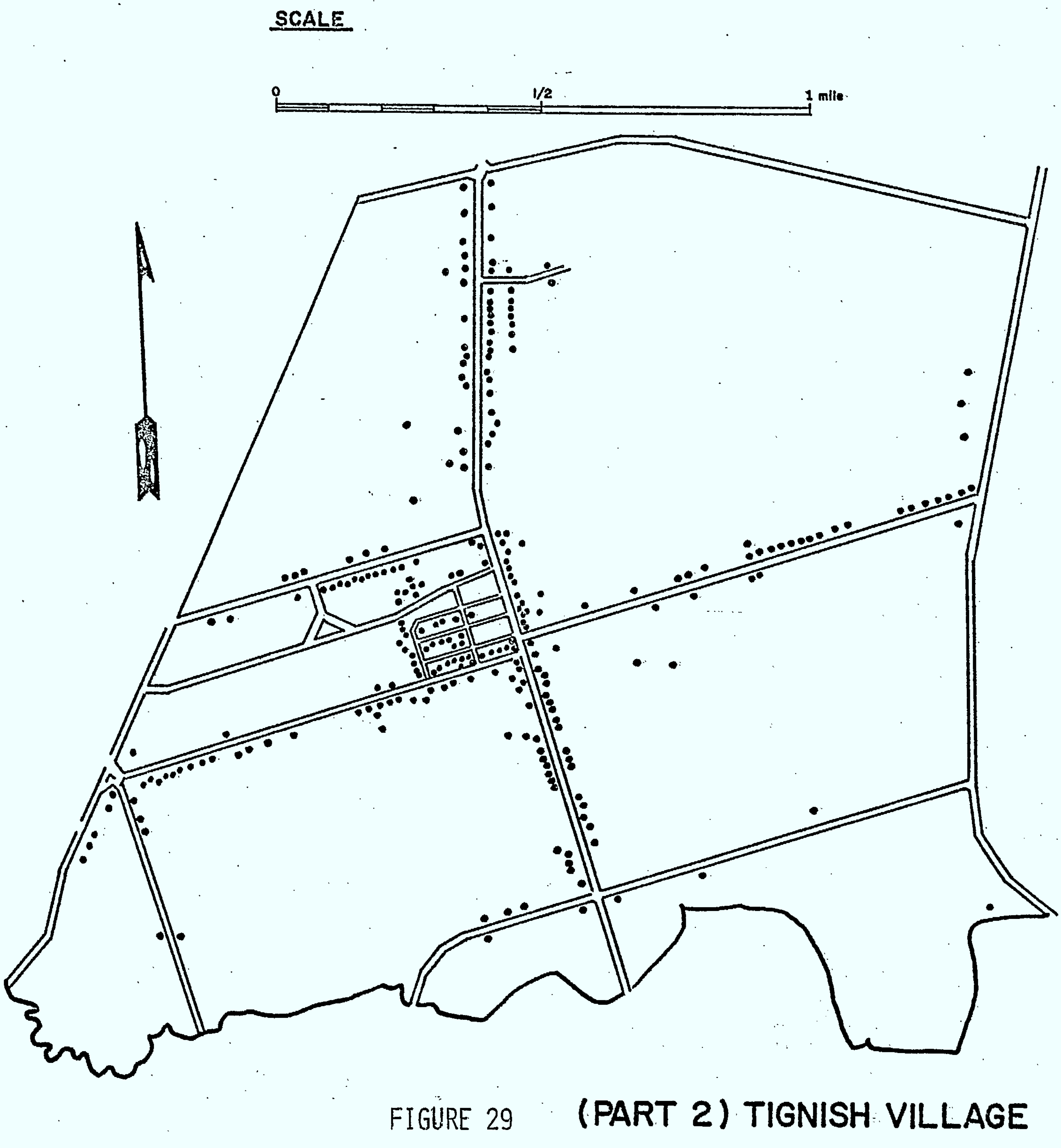


FIGURE 29 **(PART 2) TIGNISH VILLAGE**

LOCATION :
FED 10002
EA 119

• = HOUSEHOLD

FIGURE 30 (PART 1)

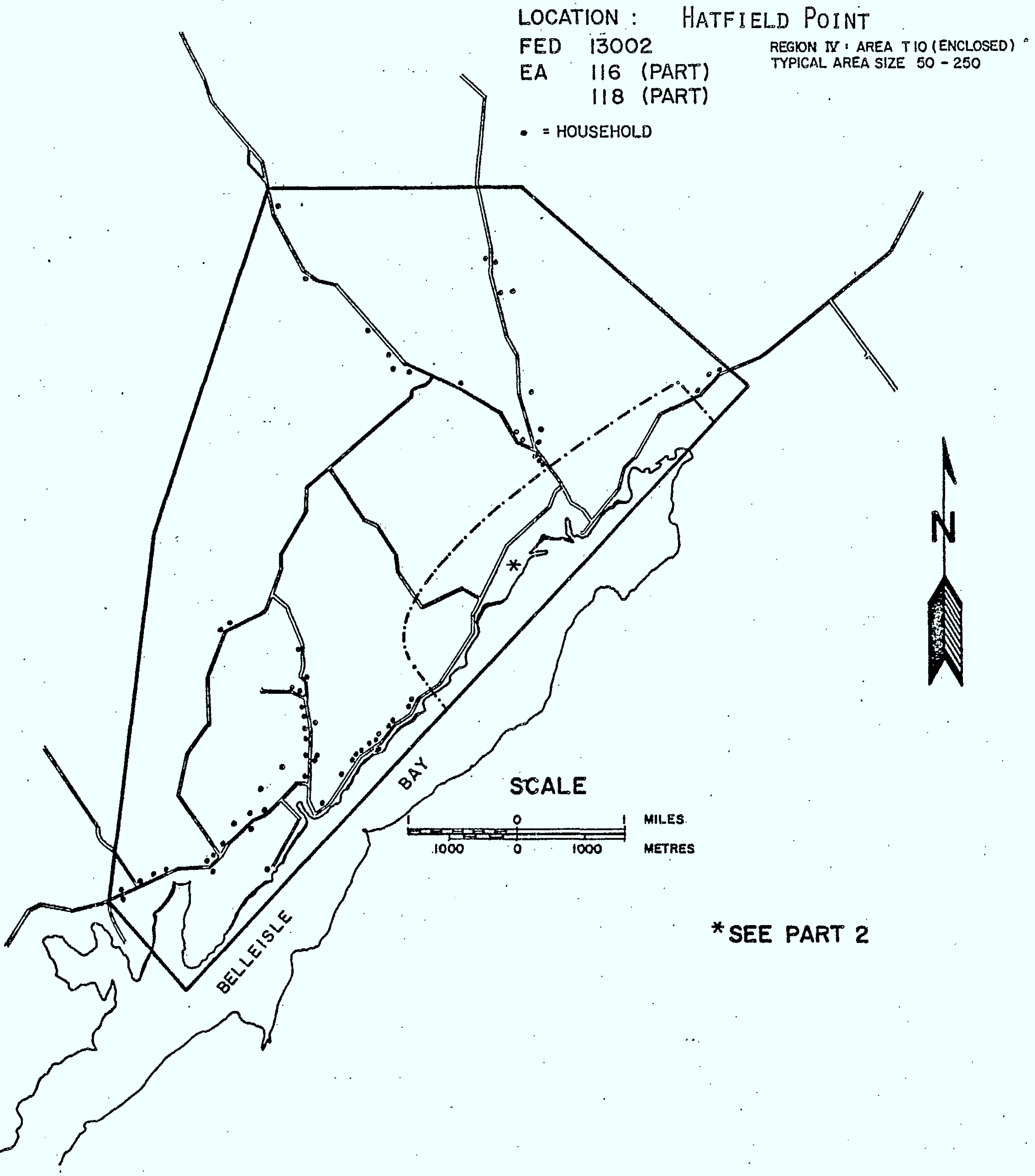
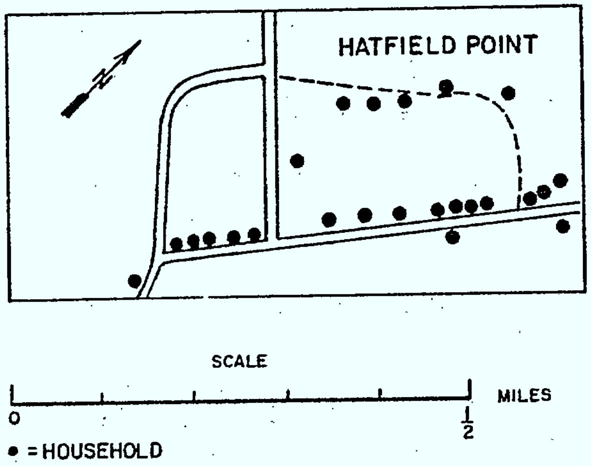


FIGURE 30 (PART 2)

LOCATION: HATFIELD POINT
FED 13002
EA 118 (PART)



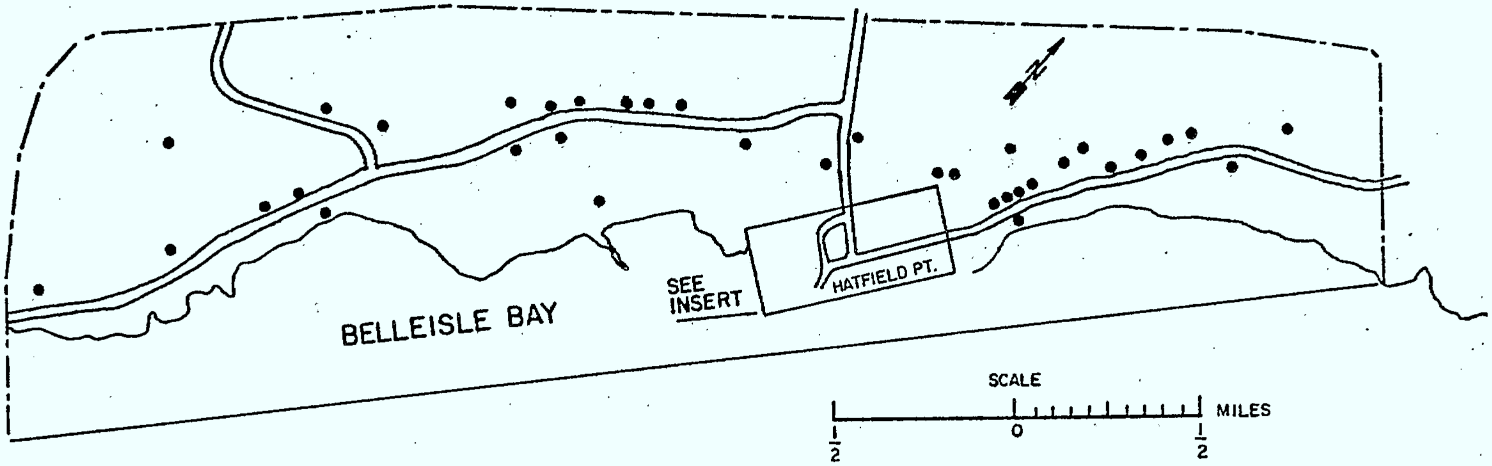
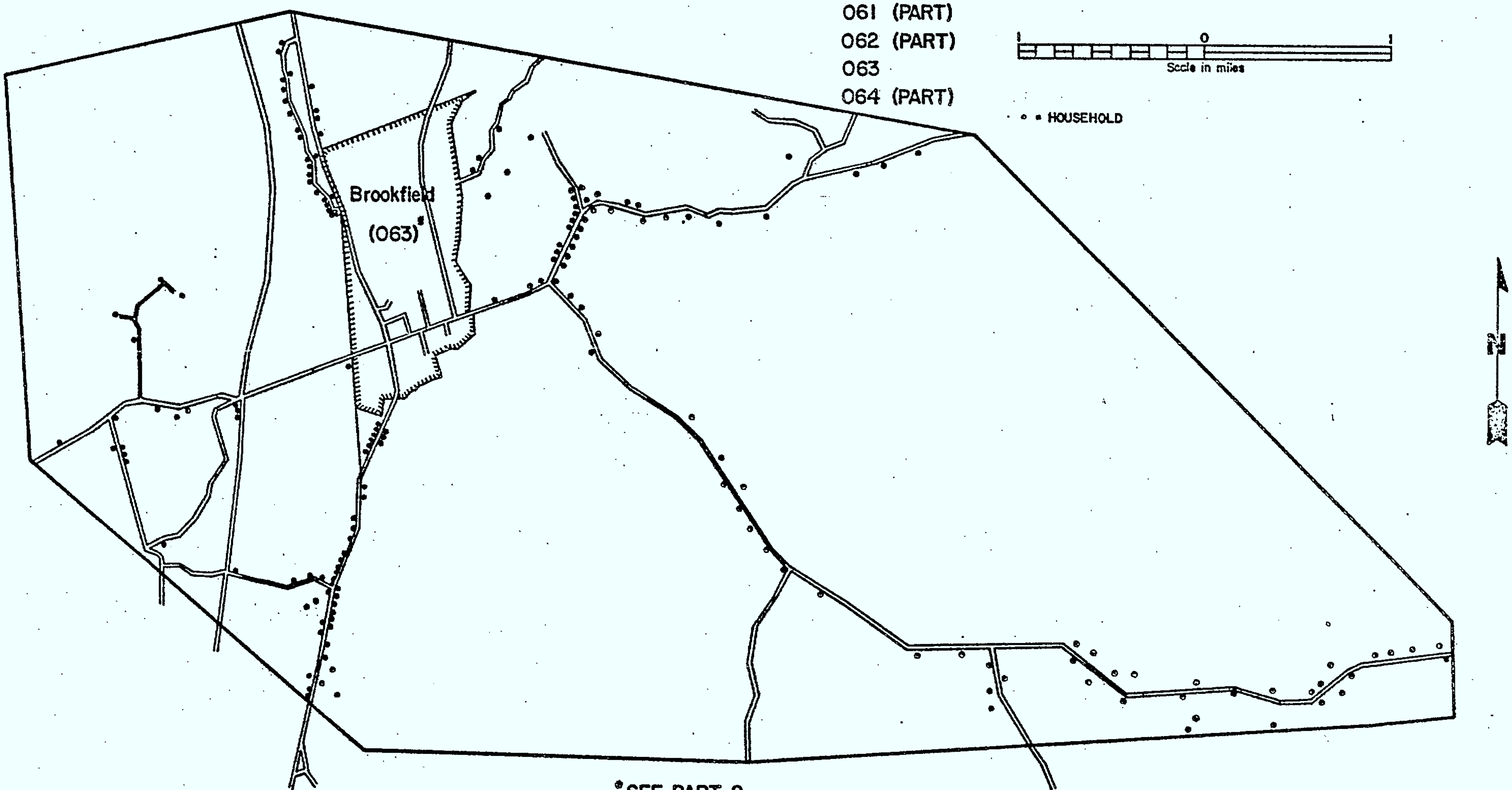


FIGURE 31 (PART I), BROOKFIELD ENVIRONS

LOCATION:
FED 12005
EA 060 (PART)
061 (PART)
062 (PART)
063
064 (PART)

REGION IV : AREA TII (ENCLOSED)
TYPICAL COMMUNITY SIZE 250 – 1000



*SEE PART 2

FIGURE 31 (PART 2) BROOKFIELD

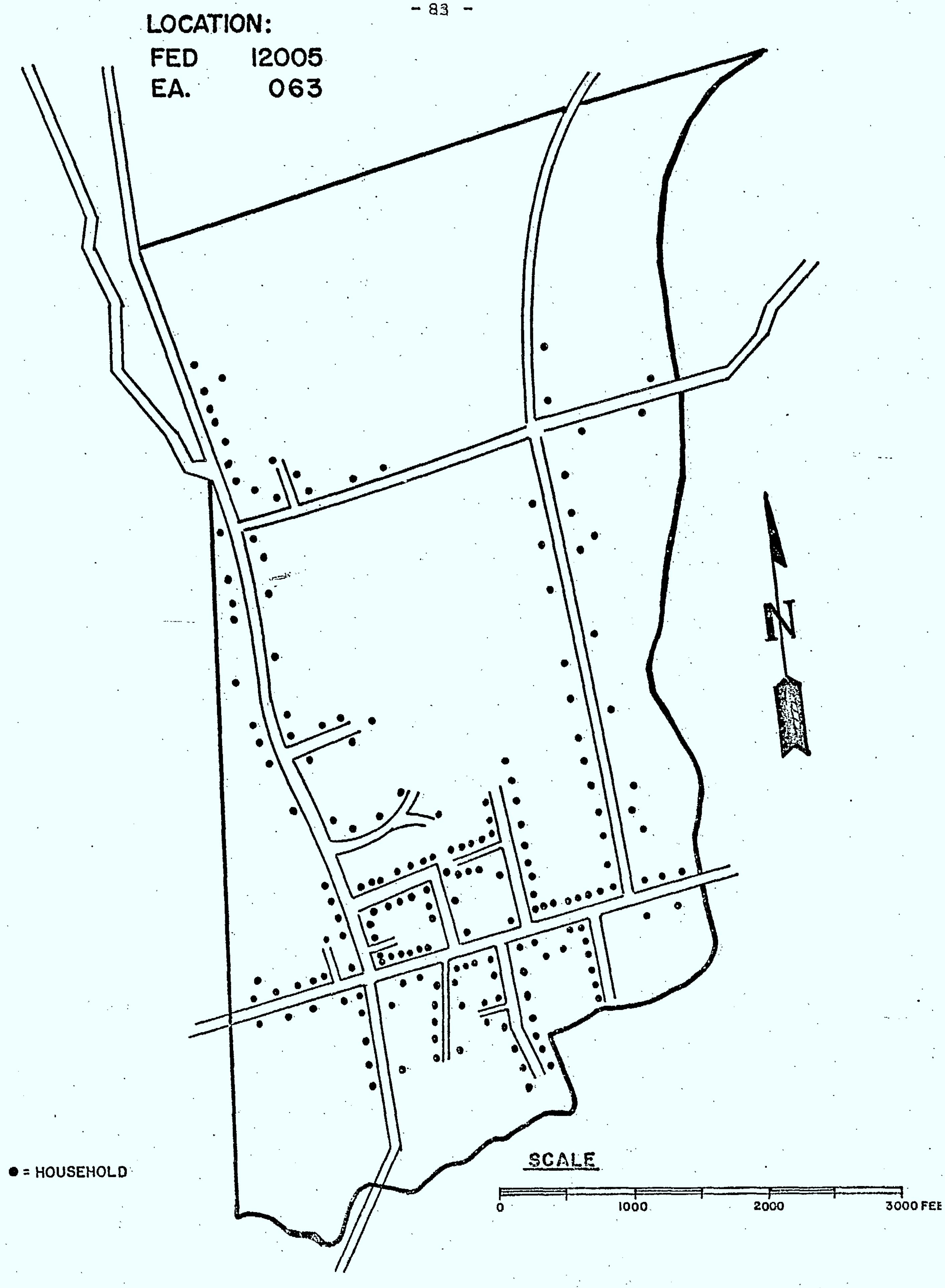


FIGURE 32 (PART I)

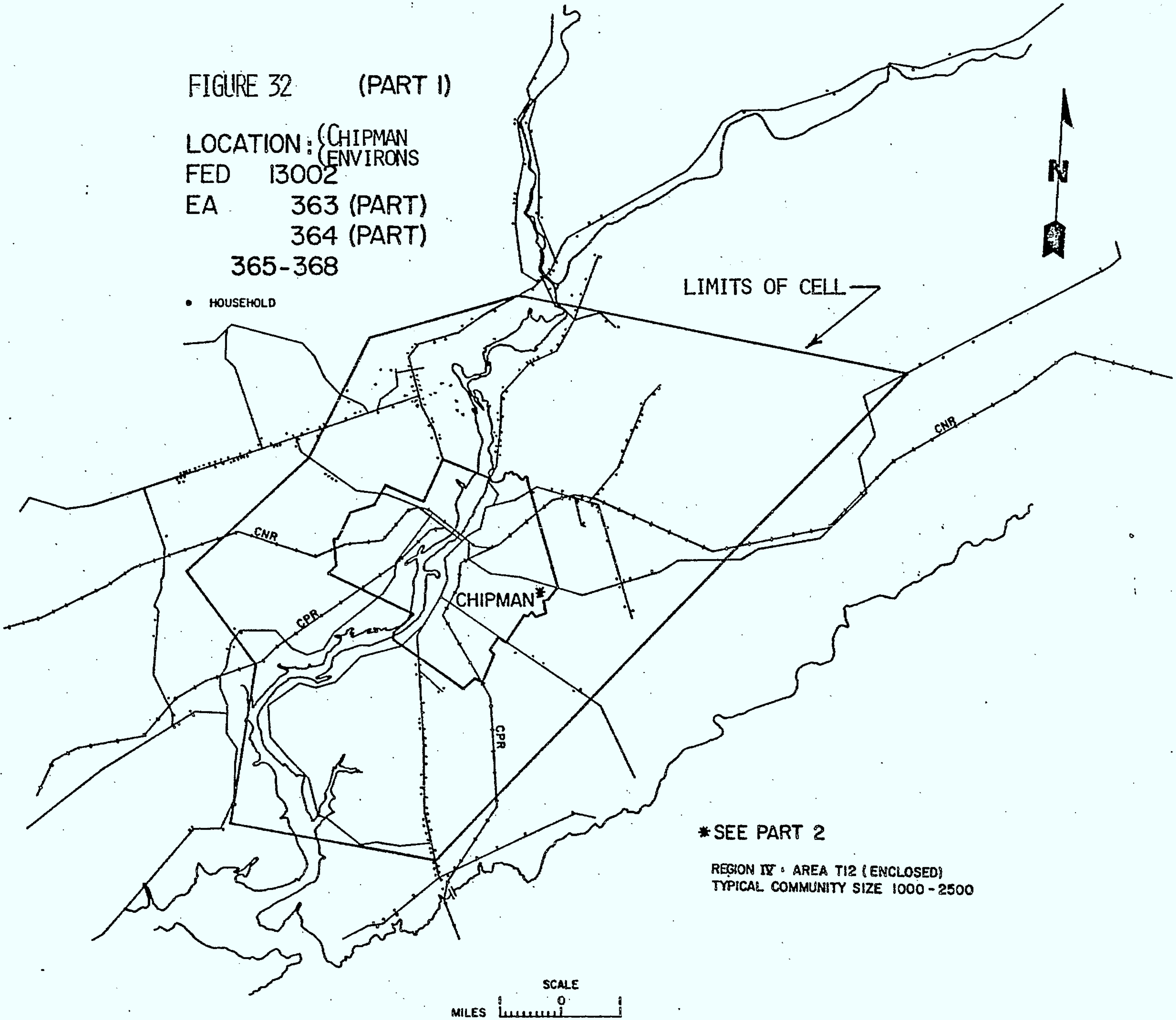
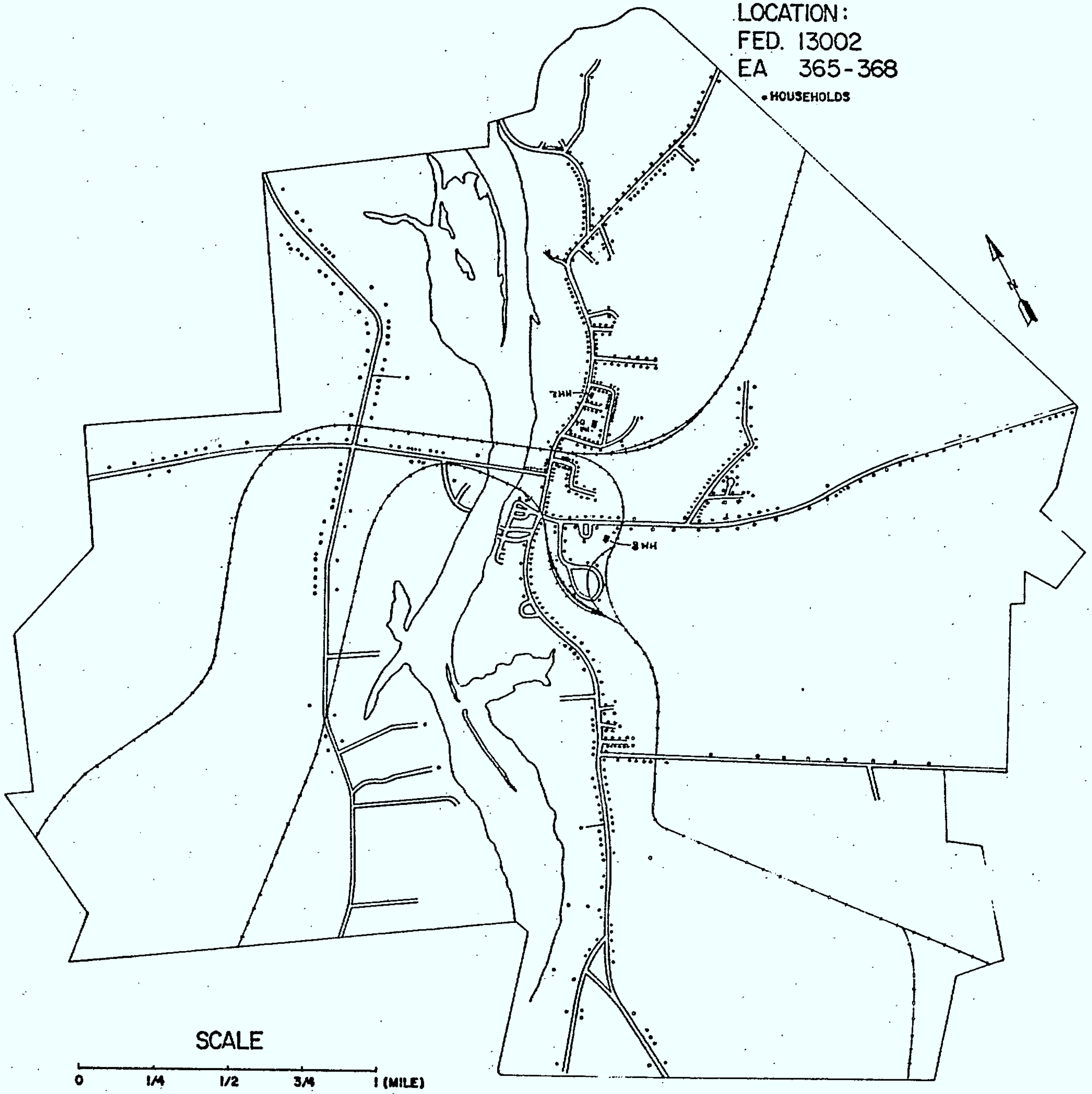


FIGURE 32 (PART 2)

CHIPMAN

LOCATION:
FED. 13002
EA 365-368



CHAPTER 4

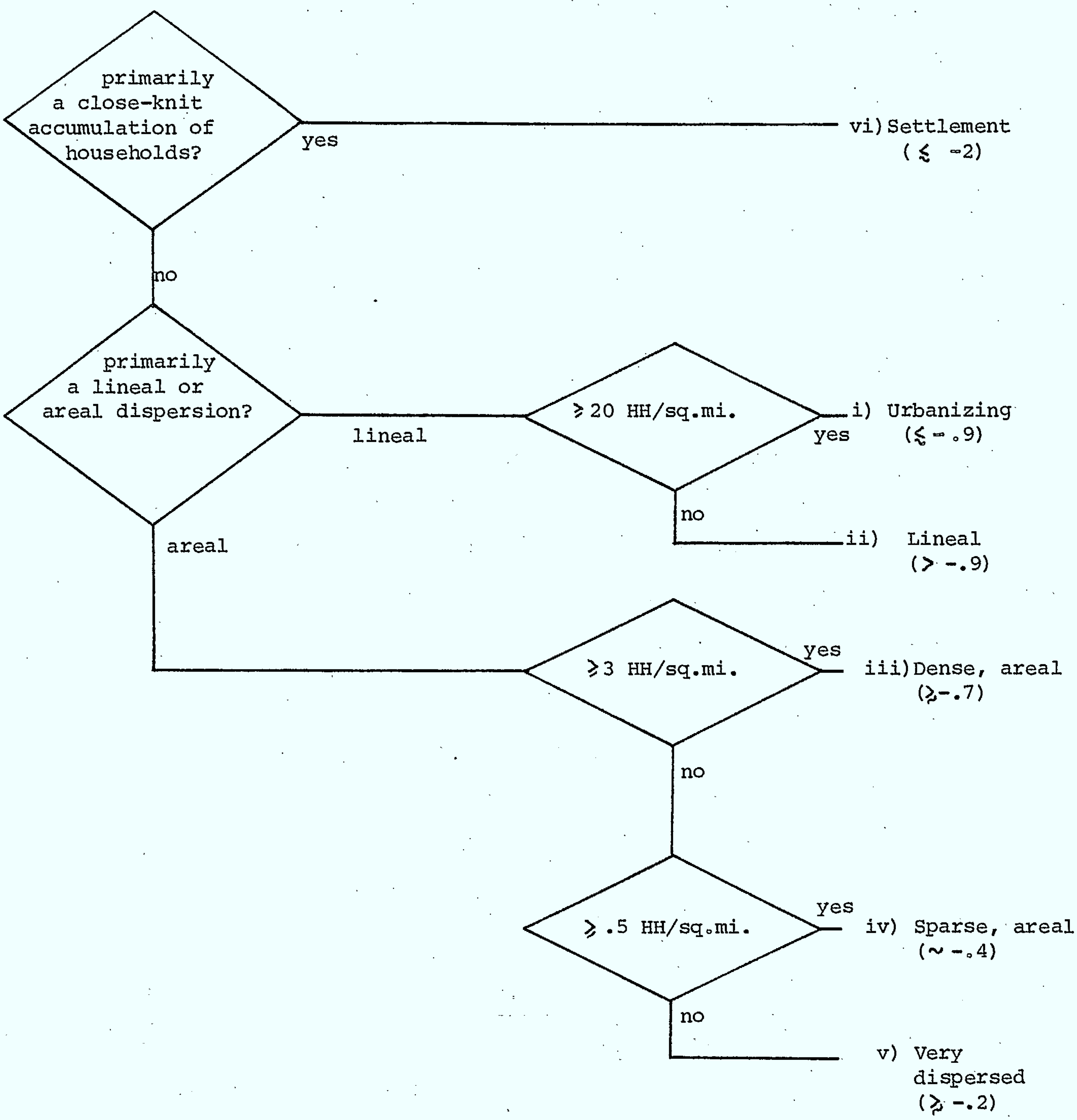
THE SIX-CELL MODEL

(The Household Distribution for all of rural Canada - Simplified Model)

Examination of the household distribution maps (Figs. 1-32) and the rank-size curves (Appendix G) for the 32 cells listed in Table 9 reveals that many cells are similar to each other and are thus redundant. In this examination, each of the Atlantic province cells was considered as comprising separately a central community and its environs, to ensure that the Atlantic province cell representation was compatible with that used for the other provinces. The examination indicated that each of the 32 cells could be accommodated into a six-cell model using the decision tree shown in Fig. 33. Here it is to be noted that a two-level sorting procedure is being implemented, the first being based on the settlement pattern (community, lineal pattern or areal pattern) and the second being based on household density. The six cells on the right hand side of this figure are considered to be the minimal number that can be chosen to fairly accurately represent the household distribution throughout rural Canada. The numbers in the parentheses refer to the typical range of slopes at the right side of the rank size curves for the constituent cell types (the 32 [with suitable separation into central community and environs, for the Atlantic province maps] described in Table 9), that go to make up the six cells in the six-cell model. For example, the notation ($\lesssim$ - .9) means that the slope is typically -.9 or less, i.e. -1 or -1.2 or even less. Comparison of the slope with the density range for each of the cell types i) to v) shows that the magnitude of each is linearly related. The significance of this fact is that the percentage of households that are isolated increases as the density decreases. Similar conclusions can be reached for two-household groupings, three household groupings, etc.

Fig. 33

DECISION TREE FOR THE SIX-CELL MODEL



The cells in the six-cell model are described in Table 10. The titles for each cell are chosen to be those which are most descriptive and it must be noted that the assignment of an area to one of the six cells is to some extent based on judgement. For example, smaller settlements such as unincorporated places can appear on any of the six-cell maps, except v). However, <u>generally</u>, settlements and in particular incorporated villages and towns are modelled as cell type "no. vi) Settlements". Another point that should be noted is that the household count per settlement given in Table 10 for the Atlantic province settlements includes all houses that lie just outside the settlement boundaries (town limits or in some cases, E.A. boundaries) that can be connected using the 500' CATV connection explained in Appendix H. Of course, such households are then deleted from the household count for the environs of such a settlement. (See entries under cell type ii) in Table 10). One final point that should be noted is that the original map of Cape Broyle and environs showed 174 households distributed in a somewhat cohesive central settlement with a single 5 household settlement and a single 2 household settlement at a mile or more distance NW. This map has been modified to show this differentiation into a core settlement and its environs and is shown in Fig. 24.

The most representative component for each of the six-cell model cells is given in Table 11. The criteria for choice of this representative component, for cells i) to v), were 1) household density closest to the average for the components making up the cell, and 2) household per community* closest to the average for the components making up the cell.

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* "community" is a term that is given a special meaning in this report. It is all households that can be linked together with 500 foot or shorter wires and is explained in more detail in Appendix H.

TABLE 10

Components of the Six-Cell Model

Cell No.	Descriptive Title	Components					Scale-Up Factor	Total	
		Fig. No.	Title	Area	HH	HH/Sq.Mi.		HH	Area
i)	Urbanizing	22	Type 5 Semi-rural	10.23	476	46.53	258.5	123,048	2,644
		22**	Prairie, Urban Sprawl				17.5	8,329	179
								131,377	2,823 sum
ii)	Lineal	14	Mennonite	133	658	4.95	3.91	2,573	520
		15	Irrigation	67.4	406	6.02	6.13	2,487	413
		16	French Longlot	112	1440	12.86	2.145	3,089	240
		19	Type 2, Township	104.64	1230	11.75	193.28	237,729	20,225
		21	Type 4 Linear	41.55	212	5.10	529.6	112,273	22,005
		24	Cape Broyle, environs	~1.5	7	~4.7	160	1,120	240
		25	Pouch Cove environs	~3	25	~8.3	26	650	78
		26	Avondale Stn. total	~5	30	~6	463	13,890	2,315
		27	Clinton, total	~4	37	~9.25	751	27,787	3,004
		28	Abrams V, environs	~10	31	~3.1	222	6,882	2,220
		29	Tignish, environs	~ 8.2	95	~11.8	35	3,325	287
		30	Hatfield Pt. total	~26	126	~ 4.8	274	34,524	7,124
		31	Brookfield environs	~29	160	~ 5.5	230	36,800	6,670
		32	Chipman environs	~75	148	~1.7	43	6,364	3,225
								489,493	68,566
iii)	Dense, areal	20	Type 3 Dispersed	46.97	204	4.34	1,153	235,215	54,156
								235,215	54,156
iv)	Sparse, areal	3	Central Kootenay	607.8	414	.681	68.6	28,382	41,695
		11A	Typical Section, A	62.22	141	2.266	699.8	98,672	43,542
		11B	Typical Section, B	220.76	104	.471	368.7	38,345	81,394
		11C	Typical Section, C	73.72	211	2.862	54	11,394	3,981
		12	Pioneer Fringe	140.1	179	1.278	334.6	59,902	46,877
		17	Indian Reservations	134	165	1.231	136.5	22,530	18,291
								259,225	235,780
v)	Very Dispersed	1	Peace River	160	156	.975	28	4,375	4,480
		2	Cariboo	503.1	178	.354	67.9	12,086	34,160
		13	Dryland Farm	220.76	104	.471	167.3	17,399	36,933
								33,860	75,573

Table 10 (cont'd)

Components of the Six-Cell Model

Cell No.	Descriptive Title	Components: Fig. No.	Title	Area	HH	HH/Sq.Mi.	Scale-Up Factor	Total: HH	Area
vi)	Settlement	4	Bella Coola	- 90 - 5	102	20.4	618.5	63,088	3,093
		5	N. Okanagan	3.42	692	202	22.8	15,786	78
		6	Langley	1.4	276	197	57.2	15,786	80
		7	Tofino	1.11	201	181	78.5	15,786	87
		8	Warfield	~.4	641	~160	17.4	11,142	7
		9	Tahsis	3.13	411	131	27.1	11,142	85
		10	Rivers, Man.	3.03	401	132	294.4	118,069	892
		18	Warren	1.66	191	115	869.6	166,100	1,444
		23	New Melbourne total	~2	36	~18	406.5	14,635	813
		24	Cape Broyle core	3.84	174	44.5	160	27,840	614
		25	Pouch Cove core	~4	389	~97	26	10,114	104
		27	Abrams Village core	~.6	67	~112	222	14,874	133
		29	Tignish, core	~2	273	~130	35	9,555	70
		31	Brookfield core	~1	199	~198	230	45,770	230
		32	Chipman, core	~5	623	~95	43	26,789	215
								566,478	7,945
								1,715,646 households	444,843 sq. miles

TABLE 11

The Six-Cell Model

Cell No.	Title	Representative Map	Per Cell		Scale-up	Rural Canada	
			HH	Area		HH	Area
i	Urbanizing	Type 5, semi-rural, Fig. 22	476	10.23	276	131,377	2,823
ii	Lineal	Type 2, Township, Fig. 19	1,230	104.64	397.96	489,493	41,643
iii	Dense, areal	Type 3, Dispersed, Fig. 20	204	46.97	1,153	235,215	54,156
iv	Sparse, areal	Typical Section, A, Fig. 11A	141	62.22	1,222.3	172,347	76,052
		Typical Section, B, Fig. 11B	104	220.76	644*	66,976*	142,169*
		Typical Section, C, Fig. 11C	211	73.72	94.32	19,902	6,953
		Sub-total for Cell iv				259,225	225,174
v	Very dispersed	Dryland Farm, Fig. 13	104	220.76	325.58*	33,860*	71,875*
vi	Settlement	Cape Broyle , Fig. 24	174	3.84	3,255.61	566,476	12,502
		Totals for rural Canada				1,715,646	408,173

*. the two numbers in each column having a *superscript can be combined, since Figs 11B and 13 are identical - to give, in essence, a six-cell model that can be described with seven maps.

The criteria for choice of a representative settlement (cell type vi)) were: 1) household count closest to the average for all settlements in this cell type, and 2) communities per settlement closest to the average for all settlements in this cell type. Since Fig. 11B and Fig. 13 are identical, it is apparent that the six-cell model can be described by seven maps, those shown in Fig. 22, 19, 20, 11A, 11C, 13 and 24. It should be noted that the six-cell model scale-up factors are chosen to preserve the total number of households. The entries in the last column in Table 11 are an indication of the magnitude of the error to be expected when the six-cell model is used. These entries were obtained by multiplying the area per cell by the scale-up factor and it is expected that the total area shown in Table 11 will differ from that shown in Table 10, and, in fact, will also differ from the area computed by Statistics Canada, using the definition for the rural study area given in the Introduction to this report. The Statistics Canada figure was 415,076.91 sq. miles.

At times a modelling per province may be desired. The information in Table 6, 10 and 11 can be combined with the information on pgs. 17 to 19 of reference 4 to provide the provincial household data presented in Table 12 and the provincial scale-up factors given in Table 13. Of course, these two tables refer to the six-cell model and of course the same technique could be used to determine provincial scale-up factors for the 32-cell model.

CELL	NUMBER OF HOUSEHOLDS											
	HH/CELL	BC	ALTA	SASK	MAN	ONT	QUE	NB	NS	PEI	NFLD	CANADA
i) Urbanizing	476	0	4,654	290	3,385	72,609	50,439	0	0	0	0	131,377
ii) Lineal	1,230	0	4,859	803	2,487	237,729	112,273	45,452	54,706	13,938	17,246	489,493
iii) Dense, areal	204	0	0	0	0	103,871	131,344	0	0	0	0	235,215
iv) Sparse, areal												
A	141	18,870	59,181	50,141	44,151	0	0	0	0	0	0	
B	104	7,333*	22,999*	19,485*	17,158*	0	0	0	0	0	0	259,219
C	211	2,179	6,834	5,790	5,098	0	0	0	0	0	0	
v) Very dispersed	104	16,461*	9,805*	7,594	0	0	0	0	0	0	0	33,860
vi) Settlement	174	132,730	39,966	54,456	23,647	71,049	95,051	35,880	54,985	3,581	55,131	566,476
Provincial totals		177,573	148,298	138,560	95,925	485,258	389,107	81,332	109,691	17,519	72,377	1,715,640
Regional totals		177,573	382,783			874,365		280,919				1,715,640

TABLE 12

RURAL HOUSEHOLDS PER PROVINCE PER CELL IN THE SIX-CELL MODEL

*The * superscript is explained in Table 11.

CELL	HH/CELL	SCALE-UP FACTORS										
		BC	ALTA	SASK	MAN	ONT	QUE	NB	NS	PEI	NFLD	CANADA
i Urbanizing	476	0	9.78	.61	7.11	152.54	105.96	0	0	0	0	276
ii Lineal	1,230	0	3.95	.65	2.02	193.28	91.28	36.95	44.48	11.33	14.02	397.96
iii Dense, areal	204	0	0	0	0	509.17	643.84	0	0	0	0	1,153
iv Sparse, areal												
A	141	133.83	419.72	355.61	313.13	0	0	0	0	0	0	1,222.3
B	104	70.51*	221.14*	187.36*	164.98*	0	0	0	0	0	0	644*
C	211	10.33	32.39	27.44	24.16	0	0	0	0	0	0	94.32
v Very dispersed	104	158.28*	94.28*	73.02*	0*	0	0	0	0	0	0	325.58*
vi Settlement	174	762.82	229.69	312.97	135.90	408.33	546.27	206.21	316.01	20.58	316.84	3,255.6

TABLE 13

SCALE-UP FACTORS PER PROVINCE PER CELL FOR THE SIX-CELL MODEL

* The * superscript is explained in Table 11.

Chapter 5

EXAMPLES OF USE OF DATA

5.1 Direct Broadcast Satellite - Ground Segment Cost

(a) The first case to be considered is the simplistic situation that exists if a TVRO and a 500 ft. CATV connection have the same cost, say $500. Furthermore, if it is assumed that i) the TVRO has multiple channel outputs making it suitable for both single home reception and as a CATV head-end unit and ii) we are interested in knowing only the number and cost of TVRO's we find that:

i) Figure 78 and Table 20 are valid for this situation, if we consider rural areas only. The number of TVRO's is the number of single household communities plus the number of two household communities, etc. and is obviously the RANK abscissa value given in Figure 78. Thus 503,837 units are required to provide 100% coverage for all rural Canadians.

ii) At a cost of $500 per TVRO, the total TVRO cost is $252 Million

(b) The next case to be considered is the case of a switchable single-channel TVRO suitable for single household reception costing $500, a CATV connection costing $1 per foot, an average house-to-house distance in each community of 300' and a multiple output channel TVRO suitable for use as a CATV headend that costs $4,100. For this case, it can be shown that every community consisting of 21 households or more should invest in a CATV system using the $4,100 TVRO as a headend unit. Alternatively, every house in every community consisting of 20 households or less should invest in a $500 TVRO. From Table 20, it follows that there are 8,982 communities having 21 households or more per community and 494,855 communities.

having 20 households or less. The number of households in this latter group for each size of community can be obtained again from Table 20 and is shown in Table 14. The above totals include the cost of the ground segment for DBS service to the 566,476 households living in cell type vi) Settlements. The grand total for the cost of the ground segment, subject to the very simplistic assumptions that have been made, is $716M. This number applies only to rural Canada and is a first approximation, taking into account the clustering of households, for the ground segment cost of a distribution system that would provide multi-channel television to 100% of rural Canadians.

5.2 Linear Density of Rural Households

This section is concerned with determining the number of households in each province that have a specific linear household distribution. The methodology consisted of overlaying a CATV distribution system onto each of the maps of the six-cell model. The cumulative distribution functions for trunk lengths and for house drop connections were then found by measurements on the map. The graphs of these twelve cumulative distribution functions are given in Figures 34 to 39. Figures 40 to 50 are a presentation of the trunk-line-length linear household distribution functions per province and of the house drop connection linear household distribution functions per province. Figures 40 to 50 were obtained by multiplying the ordinates of Figs. 34 to 39 by the appropriate household counts given in Table 12 for each province then summing the ordinates. The average drop and trunk lengths given in all figures and in Table 15 were obtained by numerical integration.

TABLE 14

OBS GROUND SEGMENT COST

(1) Size	(2) Rank	(3) No. of Communities of size i to j = Rank (j)- Rank (i)	(4) No. of Households = j x (3)	TVRO Cost Each	TVRO Cost Total $ Million	Wiring Cost $ Million
28	8,982					
17	9,076	94	1,598	$ 500	1.6	0
16	9,750	674	10,784	500	5.39	0
15	-	-	-	"	-	0
14	9,844	94	1,316	"	.66	0
13	10,997	1,153	14,989	"	7.49	0
12	12,150	1,153	13,836	"	6.92	0
11	13,303	1,153	12,683	"	6.34	0
10	13,977	674	6,740	"	3.37	0
9	14,253	276	2,484	"	1.24	0
8	19,661	5,408	43,264	"	21.63	0
7	21,529	1,868	13,076	"	6.54	0
6	24,022	2,493	14,958	"	7.48	0
5	28,829	4,807	24,035	"	12.02	0
4	42,472	13,643	54,572	"	27.29	0
3	72,288	29,816	89,448	"	44.72	0
2	158,459	86,171	172,342	"	86.17	0
1	503,837	345,378	345,378	"	172.69	0
0 to 28	-	8,982	894,184*	$4,100	36.83	268.26
				Sub-totals	448.38	268.26
				Total	$ 716.64 million	

* from Table 20

Because it is obvious that the mean length (the 50% level) for every cell and province differs substantially from the average length, the user of this data must be cautioned as to the large effect that the widely dispersed households have on any composite parameter such as the average trunk length. Although no example is given in this report for using the distribution functions shown in Figs 40 to 50, the knowledgeable reader will recognize that these curves can be interpreted to give, for example, the number of households in rural Canada that have a linear household density that exceeds 18 households per mile.

TABLE 15

AVERAGE TRUNK AND DROP CABLE LENGTHS

Location	Average Length per Household (miles)		Linear Household Density (HH/Mile)		
	Trunk (1)	Drop (2)	per mile of trunk = 1/(1)	per mile of cable = 1/{(1) + (2)}	per mile of house to house distance = 1/{(1) + 2 x (2)}
Cell i)	.0324	.0124	30.8	22.3	17.5
Cell ii)	.100	.0304	10.0	7.67	6.22
Cell iii)	.0822	.0317	12.2	8.78	6.87
Cell iv)	.326	.146	3.07	2.12	1.62
Cell v)	.675	.280	1.48	1.05	0.81
Cell vi)	.0224	.0181	44.6	24.7	17.1
BC*	.130	.0571	7.7	5.34	4.1
Alta*	.258	.106	3.88	2.75	2.13
Sask*	.236	.0992	4.24	2.98	2.30
Man*	.268	.106	3.73	2.67	2.08
Ont*	.0754	.0261	13.3	9.85	7.84
Que*	.0647	.0259	15.5	11.0	8.58
N.B.*	.0660	.0264	15.2	10.8	8.42
N.S.*	.0601	.0258	16.6	11.6	8.95
P.E.I.*	.0829	.0284	12.1	8.98	7.16
Nfld*	.0434	.0226	23.0	15.2	11.3
Canada*	.115	.0461	8.7	6.21	4.83

The asterisk means that only the rural portion is considered.

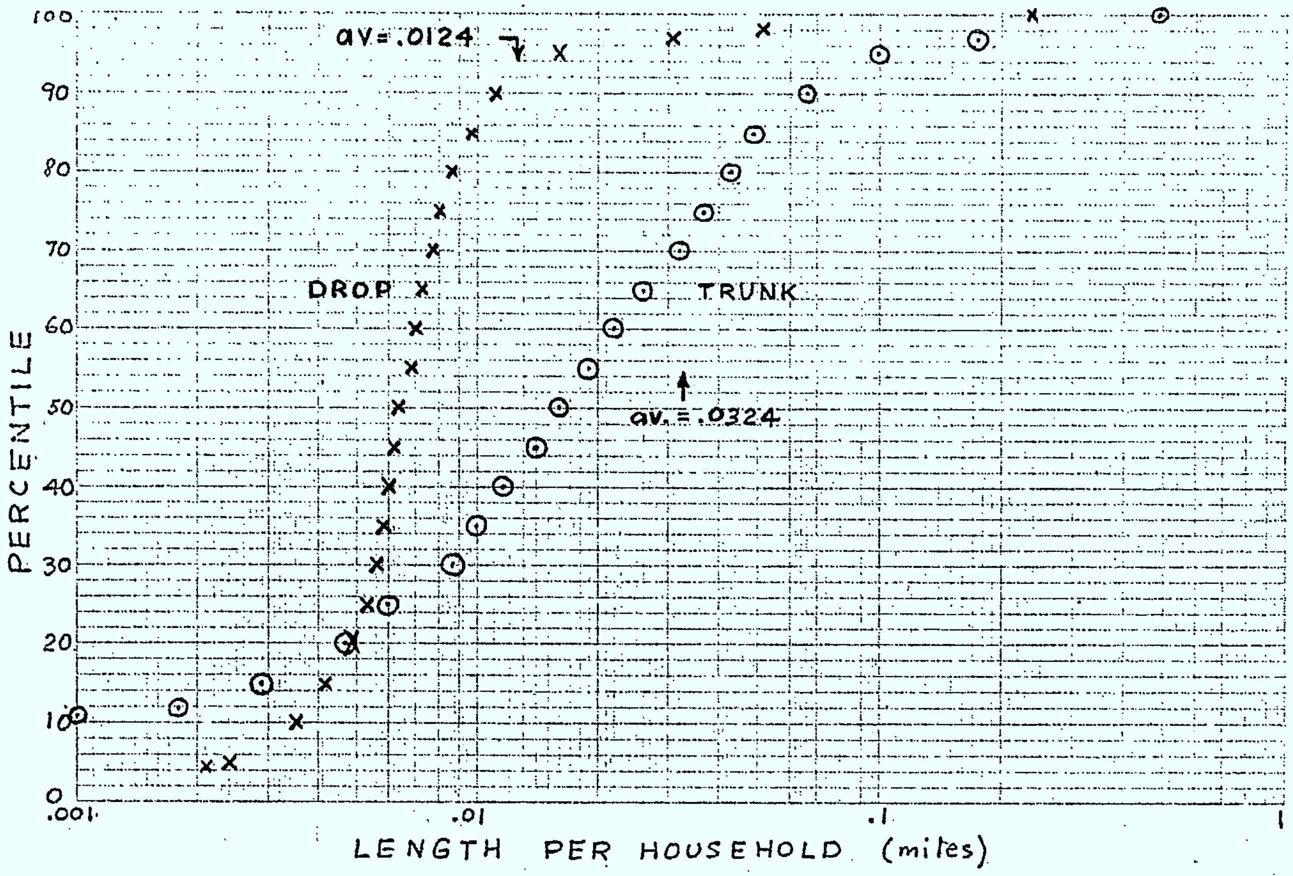


Figure 34. Cable Length Functions, Cell Type i)

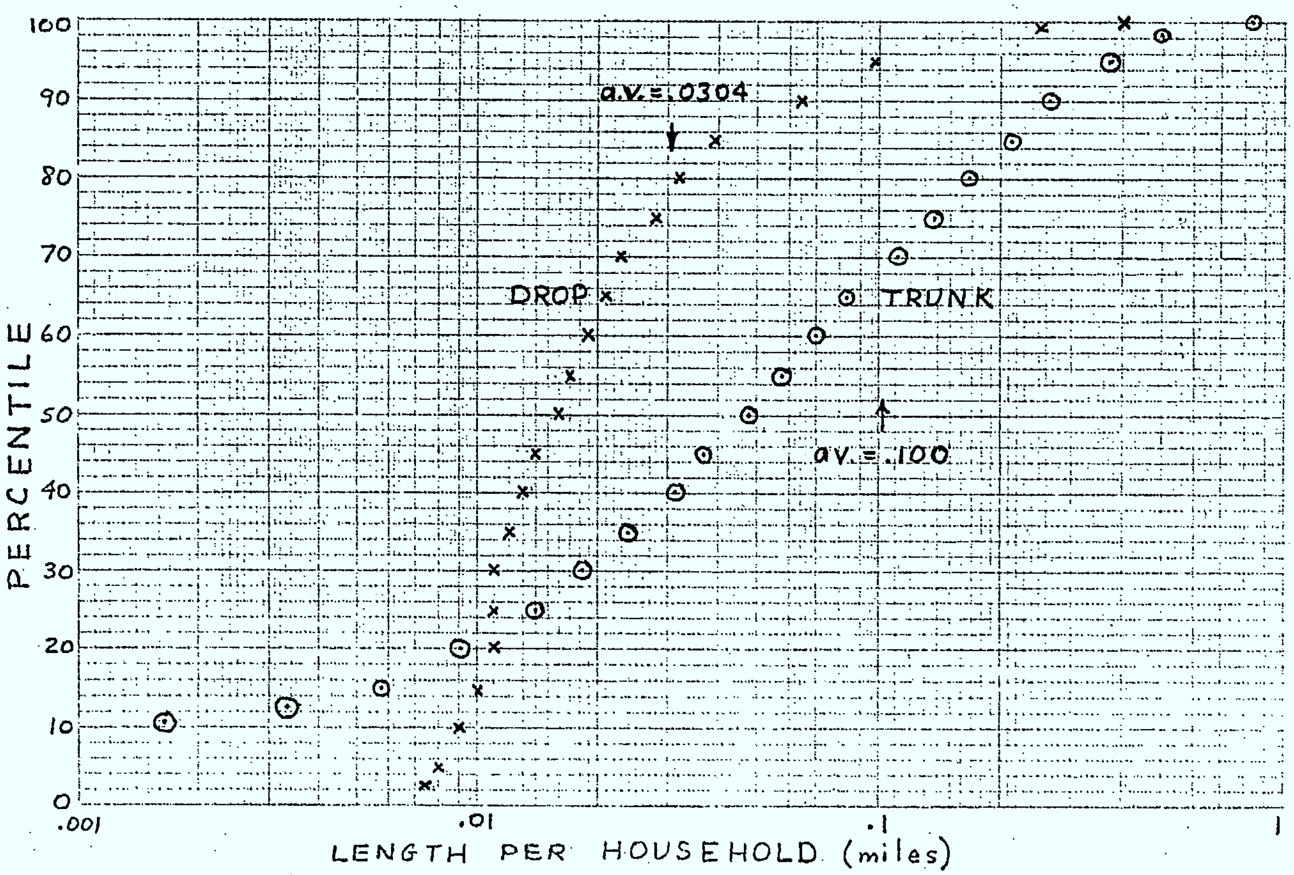


Figure 35. Cable Length Functions, Cell Type ii)

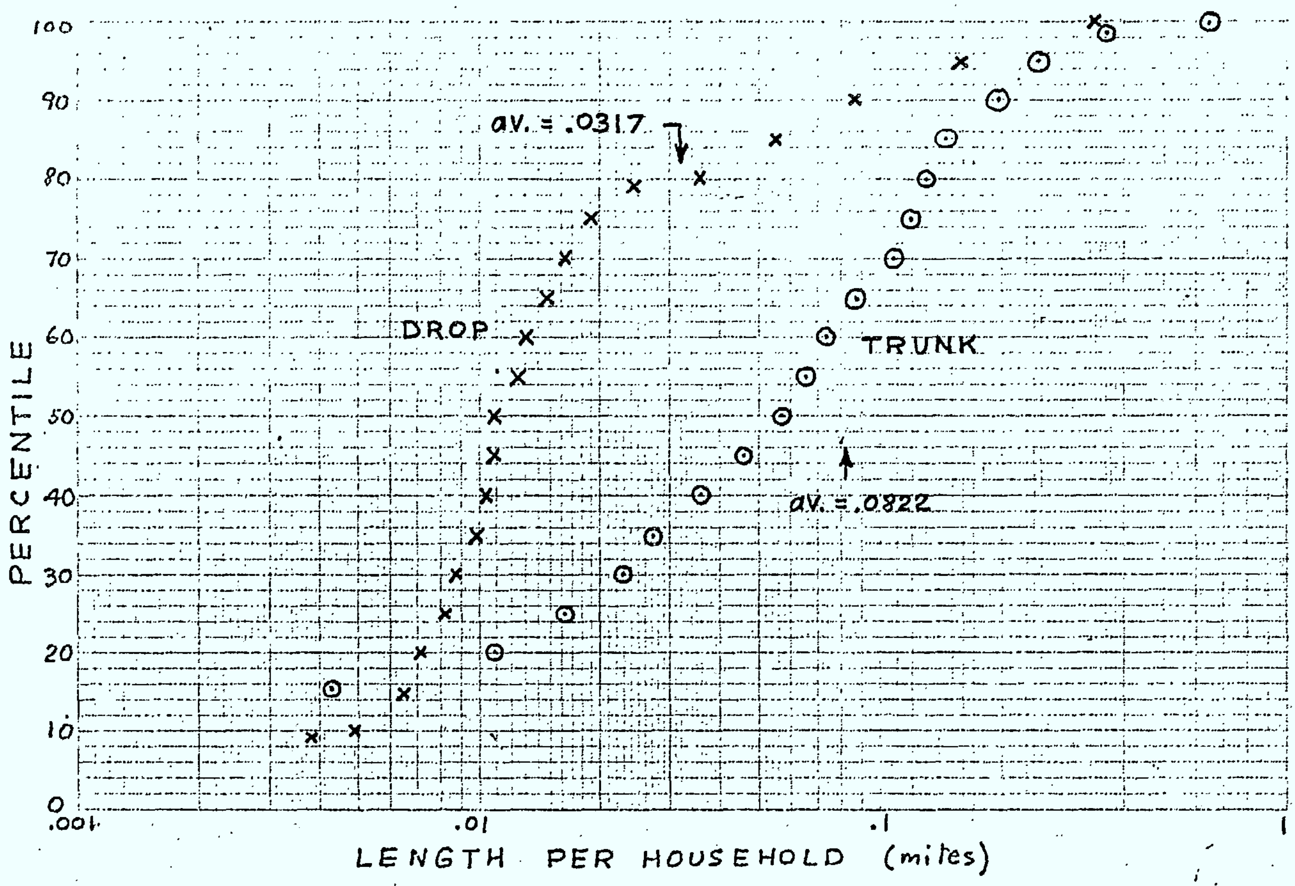


Figure 36. Cable Length Functions, Cell Type iii)

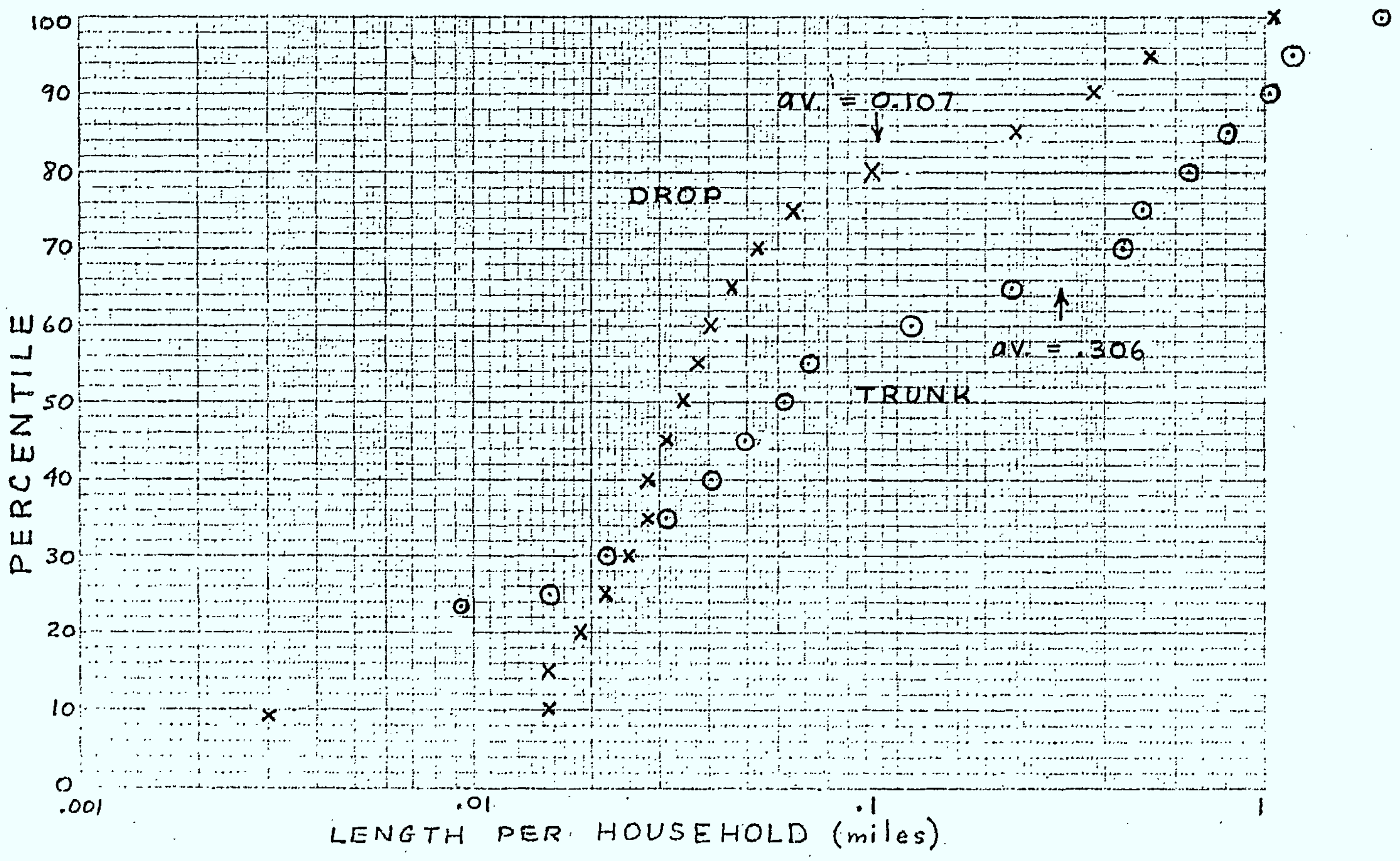


Figure 37A. Cable Length Functions, Cell Type ivA)

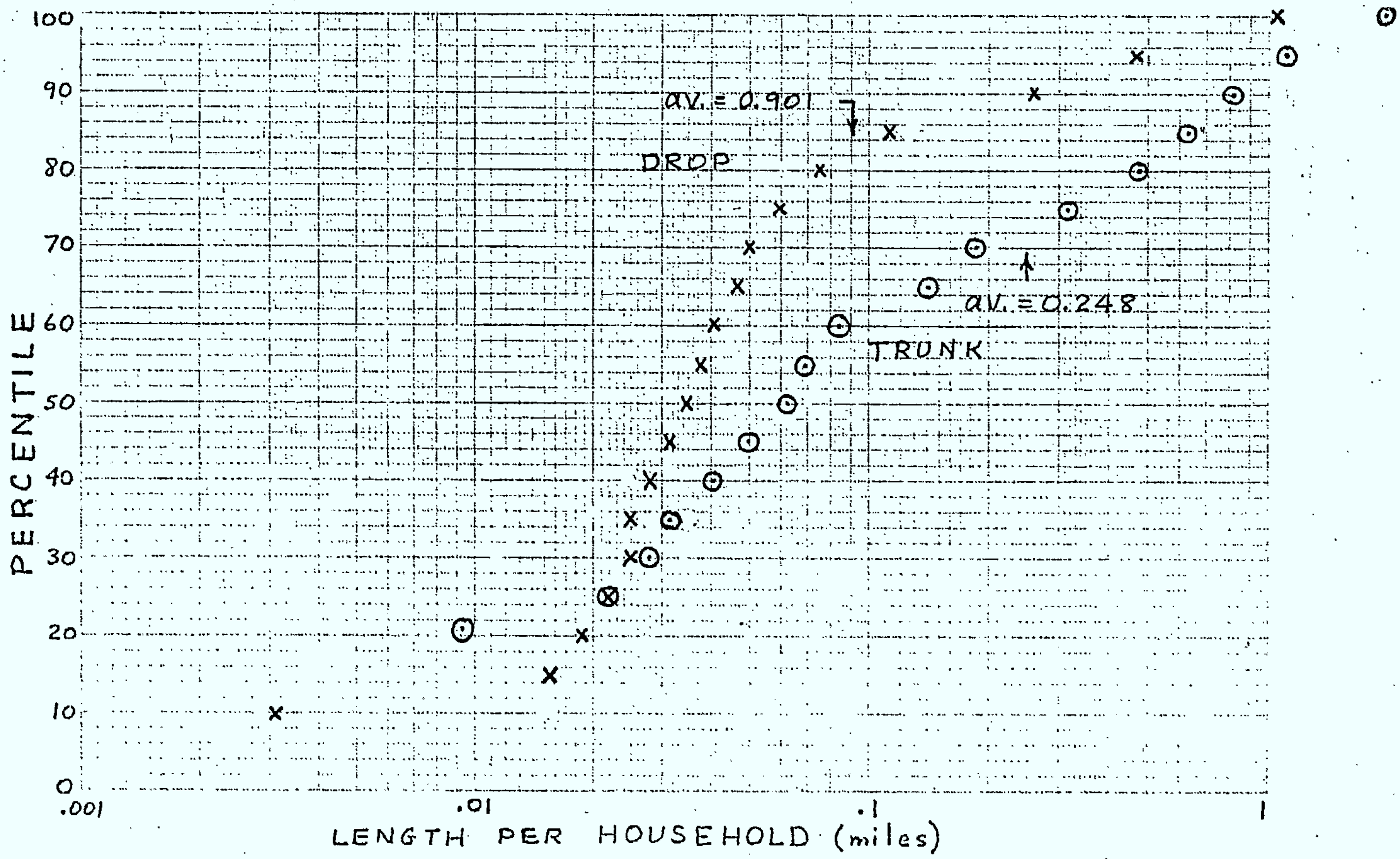


Figure 37B. Cable Length Functions, Cell Type ivC)

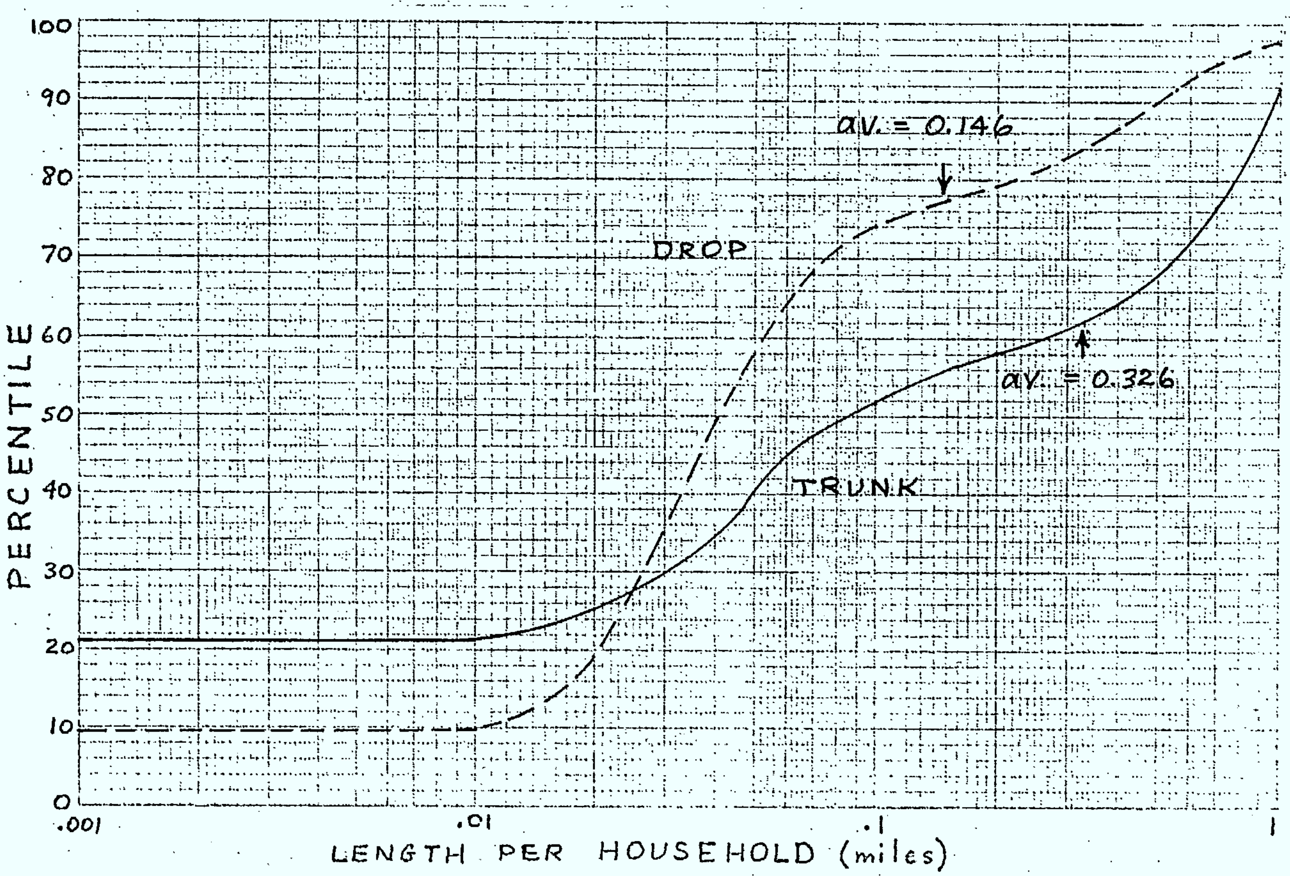


Figure 37C. Cable Length Functions, Cell Type iv). These curves were obtained using data from Table 11 and Figs. 37A, 37B and Fig 38.

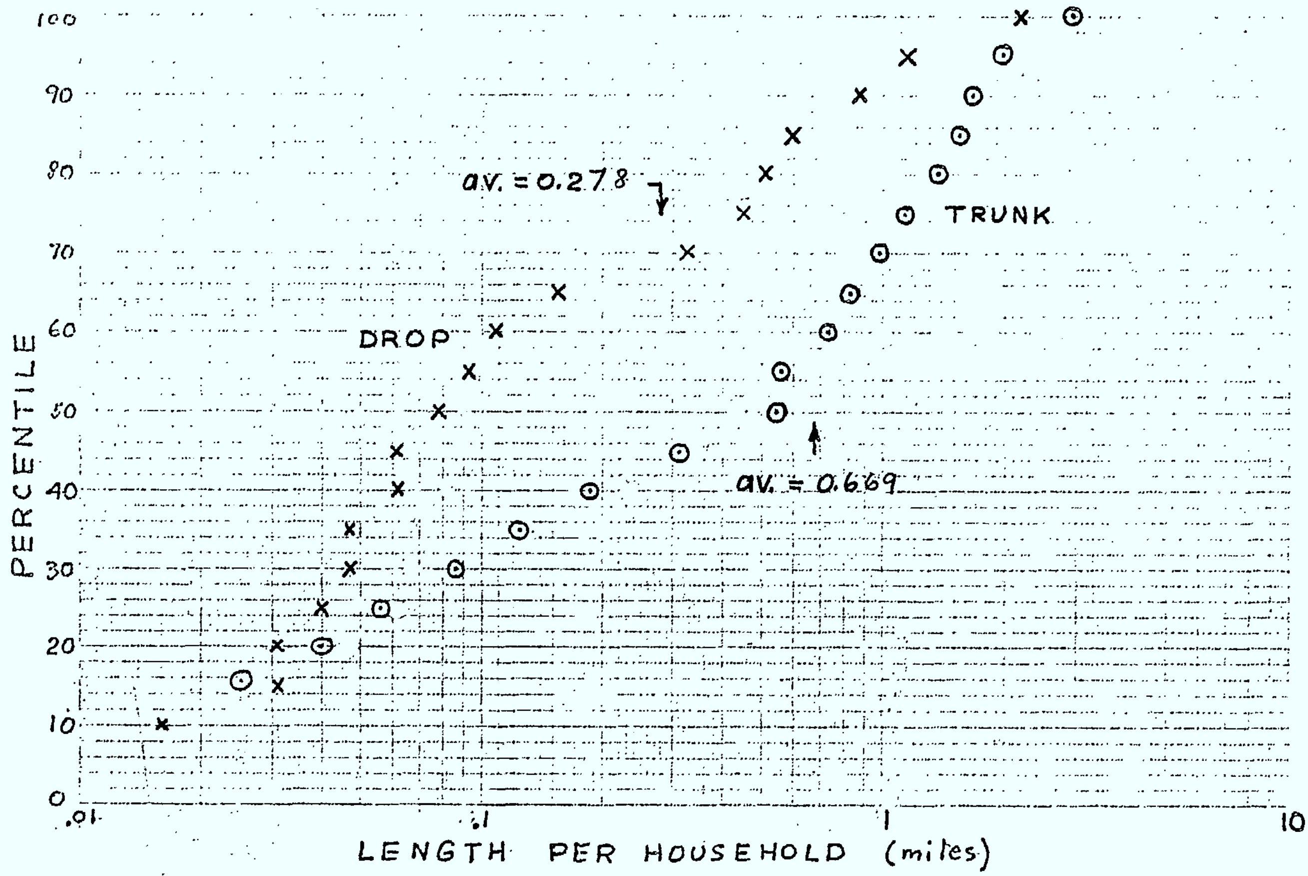


Figure 38. Cable Length Functions, Cell Type v) and ivB).

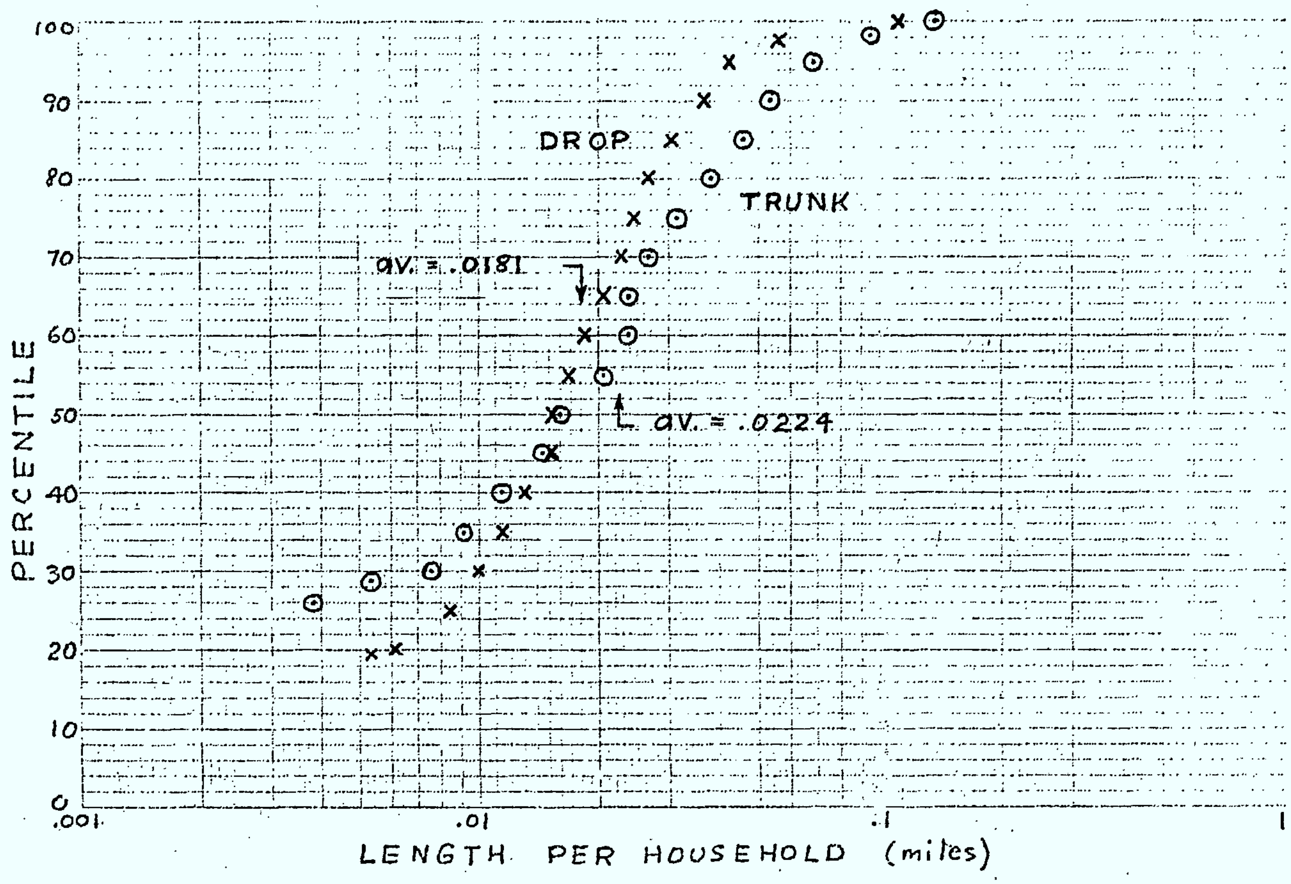


Figure 39. Cable Length Functions, Cell Type vi).

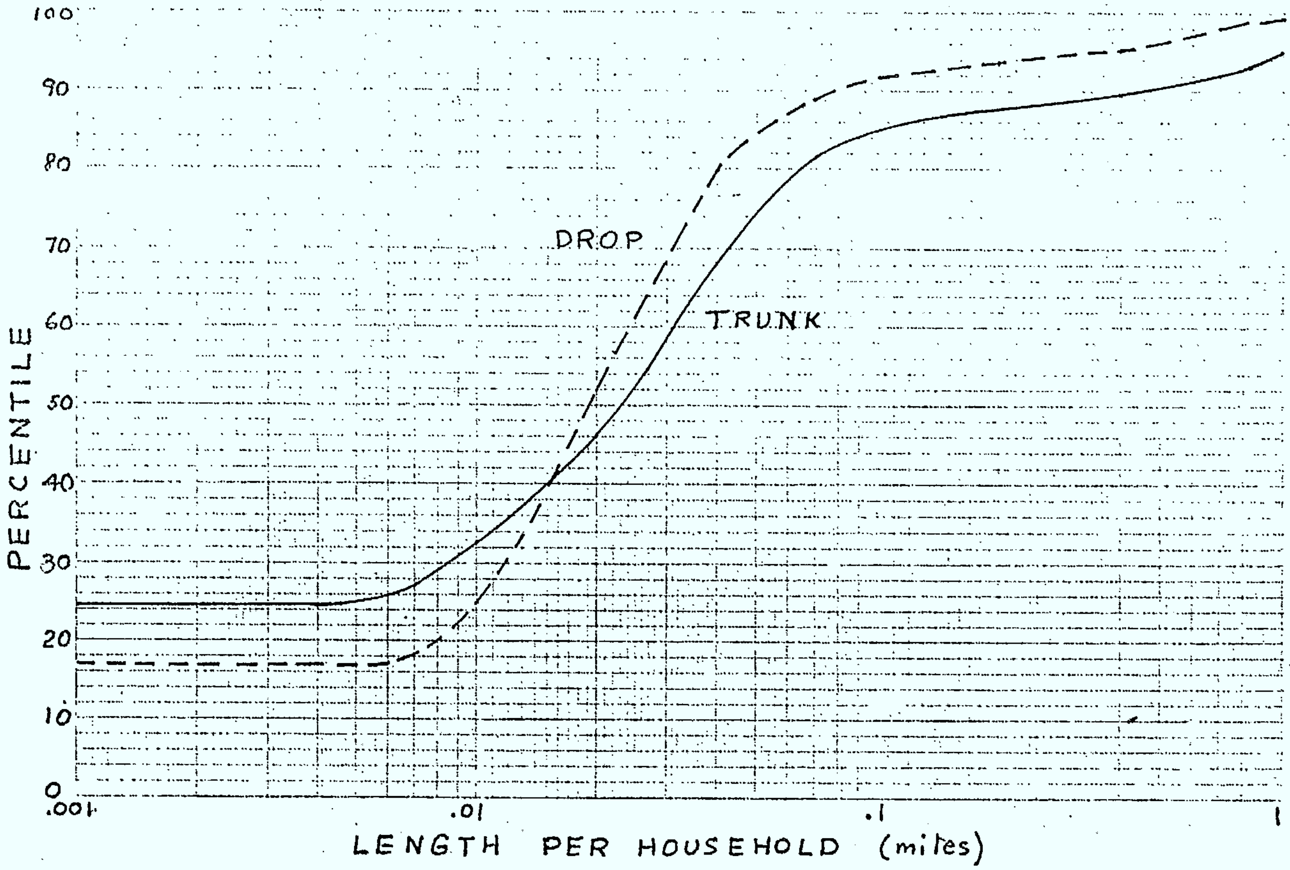


Figure 40. Cable Length Functions, Rural British Columbia

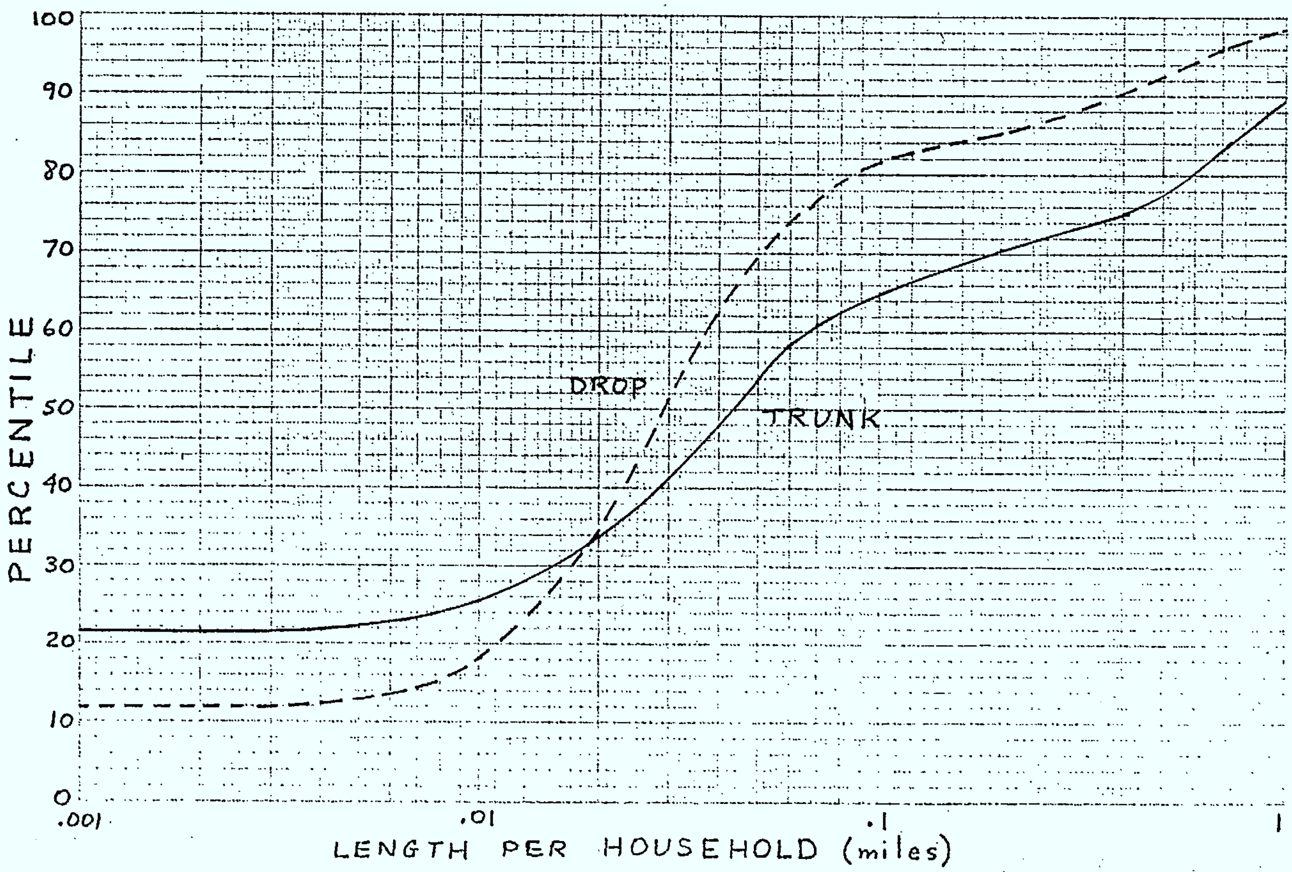


Figure 41. Cable Length Functions, Rural Alberta

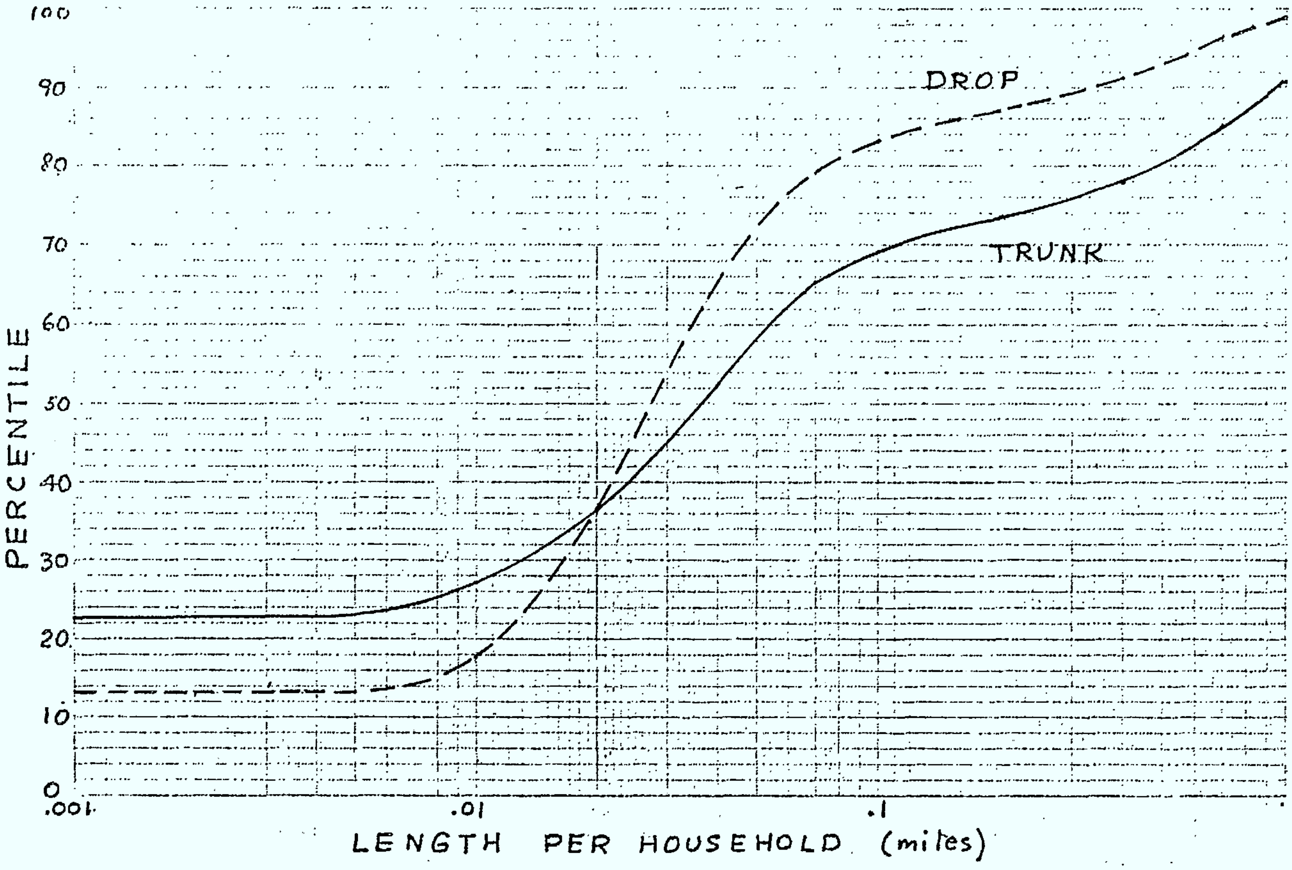


Figure 42. Cable Length Functions, Rural Saskatchewan

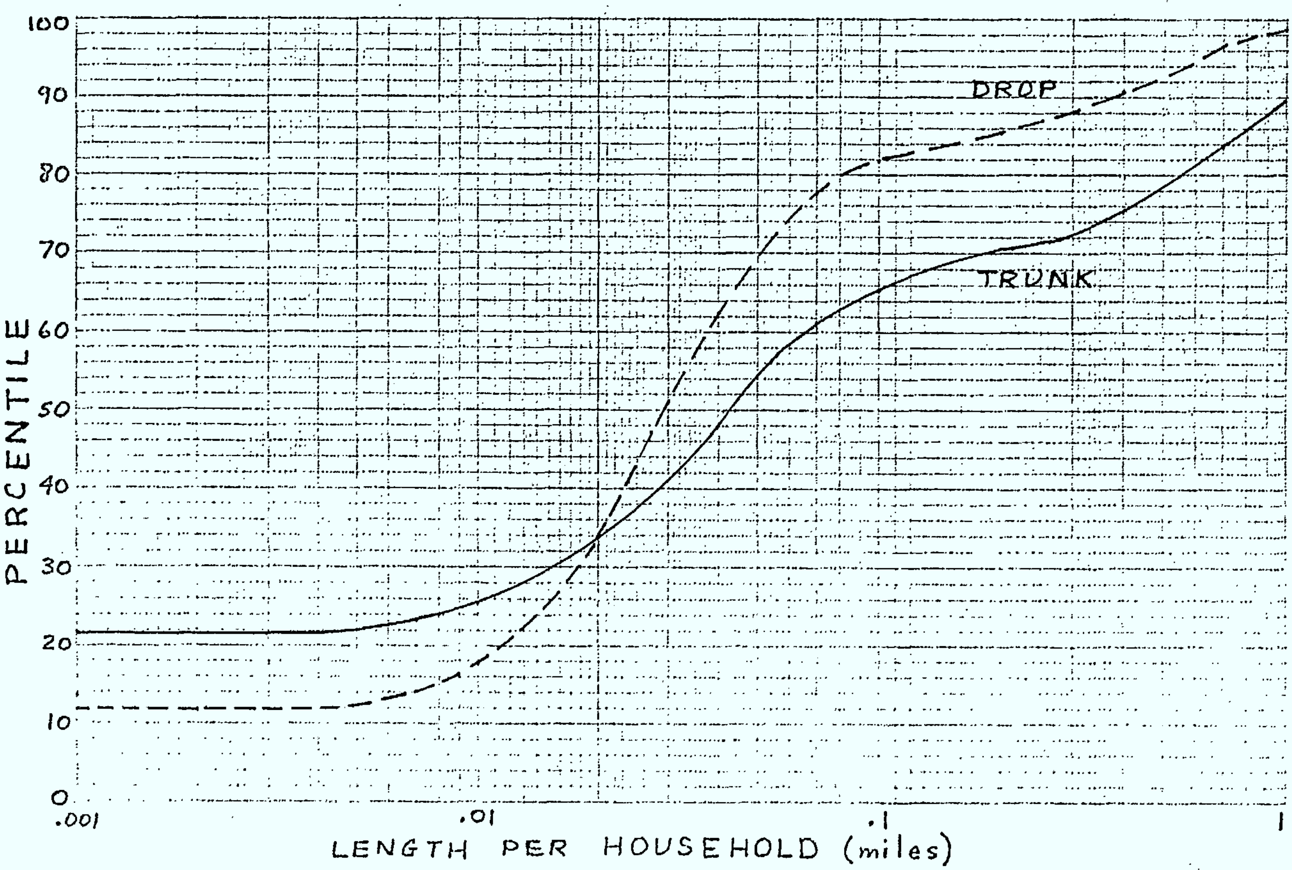


Figure 43. Cable Length Functions, Rural Manitoba

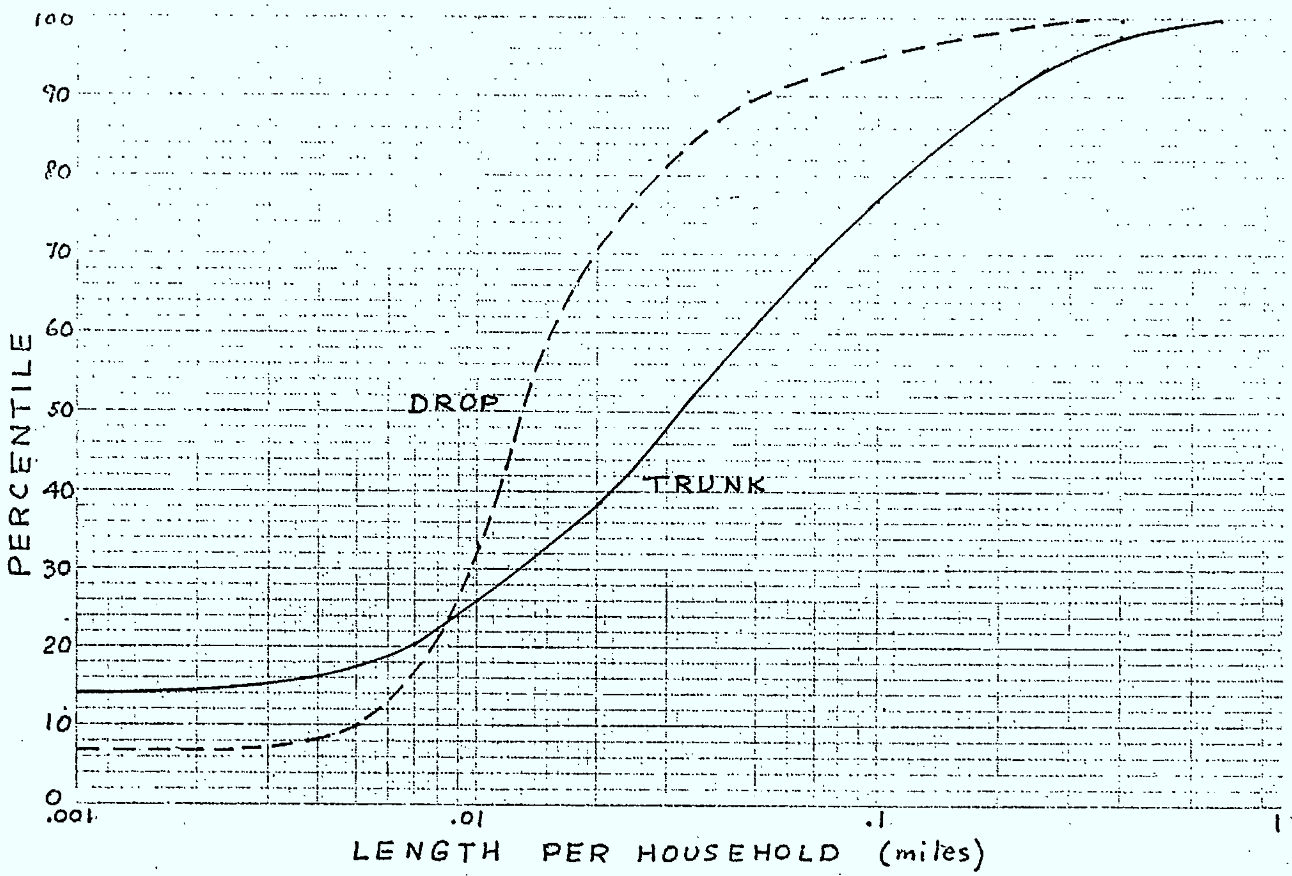


Figure 44. Cable Length Functions, Rural Ontario

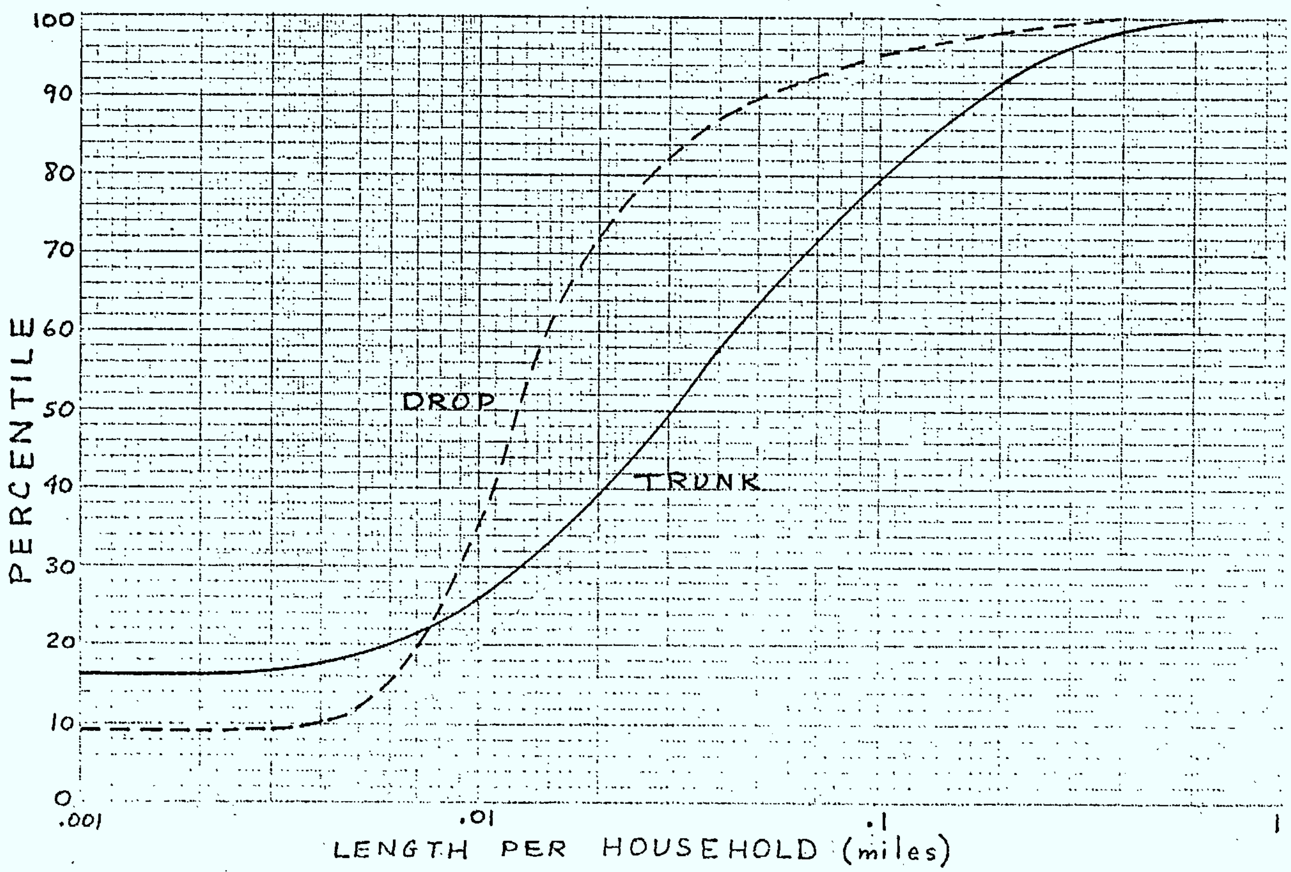


Figure 45. Cable Length Functions, Rural Quebec

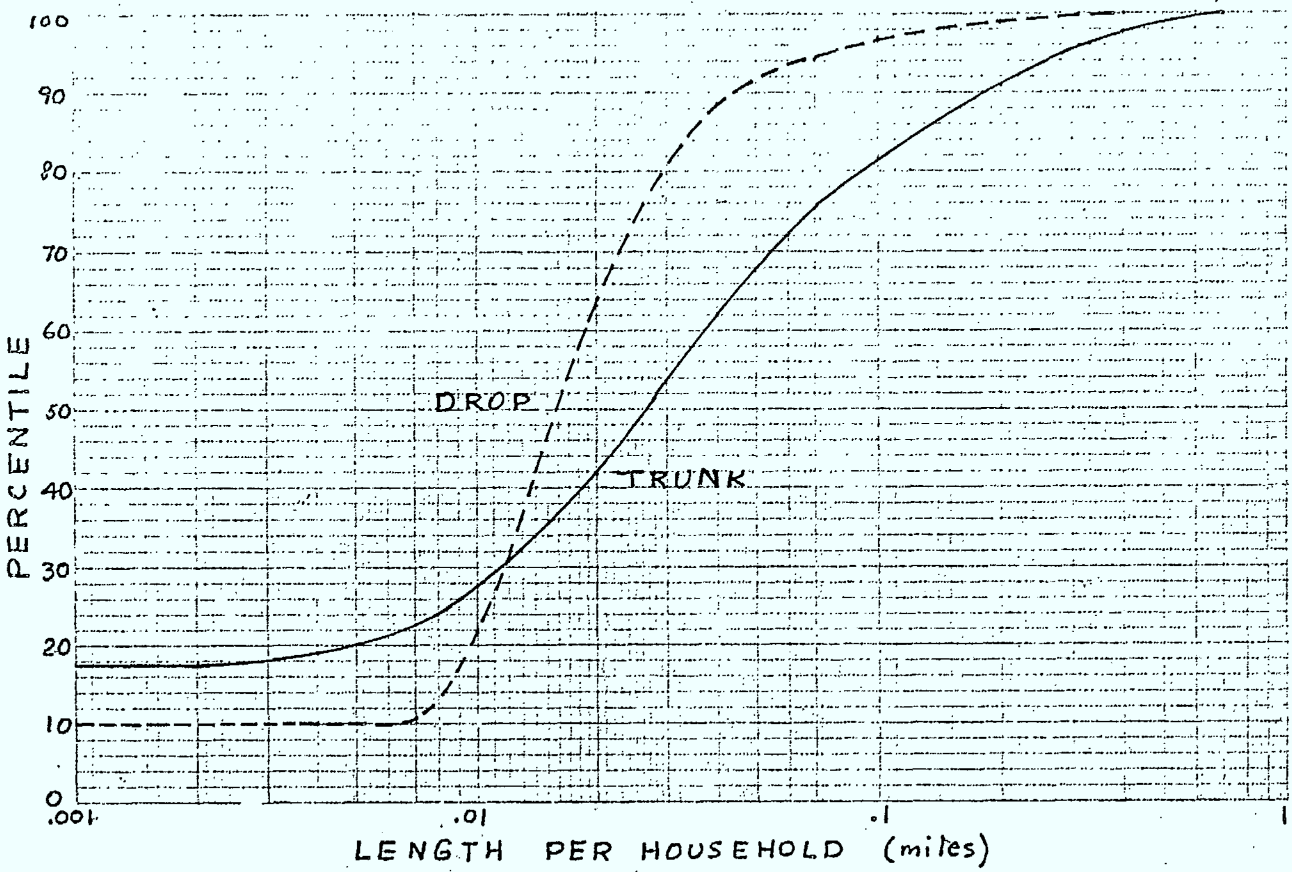


Figure 46. Cable Length Functions, Rural New Brunswick

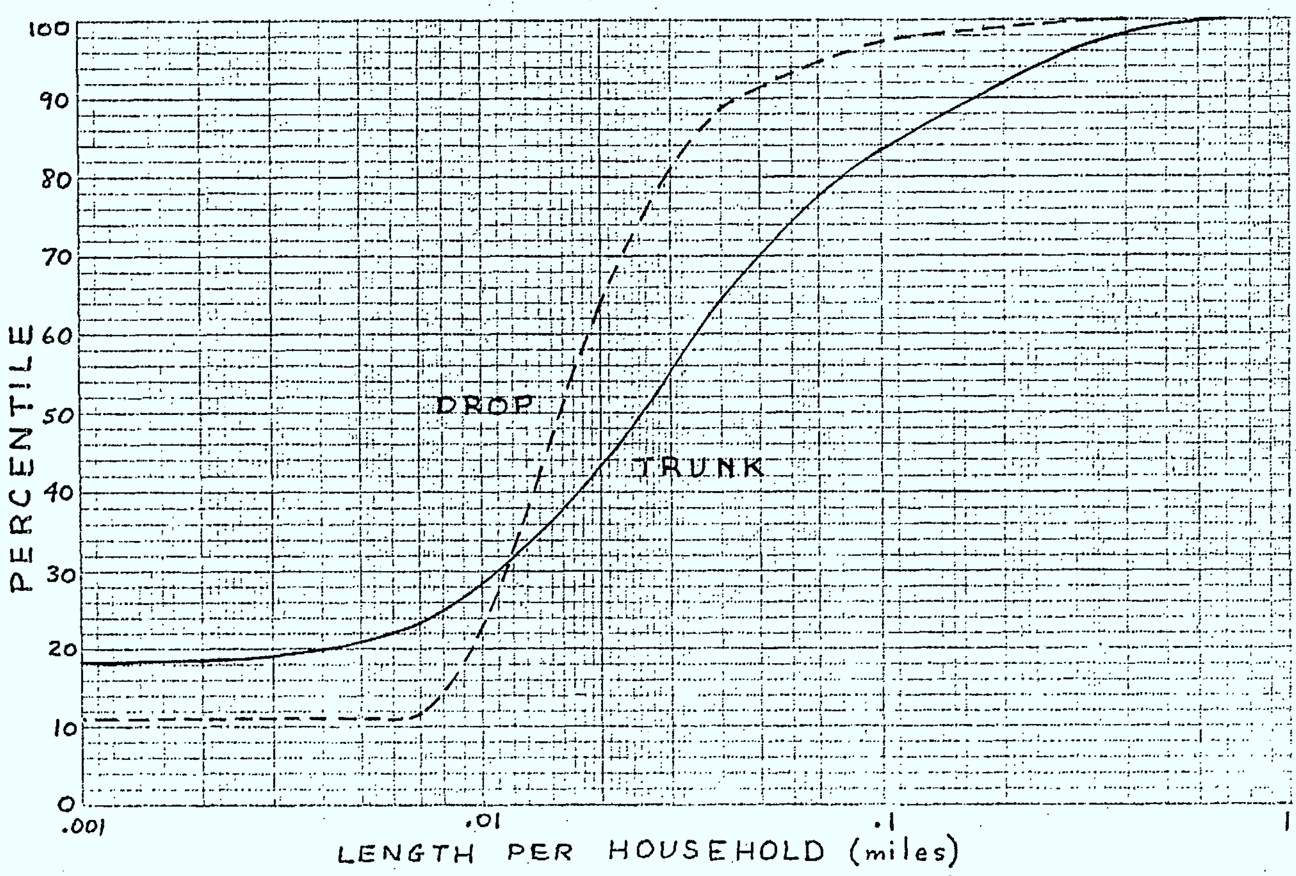


Figure 47. Cable Length Functions, Rural Nova Scotia

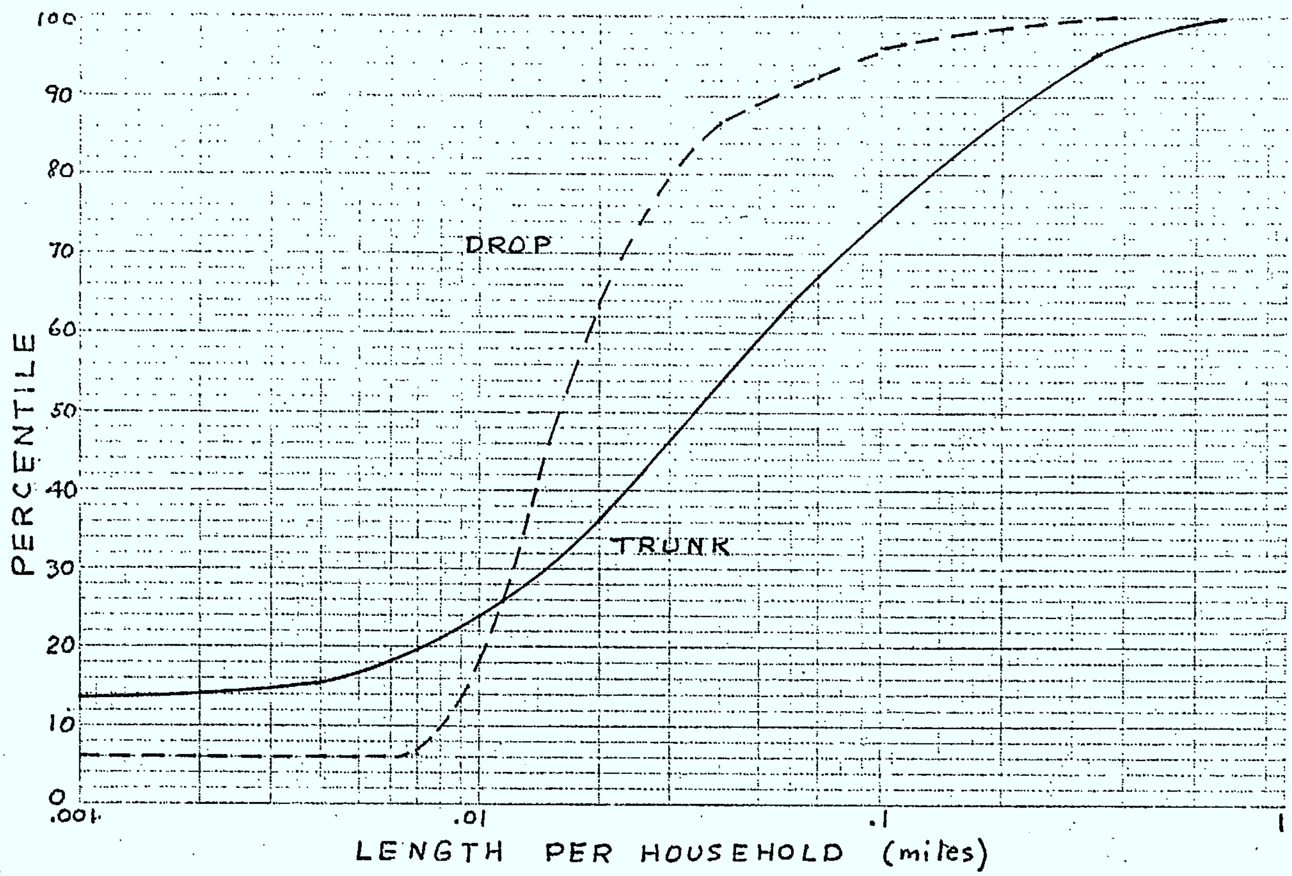


Figure 48. Cable Length Functions, Rural Prince Edward Island

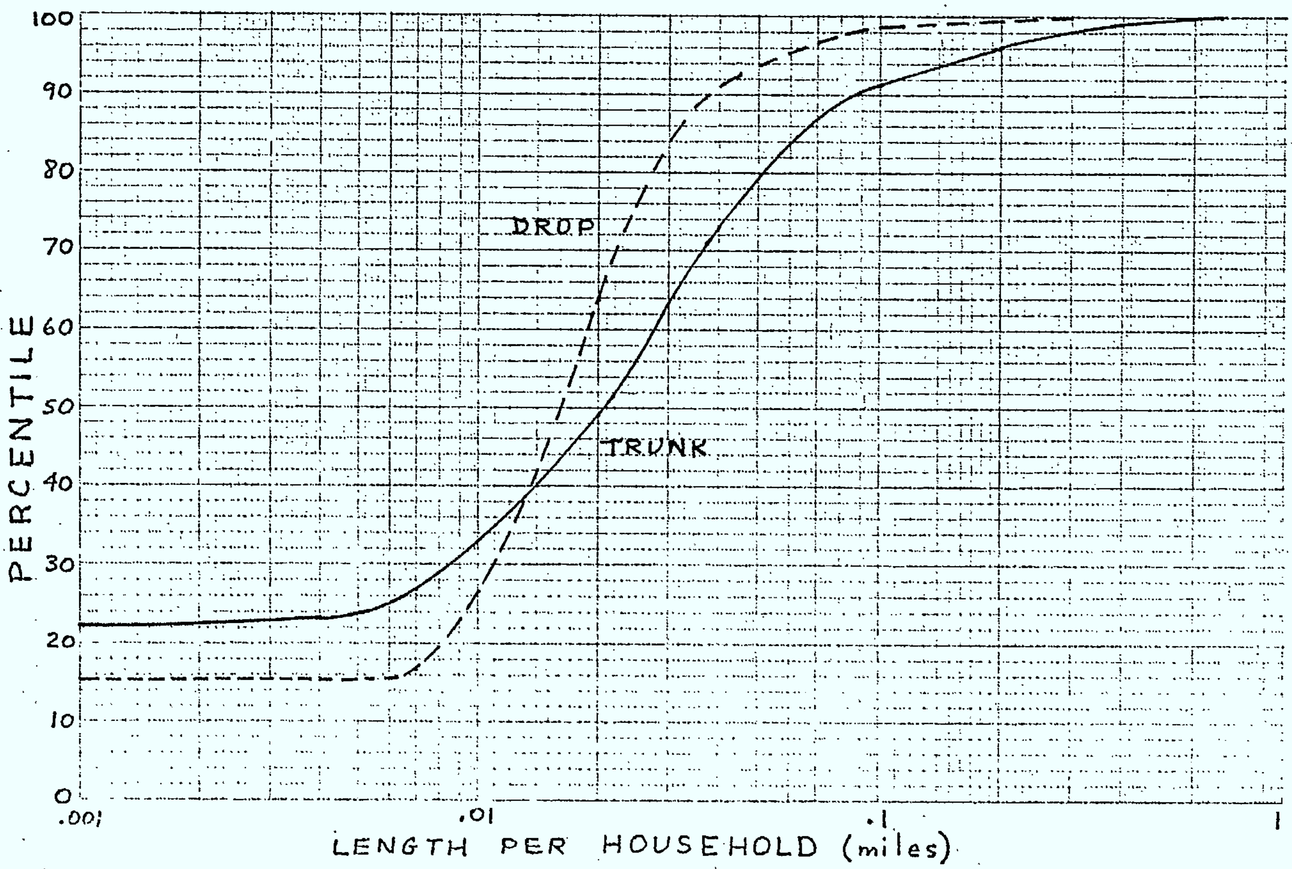


Figure 49. Cable Length Functions, Rural Newfoundland

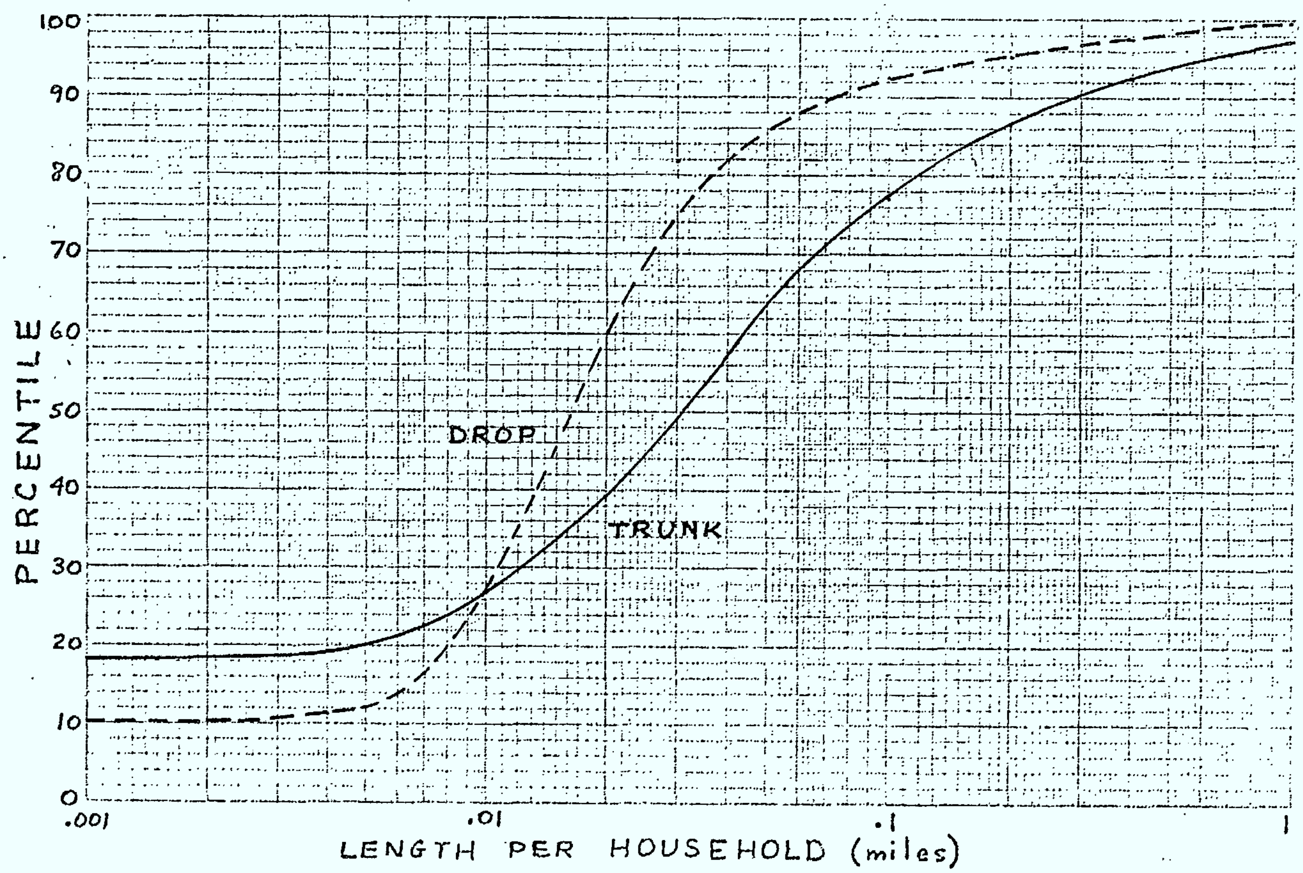


Figure 50. Cable Length Functions, Rural Canada

Chapter 6

CRITIQUE AND SUGGESTIONS FOR FURTHER WORK

Because the data presented in this report will be used in other studies being sponsored under the Rural Communications Program and because the authors' year-long contact with the material has made them very aware of the errors that may be expected in such studies, a few words on accuracy are needed. The present report is potentially fraught with errors because it has been concerned with sampling (for choosing typical cells), with inherent knowledge of Professors (when individual E.A.'s are assigned to a cell type) and finally with judgement when, for example, one of the 32-cell types is assigned to one of the six-cell types. The problem of estimating accuracy is made even more difficult when it is realized that the key data that has been obtained, the number of single, double, triple, etc. household communities simply does not exist elsewhere. Therefore, only secondary tests of accuracy are possible. Two will be considered here, where the paging refers to the present report:

i) Rural Study Area:

basic Statistics Canada data (pg 92)	415,076.91 sq. mi.
32-cell model (pg 27)	448,843
six-cell model (pg 91)	408,173

The model predictions are always within 8%.

ii) Household count:

DOC rural (Table 16)	1,749,891
32-cell model (pg. 27)	1,715,646
six-cell model (pg. 93)	1,715,640

The -2% prediction of the models appears very encouraging. However, the scale-up factors were chosen to preserve the correct household count!

The 2% deviation is thus not a true measure of the accuracy of the model. A better estimate of the accuracy of the six-cell model can be obtained by comparing the household count per province (second last columns, Table 16) with the predictions of the model (Table 12, pg. 93). For example, the two respective numbers for New Brunswick are 95,867 and 81,332 households or a deviation of -15%.

Therefore, the authors' best guess for the accuracy of parameters calculated from the six-cell model is in the range of 15 to 20%.

Suggestions for further work include the following possibilities:

i) A more refined DBS ground segment cost calculation taking into account cost elasticity of hardware due to market size, cost of money and consideration of payment options.

ii) A re-choosing of an area to represent the "typical section" portion of the Prairie Provinces.

iii) A decrease from seven to six in the number of maps required to represent the six-cell model (typical section map 11C does not represent very many households).

iv) A re-doing of the entire project with the objective being to include incorporated settlements into the cell models used for describing larger areas. The present method of treating incorporated settlements separately makes it very difficult to do accurate costing of certain services such as large area, multi-hub CATV.

v) Selecting one or more additional examples of the B.C. "cluster" type cell since the possibility exists that Bella Coola is not an optimal choice.

vi) Publicising the original results, for example the rank-size data obtained, examples being Figs 78 and 79, to ascertain wider audience interest in this material, and possible support for further work.

vii) Completing theoretical studies that explain why the rank-size curve often has a slope close to -1 (see pg. 134).

viii) Completing various communication system studies that rely on household grouping data.

REFERENCES

1. Geographic Distribution of Households within Rural British Columbia, K.G. Denike, University of British Columbia, report prepared under DOC contract OSU77-00362.

2. Characteristics of Typical Areas of Household Distribution in the Rural Portion of the Prairie Provinces, K.J. Fairbairn and D. Wittkowski, University of Alberta, Edmonton, report prepared under DOC contract OSU77-00369.

3. Study of the Distribution of Households in Rural Areas, Quebec-Ontario Region, Pierre Lacasse, University of Sherbrooke, Sherbrooke, report prepared under DOC contract OSU77-00341.

4. Household Distribution in the Rural Areas of the Atlantic Provinces, L.C. MacLean and K.L. Weldon, Dalhousie University, Halifax, report prepared under DOC contract OSU77-00343.

5. Rural Demographic Study, British Columbia Region, Simon Fraser University, Burnaby, B.C., report prepared under DOC contract OSU76-00212.

6. Rural Demographic Study, Prairie Region, University of Alberta, Edmonton, report prepared under DOC contract OSU76-00217.

7. Rural Demographic Study, Quebec-Ontario Region, University of Sherbrooke, Sherbrooke, report prepared under DOC contract OSU76-00245.

8. Rural Demographic Study, Atlantic Region, Dalhousie University, Halifax, report prepared under DOC contract OSU76-00241.

9. Statistics Canada publication 92-805 (Bulletin 1-6), 1976, Census of Canada.

10. Statistics Canada Publication 93-805, 1976 Census of Canada.

APPENDIX A

MAP OF VALEMOUNT, B.C.

The map of Valemount in Professor Denike's report shows 176 households plus five motels. This map was prepared from information supplied by Ray Torchinsky of Agra Cable TV on service connections (hydro?), as of 1974.

The 1976 Census count of households for EA 010, which has boundaries that coincide with the village boundaries of Valemount, was 264.

The map shown in Fig. 51 is the block face count for EA 010 and is derived from the visitation record book for EA 010 as of the 1976 Census. The total number of private households is the sum of the block face counts, or 266. Unfortunately, Statistics Canada would not release address information for these 266 households.

Mr. G.W. Udell, the mayor of Valemount, sent a map to the present author on June 15, 1978 that identifies the precise location of 304 residences, one senior citizens' home and six motels within the village boundaries. The date of validity of the map is June 1978.

Attempts to reconcile differences between the various maps, to obtain a household location map valid as of the 1976 Census, have been unsuccessful, so it has been necessary to exclude Valemount from consideration as a typical cell. The primary cause for this action is the poor quality of the enumerator's map, fortunately a situation that did not exist for any of the other cells.

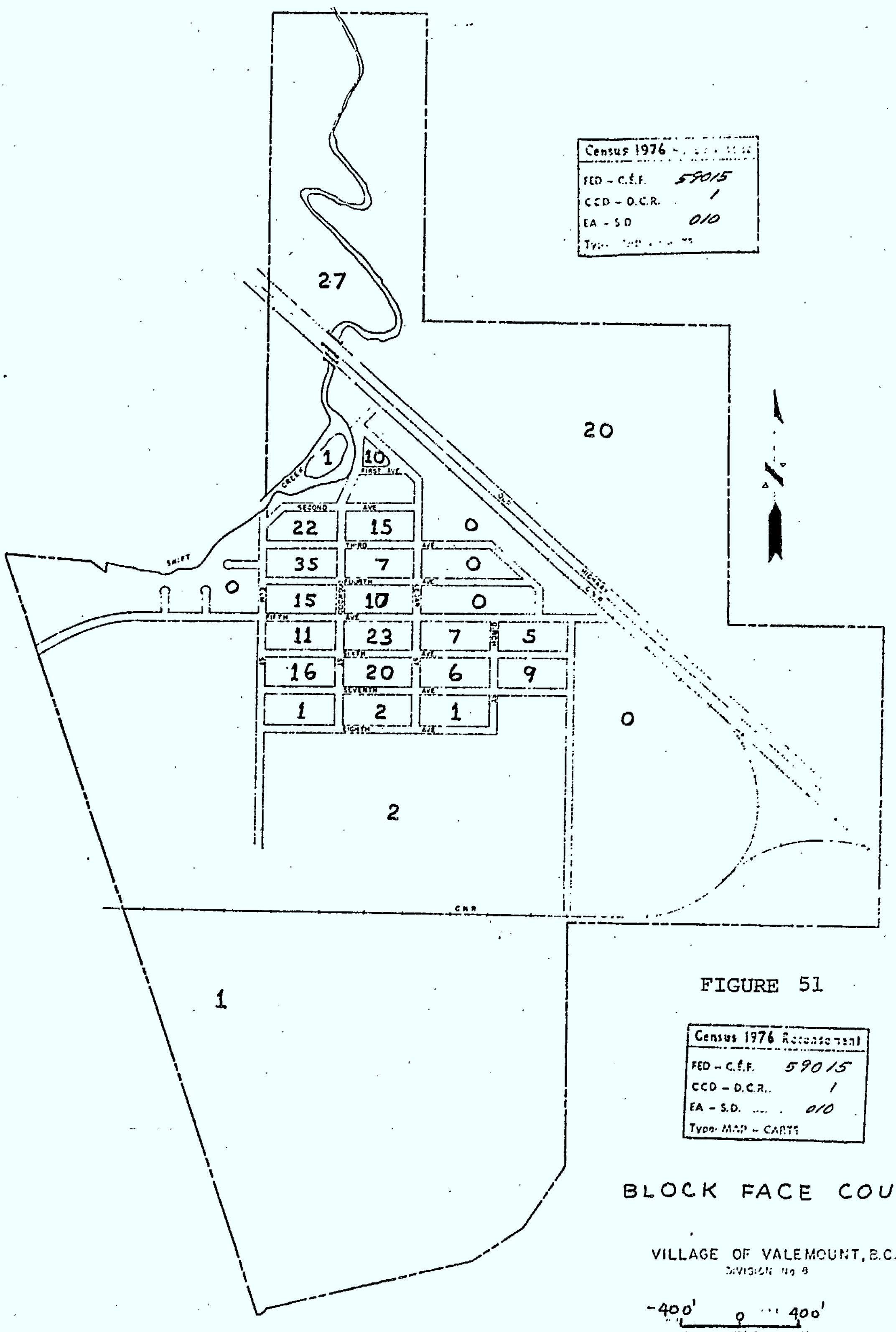


FIGURE 51

BLOCK FACE COUNTS

VILLAGE OF VALEMOUNT, B.C.

APPENDIX B

THE SCALE-UP FACTOR FOR VILLAGE-LIKE CELLS

A problem exists for the B.C. "clusters", "settlements" and "urban centers", also for the Prairie "towns", for the Ontario/Quebec "villages" and for the portions of the Atlantic cells that should be regarded as cohesive settlements. The problem is, how do we determine a scale-up factor when a "typical cell" is not representative? As an example, let us take a close look at the Prairie town cell and at the available options for solving this problem. The household location map given by Professor Fairbairn shows that the town of Rivers, Manitoba consists of two E.A.'s that contain 396 households in a tightly-knit street pattern and 5 dispersed households. This town is supposed to be typical of the towns throughout the rural E.A.'s of the Prairie Provinces. Since Prof. Fairbairn shows both unincorporated and incorporated villages on his other household location maps but with very questionable scaling (e.g. Consul, the only incorporated village mapped, is to be scaled up by the factor 120.75 -- there are certainly far more incorporated villages on the Prairies than 120!) Thus a decision, based on minimal error in modeling, must be made as to how to include incorporated villages. A summing of all incorporated villages and towns with populations less than 2500, from reference 9 shows 725 places with an average population of 501 and a total population of 363,225. In Appendix C it is shown that the best estimate available for the ratio of people to households in the Prairie portion of the rural study area is 3.352 people per household. Thus the total number of households represented by the Prairie town cell is 363,225 ÷ 3.352 = 108,361 households

and the number of Prairie "towns" of average size ~150 households is 725.*
Since Rivers, Manitoba contains 401 households it is obvious that a choice must be made for scale-up methodology. The obvious options are:

a) Household Basis: Assuming that the total number of households is to be preserved, the number of "Rivers" cells must be 108,361 ÷ 401 ≈ 270. Use of this number as a scale-up factor means introducing an error in the total number of incorporated settlements with populations < 2500 persons (e.g. 725 vs 270!).

b) Settlement Basis: Assuming that the number of settlements is of greatest importance, the scale-up factor to use is 725. Obviously this choice will result in an error in the total household count (725 x 401 = 290,725 vs 108,361!)

c) Other Criteria: One example is to scale-up the number of E.A.'s in the typical cell to correspond to the total number of E.A.'s in the "Prairie town tract". This specific example would involve a substantial amount of effort and would yield results similar to the household scale-up since the number of households per E.A. is approximately constant.

Some of the maps for "village-type" areas show multiple E.A.'s and contiguousness with neighbouring built-up areas. The effect of these two characteristics on our usage of the data in communication system costing is such as to mean that the minimal error will be obtained if we use method a) above. Granted some predictions will be in error but many of the errors will compensate out when the data is combined into a "rural Canada" representation.

* These numbers are used for illustration purposes only. The most accurate population and household data are given in Table 6.

APPENDIX C

PERSONS PER HOUSEHOLD AND NUMBER OF HOUSEHOLDS

Table 16 provides good approximations for the household size and number of households throughout the rural study area. Columns 2 to 6 were obtained from reference 10. It should be noted that "S.C. Rural" includes all E.A.'s with a density less than 1 person per square mile and that S.C. 1000-2500 contains many E.A.'s already counted as S.C. rural. Thus, the total of 272,920 for Newfoundland in column 8 (which is the sum of the column 2 and 5 entries) differs from the number 278,367 given in column 11, the latter being the number of people in Newfoundland considered to be rural, based on the DOC definition given in the Introduction. Insofar as the present report is concerned, the most important entries are those in columns 11 and 12.

* No. of HH = 9 x 10 (exc. totals)
** HH Size = 10 ÷ 11

PROVINCE	STATISTICS CANADA RURAL			STATISTICS CANADA-pop'n=1000-2500			TOTAL			DOC RURAL		
	1 Population	2 No. of HH	3 HH Size	4 Population	5 No. of HH	6 HH Size	7 Population	8 No. of HH	9 HH Size	10 Population	11* No. of HH	12** HH Size
Newfoundland	225,875	51,520	4.384	47,045	10,535	4.466	272,920	62,055	4.398	278,367	63,294	4.398
PEI	73,065	19,965	3.660	6,470	1,920	3.370	79,535	21,885	3.634	86,972	23,933	3.634
Nova Scotia	358,960	103,555	3.466	31,870	9,545	3.339	390,830	113,100	3.456	382,643	110,718	3.456
New Brunswick	318,160	84,645	3.759	34,470	9,785	3.523	352,630	94,430	3.734	357,966	95,867	3.734
TOTAL	976,060	259,685	3.759	119,855	31,785	3.771	1,095,915	291,470	3.760	1105,948	293,812	3.764
Quebec	1,275,925	336,230	3.795	189,090	54,395	3.476	1,465,015	390,625	3.750	1,492,390	397,971	3.750
Ontario	1,523,715	445,350	3.421	158,495	52,785	3.003	1682,210	498,135	3.377	1,674,050	495,721	3.377
TOTAL	2,799,640	781,580	3.582	347,585	107,180	3.243	3147,225	888,760	3.541	3,166,440	893,692	3.543
Manitoba	295,855	85,212	3.472	37,210	12,835	2.899	333,065	98,047	3.397	333,915	98,297	3.397
Saskatchewan	399,930	120,555	3.317	52,035	18,655	2.789	451,965	139,210	3.247	449,903	138,560	3.247
Alberta	441,930	127,195	3.474	63,400	20,500	3.093	505,330	147,695	3.421	499,214	145,926	3.421
TOTAL	1,137,715	332,962	3.417	152,645	51,990	2.936	1,290,360	384,952	3.352	1,283,032	382,783	3.352
British Columbia	555,735	172,345	3.225	68,815	22,285	3.088	624,550	194,630	3.209	576,348	179,604	3.209
Canada (exc. Yukon & N.W.T.)	5,469,150	1,546,572	3.536	688,900	213,240	3.231	6,158,050	1,759,812	3.499	6,131,768	1,749,891	3.504

TABLE 16

HOUSEHOLD COUNT AND SIZE PER PROVINCE

APPENDIX D

THE PERIPHERY PROBLEM - IRRIGATION DISTRICT MAP

The problem considered here is how to modify the map supplied by Professor Fairbairn to assign the most likely number of households to each community (See App. H) that is at the edge of the supplied map. Since we have no knowledge of the household locations just outside of the supplied map, the question arises as to whether each single household on the periphery of the supplied map should be considered as a single household community, as half of a double household community or as a household belonging to an even larger community. This problem which henceforth will be referred to as the periphery problem exists for all maps that have a non-trivial number of households around the edge. For example, this problem usually exists when a road goes along one of the map boundaries. The three maps that require modification due to the existence of the periphery problem are considered in detail in Appendices D, E and F.

The methodology used in the following analysis in essense consists of using the statistics of interior communities to predict the most likely occurence of boundary communities. The steps involved are:

i) Counting the number of communities (defined as in Appendix H) on interior roads that have (a) one household only, i.e. $n(1,0) + n(0,1)$; (b) two households, both being on one side of the road, i.e. $n(2,0) + n(0,2)$; (c) two households, one on each side of the road, i.e. $n(1,1)$,; (d) three households ...etc. The notation $n(i,j)$ means the number of interior communities that consist of i households on one side of the road and j households on the other side.

ii) Counting the number of communities on the exterior boundary of the map that have $i = 1, 2, 3$ etc. households. The notation $\sum_j N(i,j)$ represents this number. For example if $\sum_j N(2,j) = 3$, there are three communities shown on the contractors map that consist of two households and that have one or both households within 500 ft of the map boundary.

iii) Calculating the conditional probability of m households on one side of a road belonging to the same community that has n households on the other side of the road, for the interior communities and thus the data in i) above (P (n,m)).

iv) Calculating the expected number of edge communities that contain one or more of the households considered in ii) above. This calculation will provide, for example, a numerical value for N (1,2) which refers to the number of edge communities that have three households, one of them being on the map and two being off.

v) Calculating the expected number of edge communities that exist in totality just off of the supplied map. For example N (0,3) refers to the number of edge communities having three households, all three being off of the supplied map.

vi) Adding the results from iv) and v), dividing by two, then adding up all components that go into making up the community size distribution for the altered map (the alteration being done to solve the peripheral problem).

ii) Modifying the supplied map by adding or deleting edge households (both within and exterior to the map boundaries) to give the community size distribution function obtained in vi) above.

Applying the above methodology to the Irrigation District map gives:

i) $N(1,0) + N(0,1) = 118$

$N(0,2) + N(2,0) = 48$

$N(1,1) = 11$

$N(1,2) + N(2,1) = 8$

$N(0,3) + N(3,0) = 3$

$N(1,3) + N(3,1) = 1$

$N(2,2) = 1$

$N(0,5) + N(5,0) = 1$

$N(2,3) + N(3,2) = 4$

$N(1,5) + N(5,1) = 1$

$N(3,3) = 1$

$N(2,5) + N(5,2) = 1$

ii) $\sum_j N(1,j) = 15, \quad \sum_j N(2,j) = 3, \quad \sum_j N(4,j) = 1$

iii) It is reasonable to assume that a good approximation for each double entry in i) above is obtained by halving the right hand side. Thus

$$\left.\begin{array}{l} n(0,1) = 59 \\ n(0,2) = 24 \\ n(0,3) = 1.5 \\ n(0,5) = 0.5 \end{array}\right\} \quad \left\{\begin{array}{l} P\ (0,1) = 59/(59 + 24 + 1.5 + 0.5) = 0.694 \\ \text{similarly } P\ (0,2) = 0.282 \\ P\ (0,3) = 0.018 \\ P\ (0.4) = 0.0059 \end{array}\right.$$

n(1,0) = 59	P(1,0) = 0.787
n(1,1) = 11	P(1,1) = 0.147
n(1,2) = 4	P(1,2) = 0.053
n(1,3) = 0.5	P(1,3) = 0.0067
n(1,5) = 0.5	P(1,5) = 0.0067
n(2,0) = 24	P(2,0) = 0.762
n(2,1) = 4	P(2,1) = 0.127
n(2,2) = 1	P(2,2) = 0.032
n(2,3) = 2	P(2,3) = 0.064
n(2,5) = 0.5	P(2,5) = 0.016
n(3,0) = 1.5	P(3,0) = 0.3
n(3,1) = 0.5	P(3,1) = 0.1
n(3,2) = 2	P(3,2) = 0.4
n(3,3) = 1	P(3,3) = 0.2

iv) $N(1,0) = (\sum_j N(1,j)) \times P(1,0)$

$= 15 \times .787 \simeq 12$

$N(1,1) =$ similarly $15 \times .147 \simeq 2$

$N(1,2) \simeq 1$

$N(1,3) \simeq 0$

$N(2,0) = 3 \times .762 \simeq 2$

v) The problem now arises as to what is the minimal error method for predicting the values for N(0,1), N(0,2) etc. Since several possibilities exist due to the multiplicity of data and since the data is expected to be inconsistent because of the large variations due to small number statistics, the average result from two methods is considered to be fairly reliable. Thus, one approximation for

N(0,1) is N(0,1) $\simeq$ N(1,0) or 12. Another is

N(0,1) $\triangleq$ P(0,1) x N(0,2) $\div$ P(0,2) or

.694 x 2.29 $\div$ .282 or 6. The average of these two

numbers is (12 + 6) $\div$ 2 = 9. The following numbers were

obtained using this averaging method:

N(0,1) = 9

N(0,2) = 4

N(0,3) = 0

vi) Considering 2N(i) as the notation for the number of edge communities regardless of whether the component households are on or off the map, gives:

2N(1) = N(0,1) + N(1,0) = 9 + 12 = 21

2N(2) = N(1,1) + N(0,2) + N(2,0) = 2 + 4 + 2 = 8

2N(3) = N(1,2) + N(2,1) + N(0,3) + N(3,0) = 1 + 0 + 0 + 0 = 1

2N(4) = N(2,2) + N(1,3) + N(3,1) + N(0,4) + N(4,0) = 0 + 0 + 0 + 0 + 1 = 1

The above numbers must be halved if we are to consider only the communities that are attributable to the area of the supplied map. Considering N(i) as the notation for these communities,

N(1) = 10

N(2) = 4

N(4) = 1

where judgement has been exercised to determine when "half-communities" should be considered or ignored.

The community size distribution for the modified map is given in Table 17.

TABLE 17

IRRIGATION DISTRICT COMMUNITY SIZE DISTRIBUTION

H.H. per Community	No. of Interior Communities*		No. of Edge Communities	Total No. of Communities	Total No. of Households	Cumulative No. of Communities
	on roads	off roads				
1	118	18	10	146	146	239
2	59	4	4	67	134	93
3	11	2		13	39	26
4	2	1	1	4	16	13
5	5			5	25	9
6	2			2	12	4
7	1			1	7	2
27	1			1	27	1
					406	

* Households in communities (App. H) within 500' of Coaldale and Lethbridge were considered urban and thus were omitted from consideration.

vii) The modified map is given in Fig. 15. It should be noted that this is a map that does not correspond to the real situation because of the few changes made around the edge (additions and deletions of households) but, insofar as the objective of accurate costing of communication systems is concerned, the modification is essential to yield an accurate scale-up factor (needed to permit generalization to the larger area).

APPENDIX E

THE PERIPHERY PROBLEM - ONTARIO, TYPE 2 CELL, TOWNSHIP/MUNICIPALITY

The methodology explained in App. D will be used. The results are:

i)
$$n(1,0) + n(1,1) = 107$$
$$n(0,2) + n(2,0) = 18$$
$$n(1,1) = 16$$
$$n(1,2) + n(2,1) = 15$$
$$n(3,0) + n(0,3) = 4$$
$$n(1,3) + n(3,1) = 4$$
$$n(2,2) = 5$$
$$n(0,4) + n(4,0) = 1$$
$$n(2,3) + n(3,2) = 1$$
$$n(3,4) + n(4,3) = 2$$

ii) $\sum_j N(1,j) = 44$, $\sum_j N(2,j) = 7$

iii)

$n(0,1) = 53.5$	$P(0,1) = .823$
$n(0,2) = 9$	$P(0,2) = .139$
$n(0,3) = 2$	$P(0,3) = .031$
$n(0,4) = .5$	$P(0,4) = .0077$
$n(1,0) = 53.5$	$P(1,0) = .677$
$n(1,1) = 16$	$P(1,1) = .203$
$n(0,2) = 7.5$	$P(1,2) = .095$
$n(1,3) = 2$	$P(1,3) = .025$
$n(2,0) = 9$	$P(2,0) = .409$
$n(2,1) = 7.5$	$P(2,1) = .341$
$n(2,2) = 5$	$P(2,2) = .227$
$n(2,3) = .5$	$P(2,3) = .0227$

iv) $N(1,0) \simeq .677 \times 44 = 29.8$

$N(1,1) = 8.9$

$N(1,2) = 4.2$

$N(1,3) = 1.1$

$N(2,0) = 2.9$

$N(2,1) = 2.4$

$N(2,2) = 1.6$

v) $N(0,1) \triangleq N(1,0) = 29.8$ is one approximation for $N(0,1)$.

Another is $N(0,1) \triangleq P(0,1) \times N(0,2)/P(0,2)$

or $.823 \times 2.9/.139 \simeq 17.2$. The average is $N(0,1) \simeq (29.8 + 17.2)/2 \simeq 24$. Similarly, $N(0,2) \approx 0.5 \times (N(2,0) + P(0,2) \times N(0,1)/P(0,1)) \simeq .5 \times (5 + 2.9) \simeq 4$. Similarly $N(0,3) \simeq 0.5 \times (N(3,0) + P(0,3) \times N(0,1)/P(0,1)) = .5 \times (1.1 + .6) \simeq 1$.

vi) $2N(1) = 54$, $2N(2) = 16$, $2N(3) = 7.6$, $2N(4) = 2.6$

Therefore,

$N(1) \simeq 27$, $N(4) = 8$, $N(3) \simeq 4$, $N(4) \simeq 1$

All of the analysis in this Appendix has been concerned with small communities containing up to four households. There is a problem with larger edge communities. It is proposed that the size of the cell be doubled and that the N(8) community on the west edge of EA 66 be considered as containing 10 households, the N(12) community in the N.E. corner of EA 002 be considered as containing 16 households and the N(14) community on the east edge of EA 002 be considered as containing 28 households.

vii) The community size distribution for the modified map is given in Table 18.

The map given in Fig. 19 incorporates the above modifications.

<u>NOTE</u>: Care must be exercised in using Fig. 19. Peripheral corrections have been made on this Figure that may or may not be required by the user, depending upon the application. It is suggested that the map is valid for most applications if one counts the households inside of the dashed lines once and counts all others twice. Of course the area is then doubled, i.e. 2 x 52.32 = 104.64 sq. miles. There are, unfortunately, exceptions to this type of weighting; the linear density calculations in section 5.2 consider the households inside the dashed lines once and other <u>non-peripheral</u> households twice. In this example peripheral communities, and households, are ignored because their linear density measured from Fig. 19 would be fallaciously low.

TABLE 18

ONTARIO, TYPE 2 CELL, TOWNSHIP/MUNICIPALITY

(*Note: Area is doubled, i.e. 2 x 52.32 = 104.64 sq. miles)

H.H. per Community	No. of Interior Communities		No. of Edge Communities*	Total No. of Communities	Total No. of Households	Cumulative No. of Communities
	On Roads	Off Roads				
1	214	40	54	308	308	481
2	68	2	16	86	172	173
3	38		8	46	138	87
4	20		2	22	88	41
5	2			2	10	19
7	4			4	28	17
8	2			2	16	13
10			1	1	10	11
16			1	1	16	10
28			1	1	28	9
30	2			2	60	8
37	2			2	74	6
38	2			2	76	4
103	2			2	206	2
TOTAL				481	1,230	

APPENDIX F

THE PERIPHERY PROBLEM - ONT/QUE TYPE 3 CELL, DISPERSED

The meandering road pattern, lack of cell boundary roads and fact that many houses can be associated with more than one road makes the procedure used in Appendices D and E inapplicable. The method to be used here consists of altering the 19 households, 12 community, map-edge community size distribution to match the size distribution for interior communities. The interior community size distribution is: N(1)= 42, N(2)= 12, N(3)= 6, N(4)= 3, N(5)= 3, N(6)= 1 for the smaller communities. The corresponding probabilities of existence are P(1)= 42/(42+12+6+3+3+1)= .359, P(2)= .205, P(3)= .154, P(4)= .103, P(5)= .128, P(6)= .051. The edge community size distribution (as given on the original map) is N(1)= 7, N (3)= 4, N(8)= 1. Considering only the smaller communities, N(1) and N(3), the total number of households is 19. One approximation that is an attempt to re-assign these 19 households to non-edge communities is N(1)= 19 x P(1) = 7, N(2)= P(2) x 19/2 = 2, N(3)= P(3) x19/3 = 1 and N(4)= P(4) x 19/4 = 1, which yields 11 communities and 17 households. Comparison with the N(1)= 7, N(3)= 4 data shows too much inconsistency, even though we are dealing here with small numbers and therefore large statistical variations. A compromise is N(1)= 5, N(2)= 2, N(3)= 2 and N(4)= 1 for the edge communities and the modified size distribution is given in Table 19.

It should also be noted that the town of Richmond, which contained 4,021 persons, according to the 1976 Census, is at the southern edge of this cell. Three groups of households contiguous with Richmond, (n(15), n(37) and n(92)), that were on Prof. Lacasse's original map are omitted from Table 19, because it is considered that these households are a part of an urban center, rather than having rural attributes. The map shown in Fig. 20 incorporates the above modifications.

TABLE 19

ONTARIO/QUEBEC, TYPE 3 CELL, DISPERSED

H.H. per Community	No. of Communities			Total No. of Households	Cumulative No. of Communities
	Interior	Edge	Total		
1	42	5	47	47	84
2	12	2	14	28	37
3	6	2	8	24	23
4	3	1	4	16	15
5	3		3	15	11
6	1		1	6	8
8	3	1	4	32	7
11	1		1	11	3
12	1		1	12	2
13	1		1	13	1
TOTAL			84	204	

APPENDIX G

RANK/SIZE CURVES

This appendix is based on the concept that a community is defined as a group of households that is physically close together. Further explanation of this concept is given in Appendix H. The reader must be cautioned that care should be used in interpreting or using the results given in the present appendix, because of the unusual definition that has been used for this word "community".

Conventional rank-size curves provide the geographer with an easily implemented and understood graph of the distribution function for the size of settlements. One example is a plot of municipality size vs the rank (the cumulative number of municipalities), starting with the largest municipality. A plot of this function, based on 1976 census data, is given in Fig. 52 One interesting aspect of this plot is that the slope is virtually constant, with value close to -1, over two decades. The variation at the left end of the curve can be attributed to large variations because of the small sample and/or anomalies such as Toronto being composed of multiple municipalities. The abrupt tailing-off at the right end could be due to the fact that a municipality is a geostatistical unit (town, village, etc.) that of necessity almost always contains some minimum number of people -- the curve appears to indicate that the concept of a municipality becomes inappropriate when the population is less than about 600 people.

Another example of a rank-size curve is shown in Fig. 53 where it is evident that the population of Canada's largest metropolitan centers follow a rank-size curve with a slope of again very close to -1.

The present report is concerned with the far right hand side of the rank-size curves just discussed. Specifically, it is concerned with proposing a more useful definition for a community (See App. H) than simply accepting

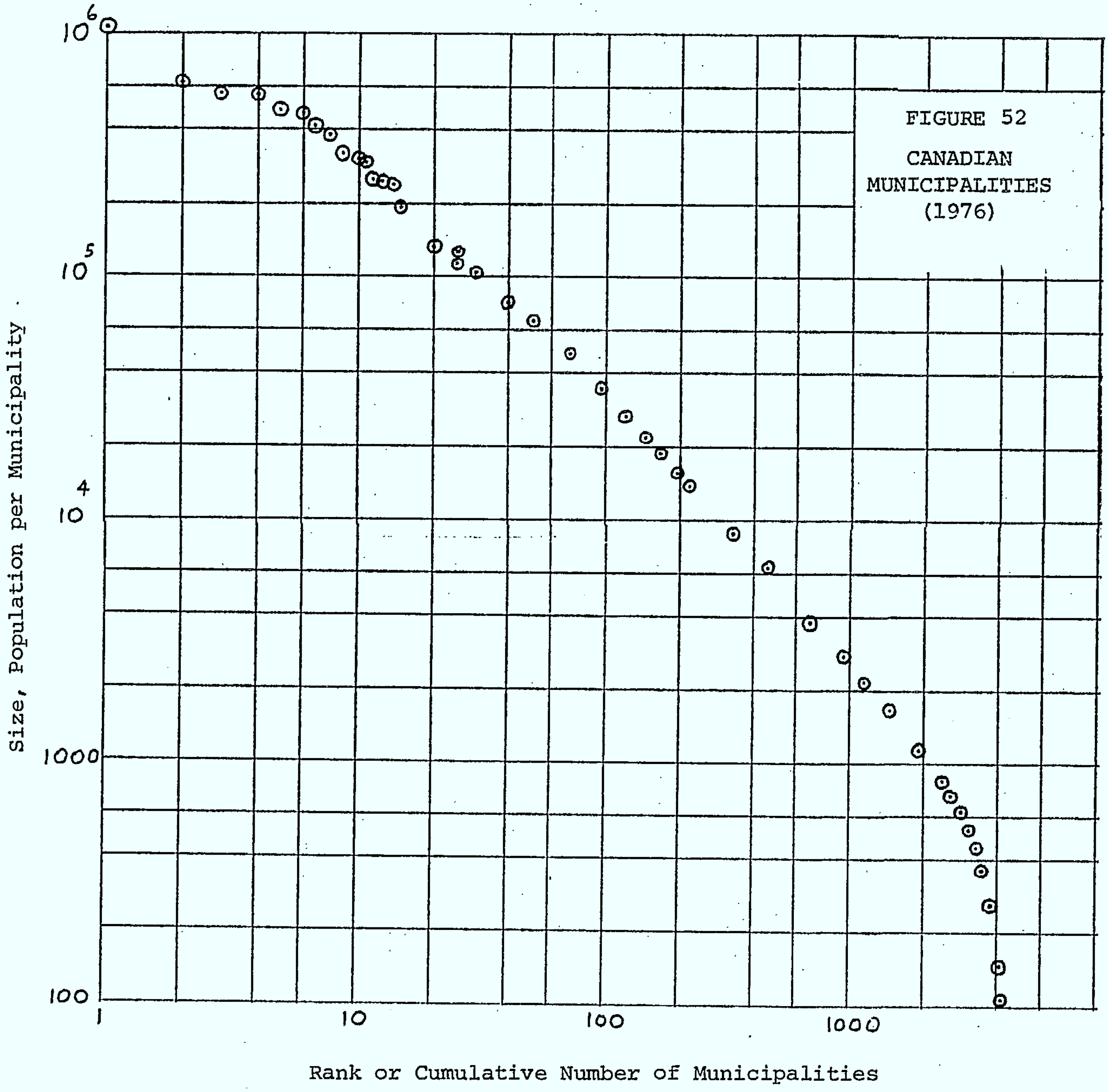


FIGURE 52
CANADIAN MUNICIPALITIES (1976)
10^6
10^5
10^4
1000
100
1
10
100
1000
Size, Population per Municipality
Rank or Cumulative Number of Municipalities

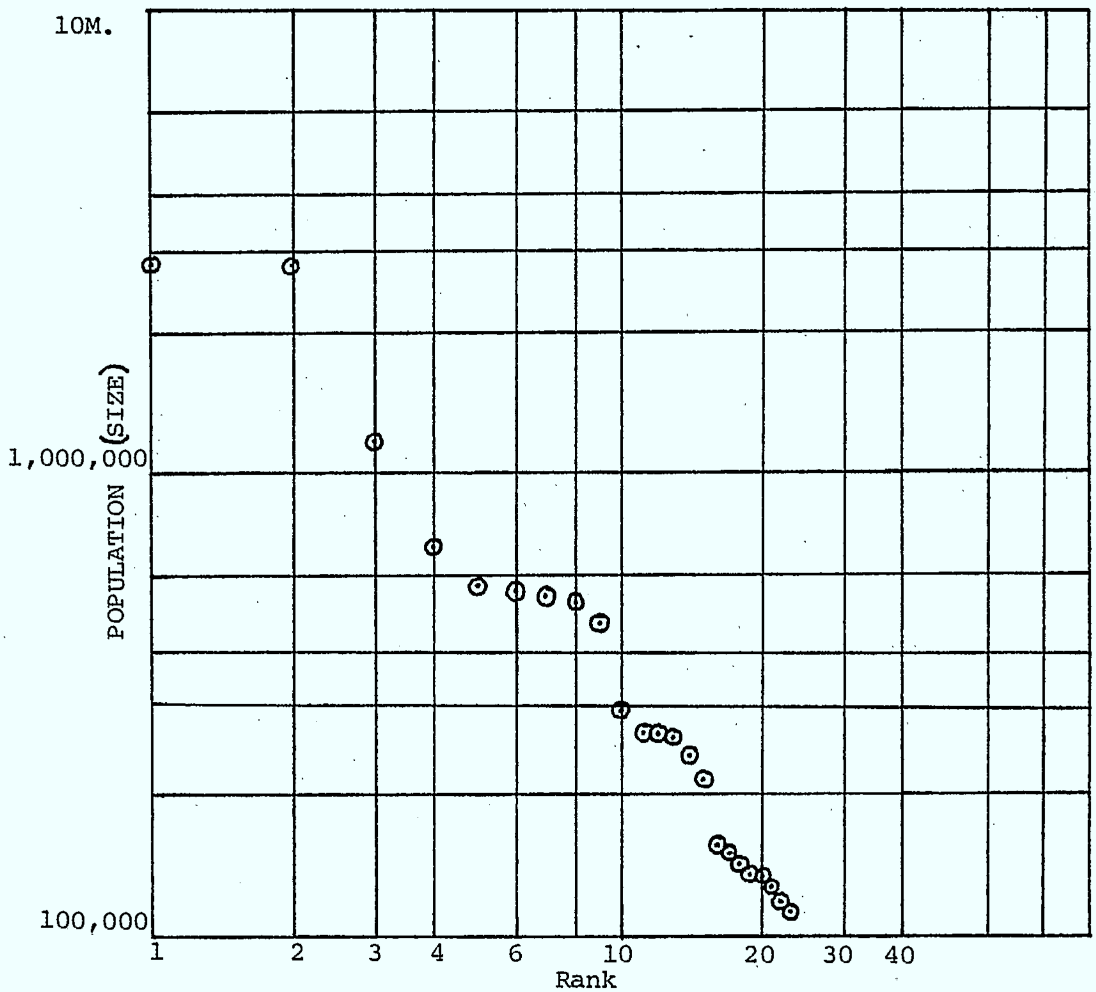


FIG. 53

RANK/SIZE CURVE FOR THE CANADIAN CENSUS METROPOLITAN AREAS (1976 Census) the conventional geo-political definition commonly used (town, municipality, etc.) The objective has been to determine, on the basis of household location only, the number of communities comprising 100, 99, 98, ... 10, 9, 8, 7, 6, 5, 4, 3, 2 and 1 households, whether these communities are unincorporated villages, cross-road communities or isolated farm households.

The rank-size curves given in Figs 54 to 76 correspond to all cells listed in Table 9, excepting settlements. The more interesting aspects of the curves are pointed out in Fig. 77 where the effects of work activities, terrain and proximity to a large center are shown to alter the curve in various ways.

The uniformity of the curves in Figs 52 and 53 over about two decades seems to indicate that there is an underlying reason for a -1 slope. One explanation for such a slope is based on the assumption of exponential growth of communities with time. The only difficult aspect of this model is to accept the necessary hypothesis that size = 1 units appear at a rate proportional to the entire population, which is, again, however, not an untenable assumption. The effect of constraints or external forces in such a natural growth model would be to alter the curve in some predictable fashion. For example, i) if people are forced to live on the land from which they derive their income, and if there are no major alternative ways of earning a living, there will be a disproportionately large number of isolated households (c.f. "agriculture" in Fig. 77). Similarly, 2) If income is being derived by service, industrial and other urban-type activities, there will be a tendency for people to cluster together into larger communities (c.f. "urbanizing" in Fig. 77).

The composite rank-size curve for all of rural Canada, based on the six-cell model, is given in Table 20. This data was obtained by scaling-up the six-cell community size data shown in Table 21 and is plotted in Figs 78 and 79. It is of interest to note that the tail-off shown in Fig 52 when population < 600 per municipality is now explained and, in fact, the rank-size curve in Fig. 79 has a -1 slope for 200 $\geq$ households per community > 10 and a -0.6 slope for 10 > households per community $\geq$ 1. The small slope for the smaller communities is attributable to the large number of farms in rural Canada.

The change in slope, as the community size decreases, is due in part to ignoring the existence of all cities and other incorporated settlements and due in part to the increasing household size.

Finally, Table 22 is a complete listing of the rank/size data for all constituents of the 32-cell model considered in Chapter 3. The cells for the Atlantic provinces are broken down into two components, where warranted, the components being the core area and the environs area. This differentiation was explained in Chapter 4.

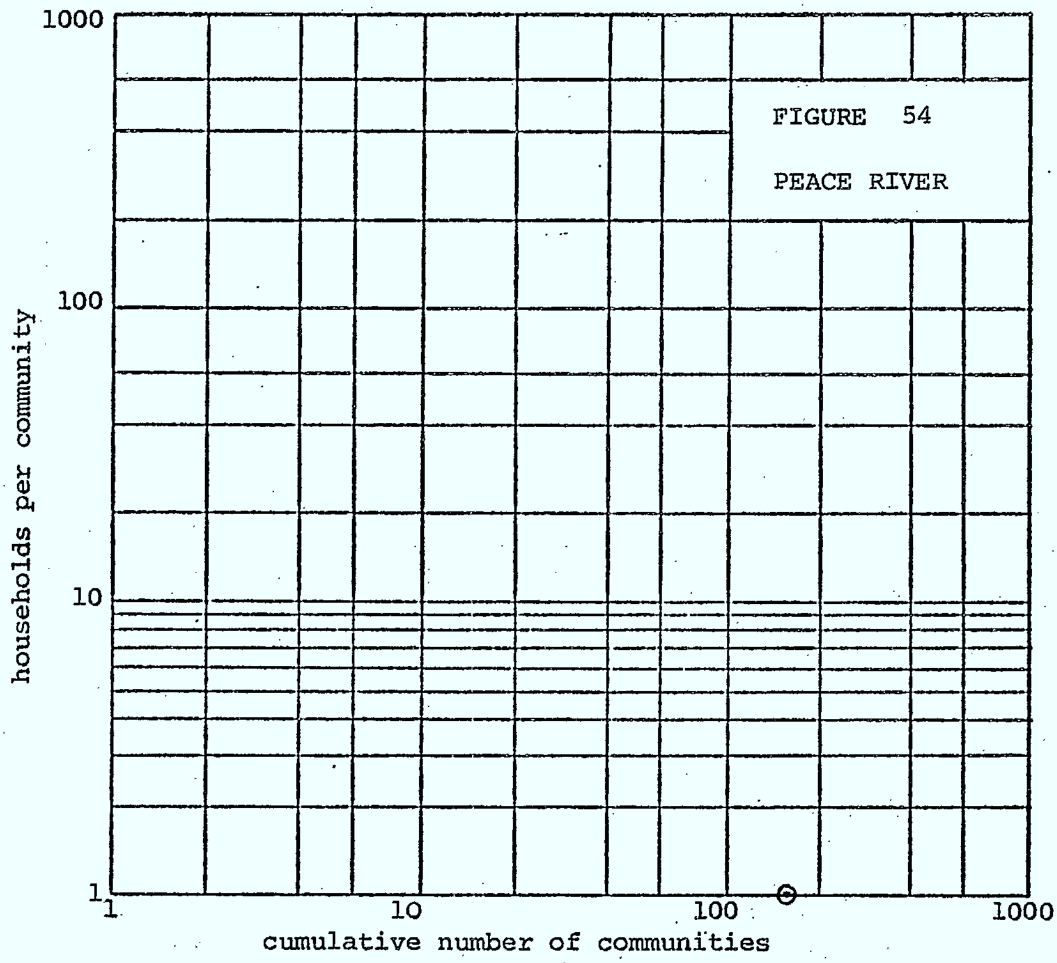


FIGURE 54
PEACE RIVER
households per community
cumulative number of communities
1
10
100
1000

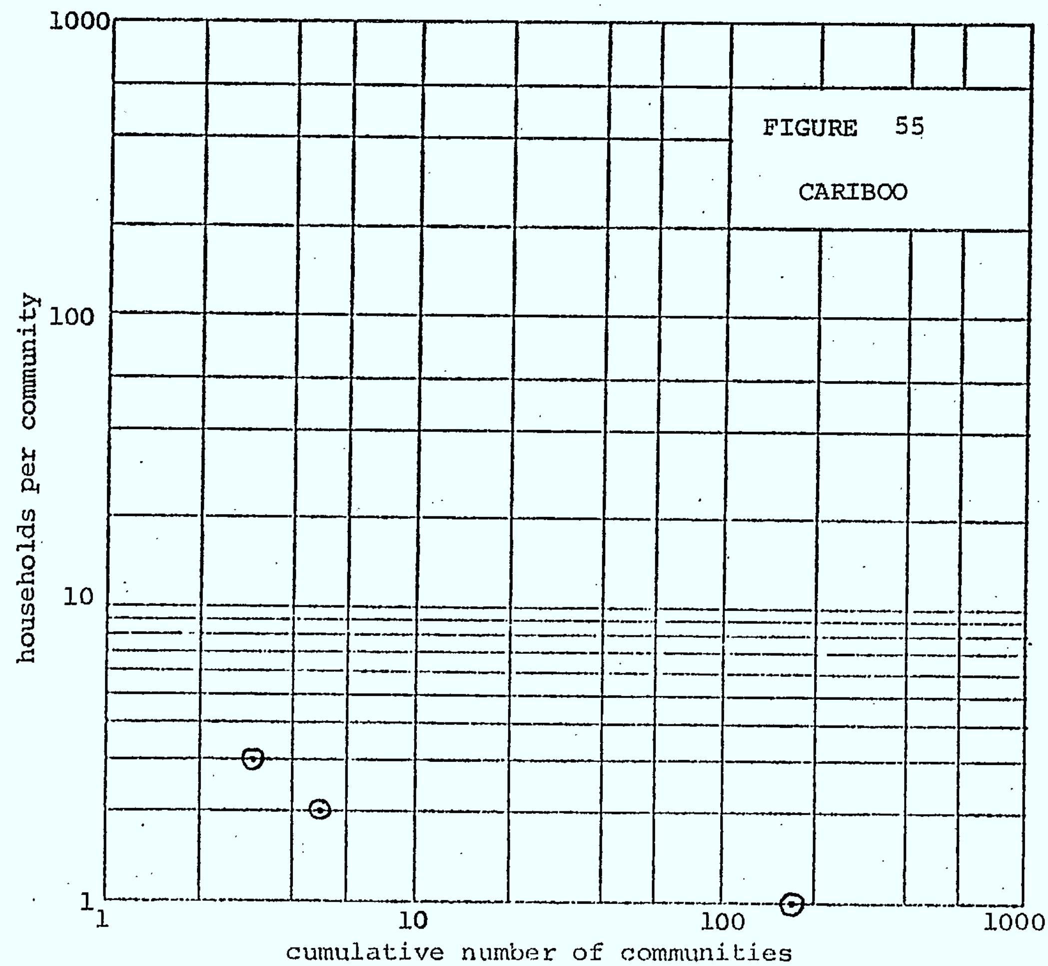


FIGURE 55
CARIBOO
households per community
cumulative number of communities
1
10
100
1000

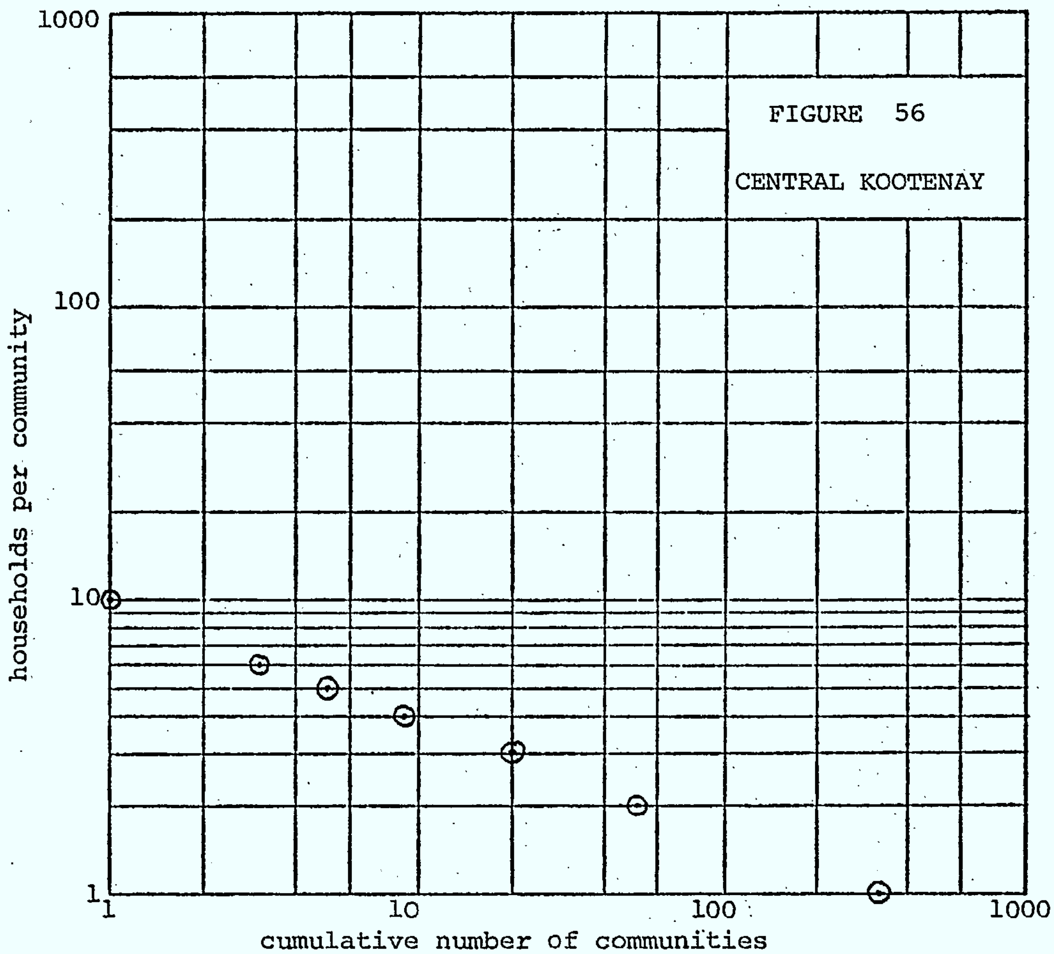


FIGURE 56
CENTRAL KOOTENAY
households per community
1000
100
10
1
1
10
100
1000
cumulative number of communities

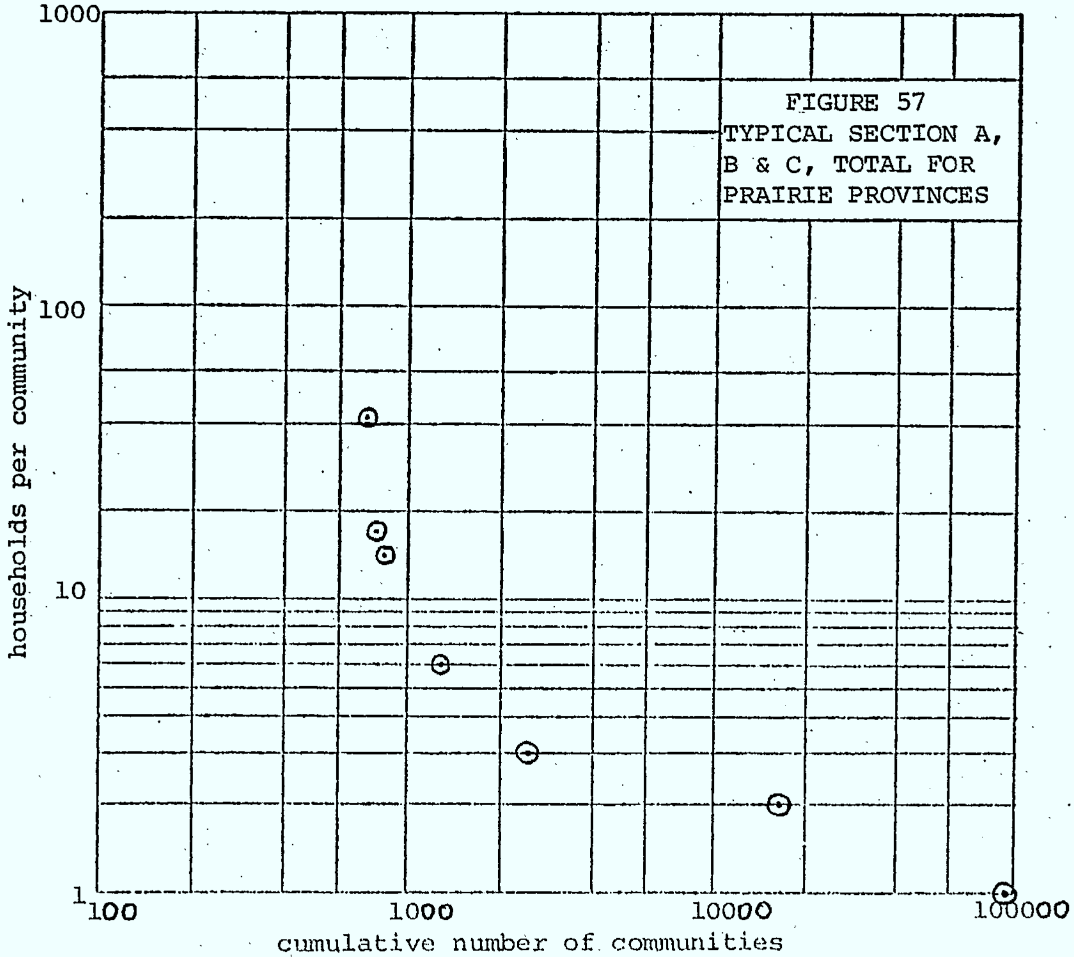


FIGURE 57
TYPICAL SECTION A, B & C, TOTAL FOR PRAIRIE PROVINCES
households per community
1000
100
10
1
100
1000
10000
100000
cumulative number of communities

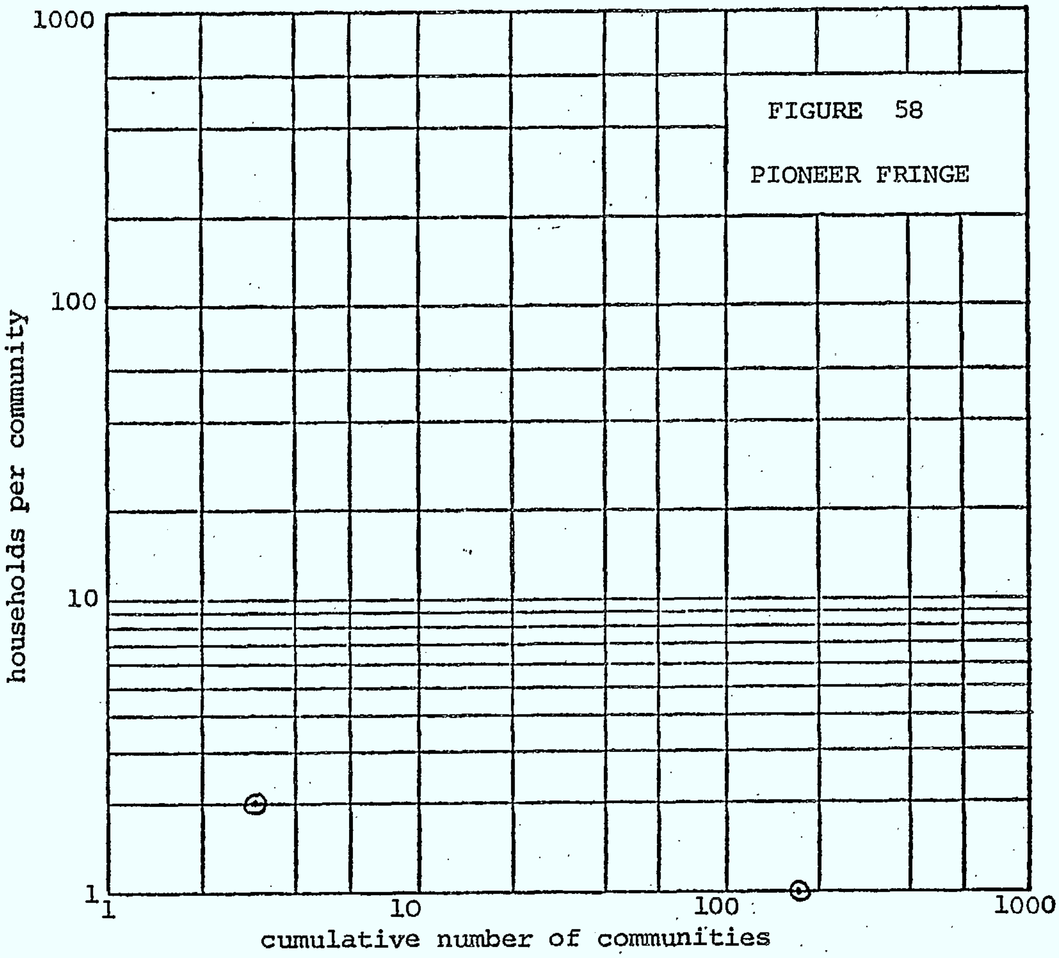


FIGURE 58
PIONEER FRINGE
households per community
1000
100
10
1
1
10
100
1000
cumulative number of communities

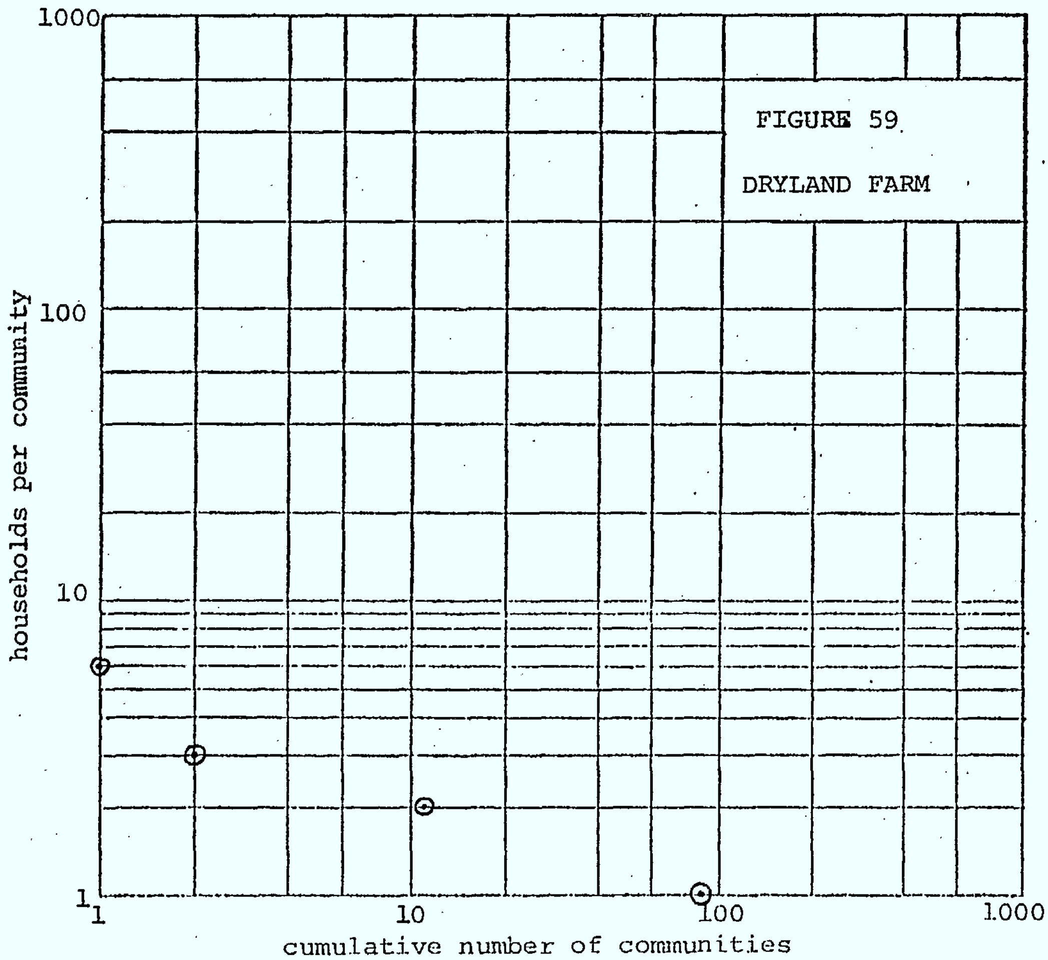
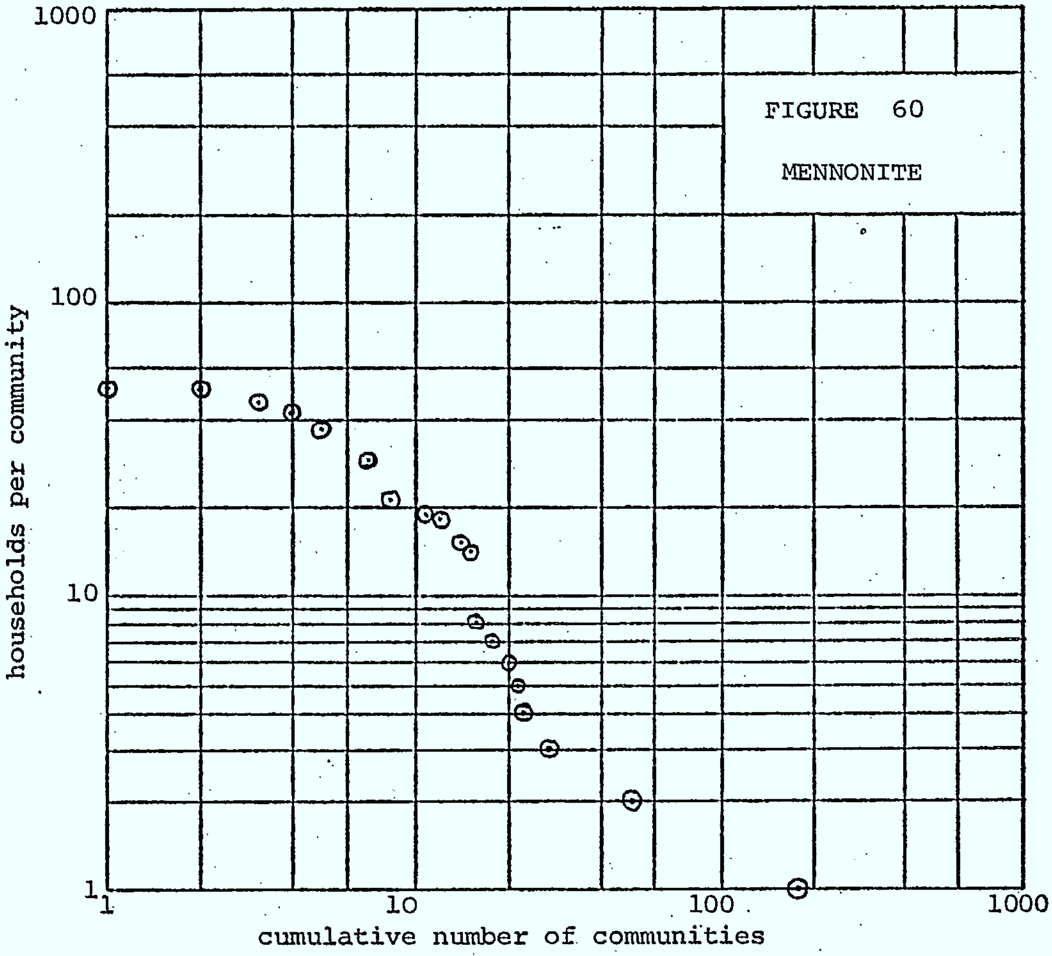
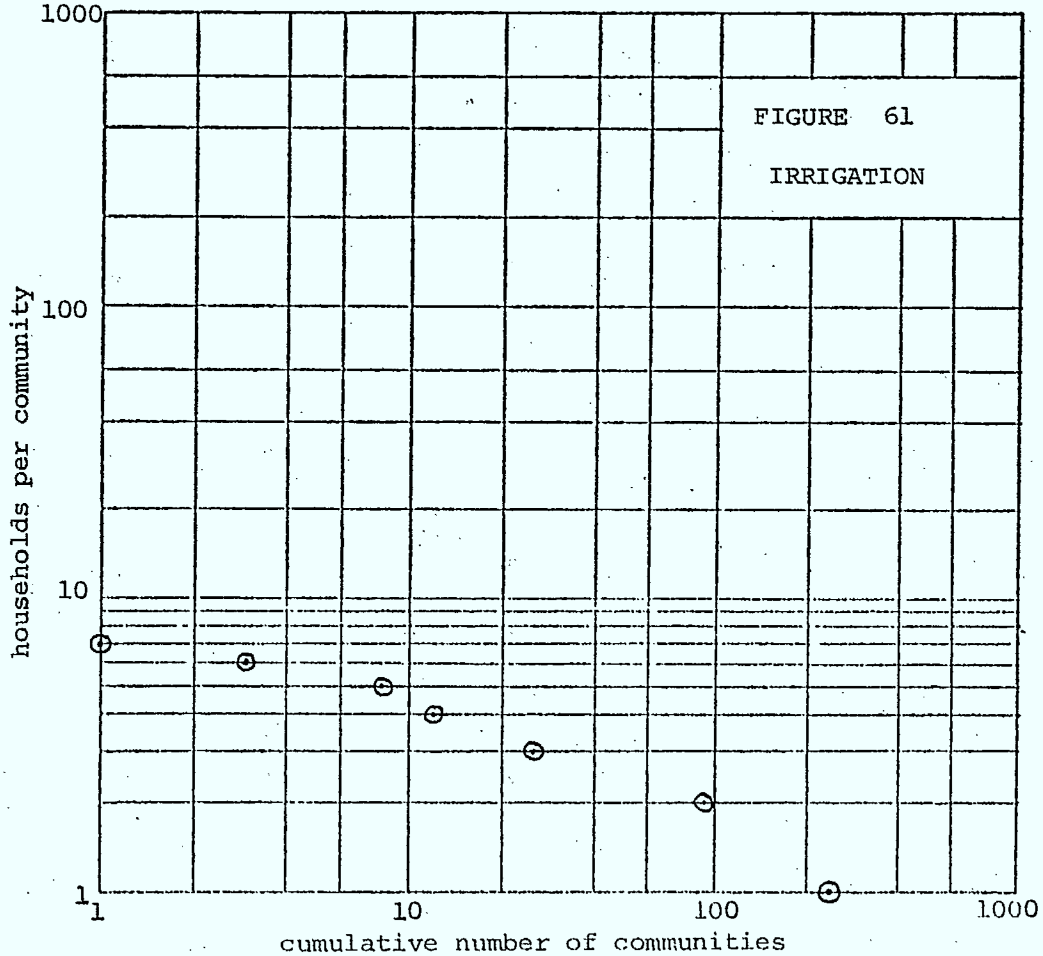


FIGURE 59
DRYLAND FARM
households per community
1000
100
10
1
1
10
100
1000
cumulative number of communities


1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities
FIGURE 60
MENNONITE


1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities
FIGURE 61
IRRIGATION

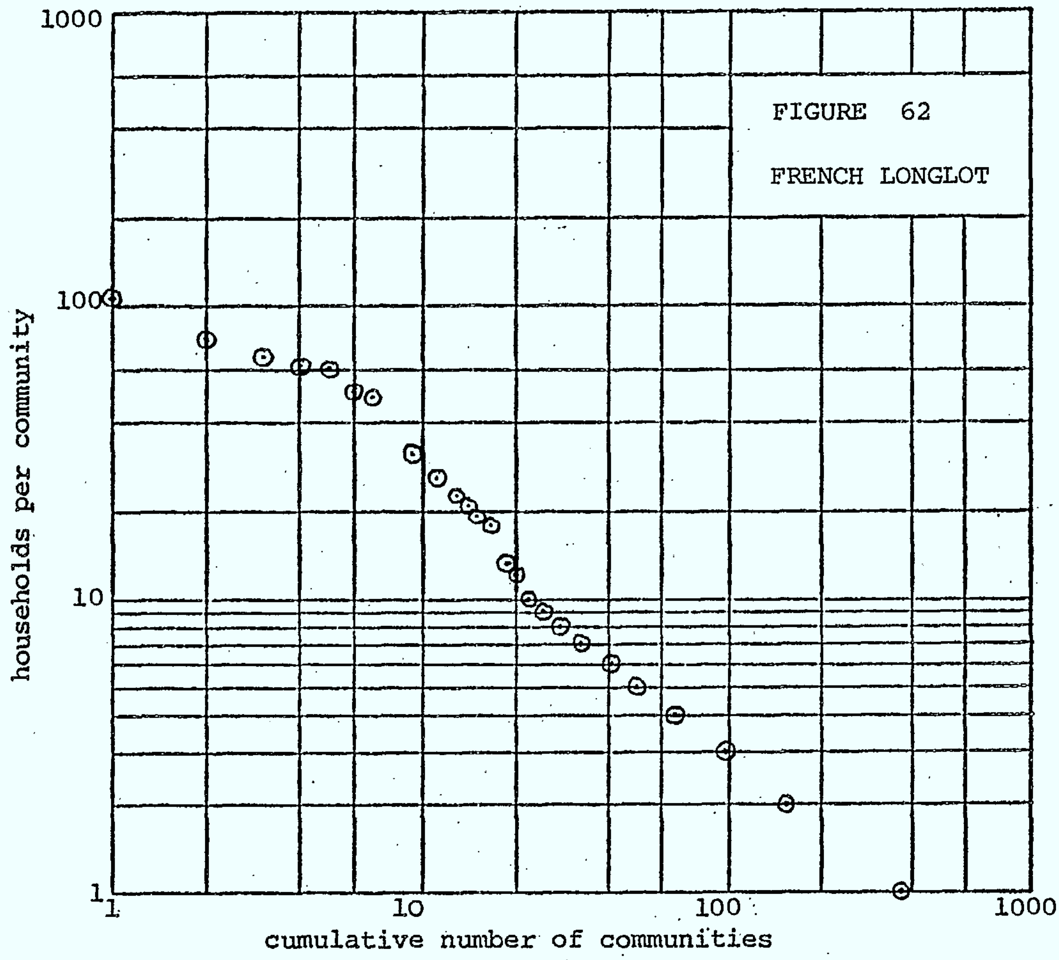


FIGURE 62
FRENCH LONGLOT
households per community
cumulative number of communities
1000
100
10
1
1
10
100
1000

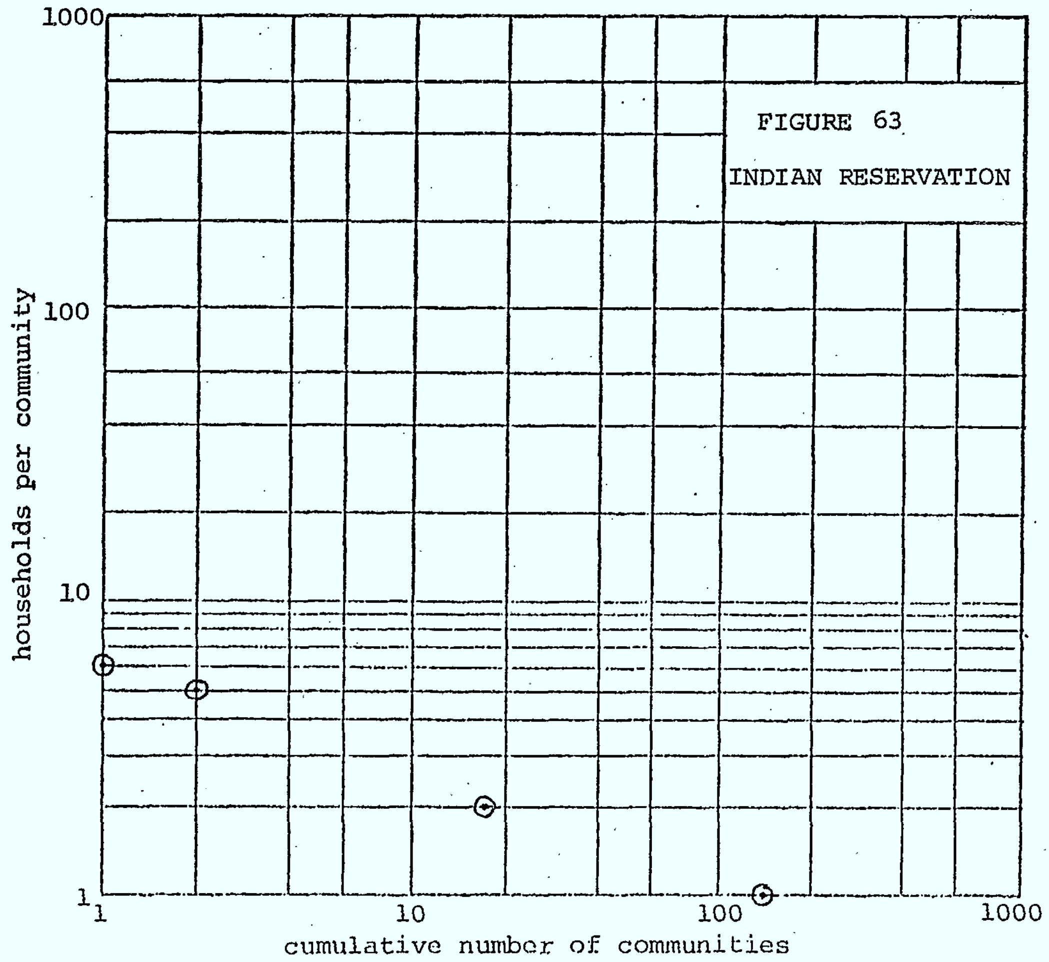


FIGURE 63
INDIAN RESERVATION
households per community
cumulative number of communities
1000
100
10
1
1
10
100
1000

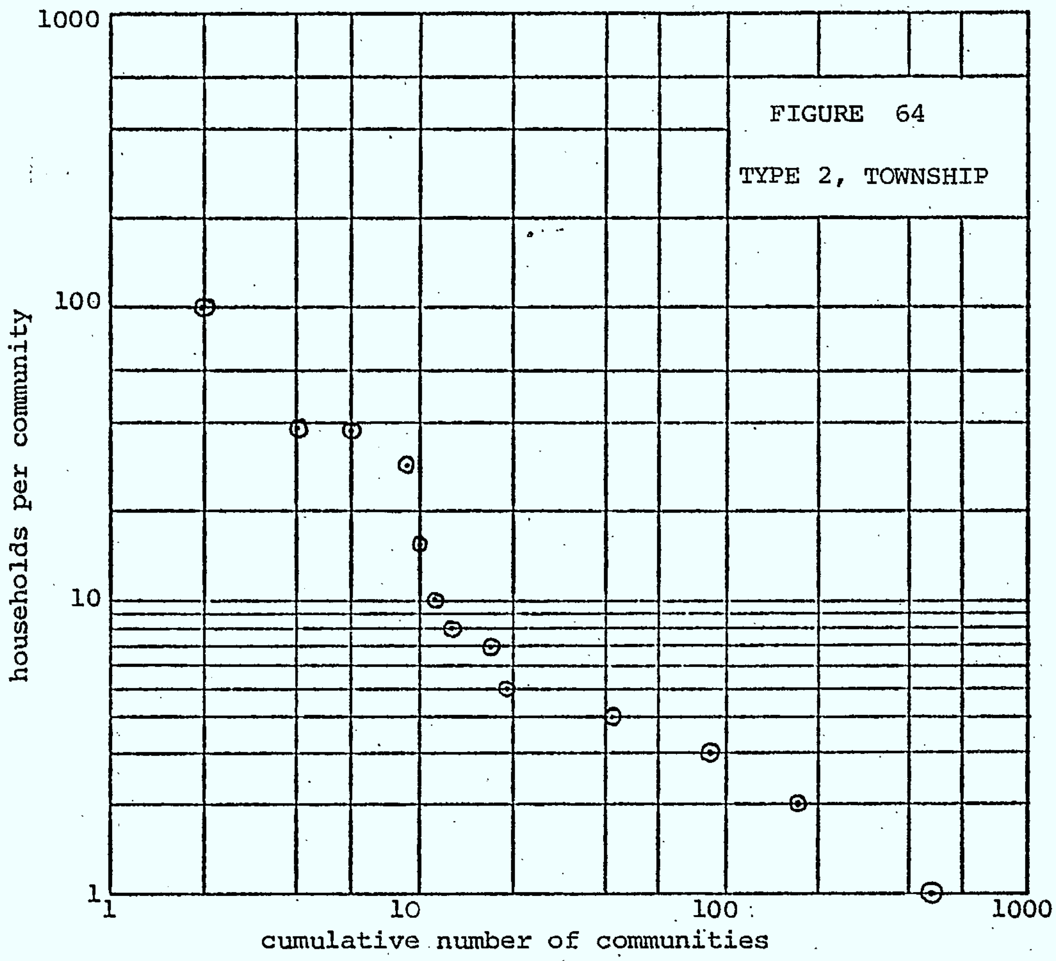


FIGURE 64
TYPE 2, TOWNSHIP
1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities

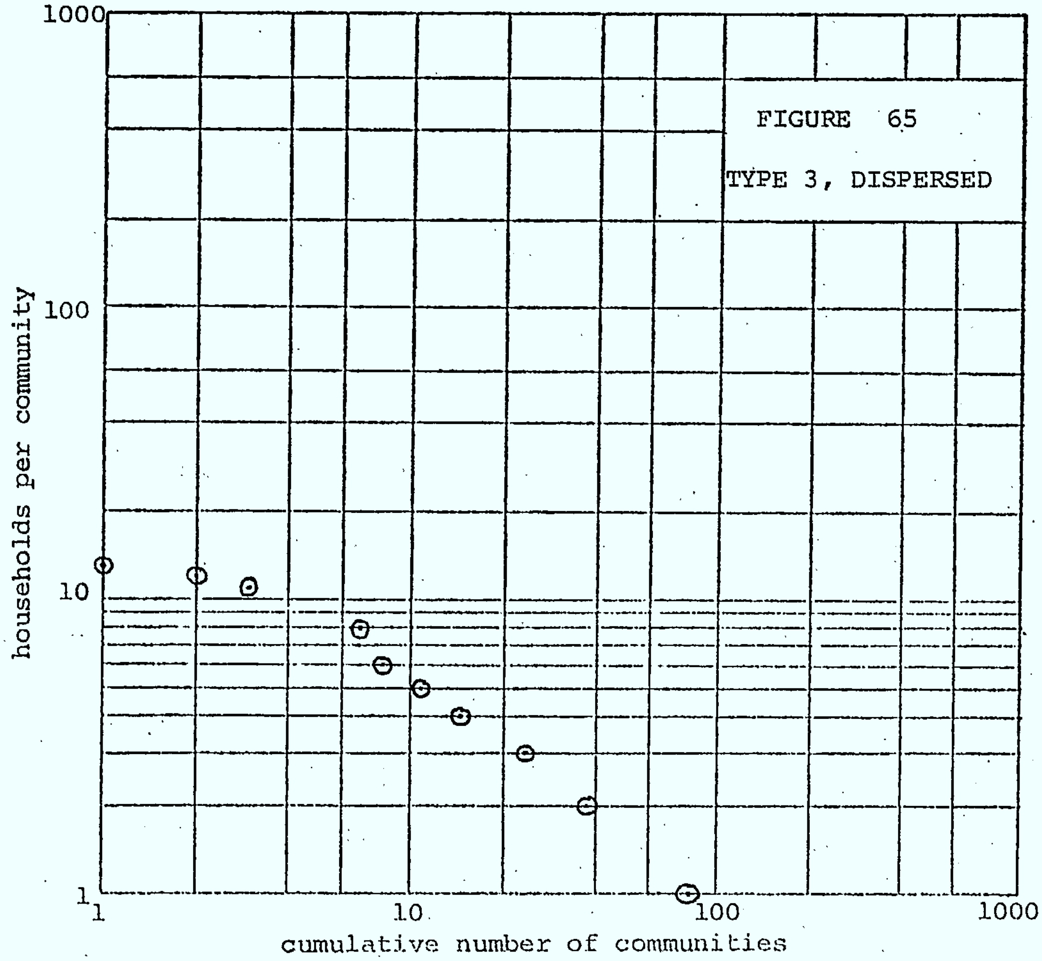


FIGURE 65
TYPE 3, DISPERSED
1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities

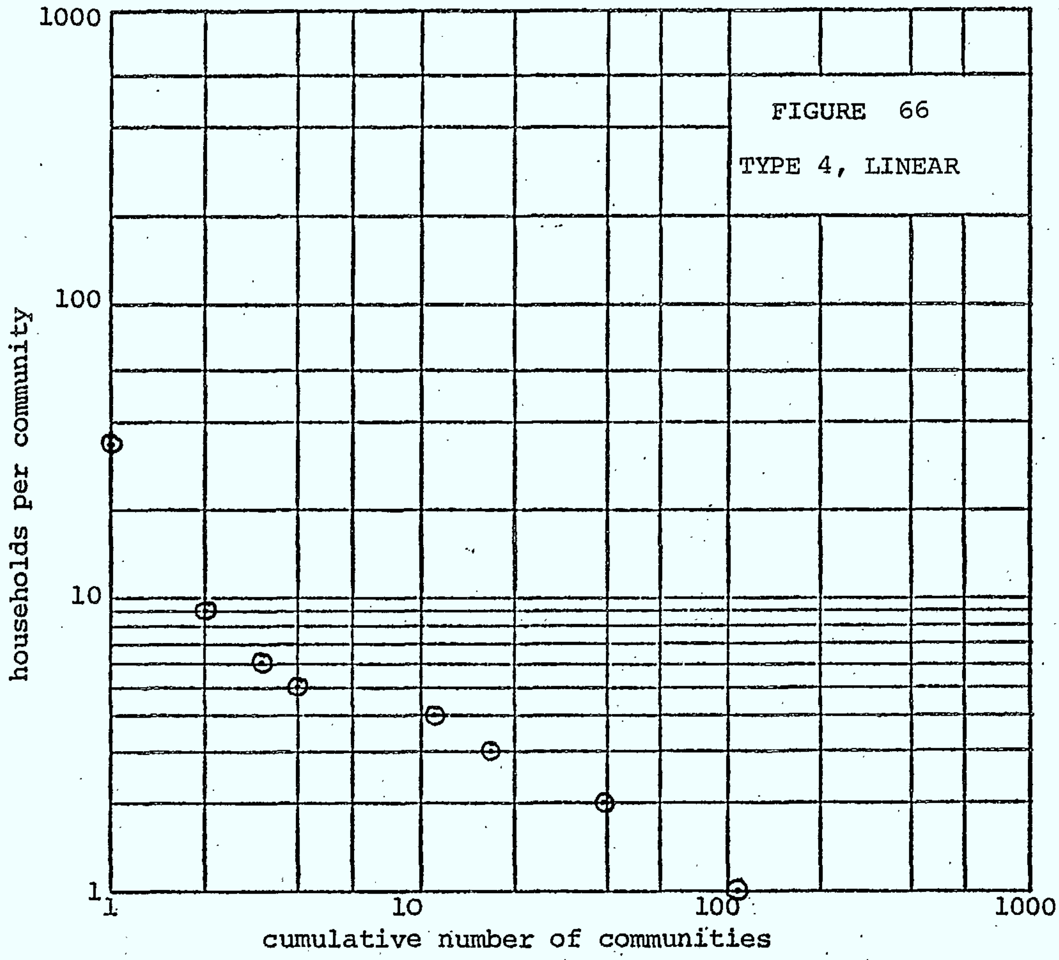


FIGURE 66
TYPE 4, LINEAR
households per community
cumulative number of communities
1000
100
10
1
1
10
100
1000

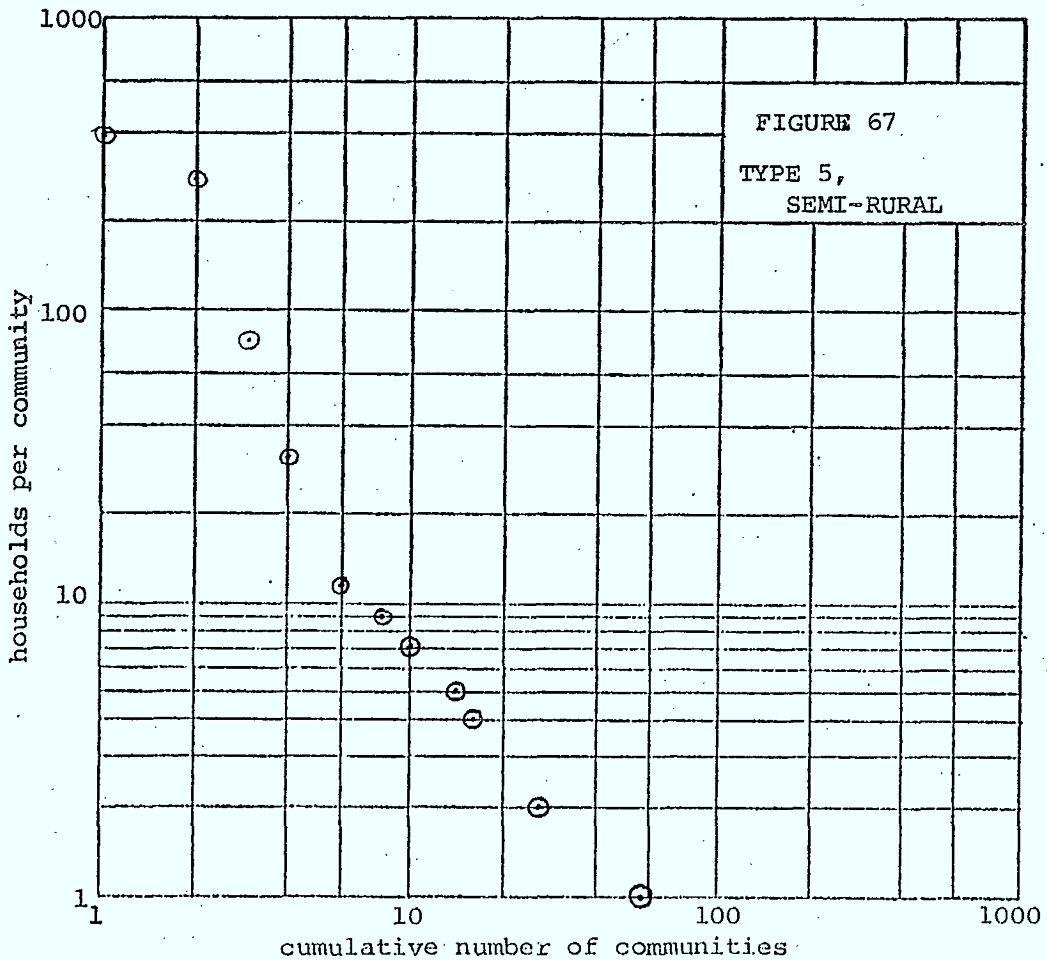
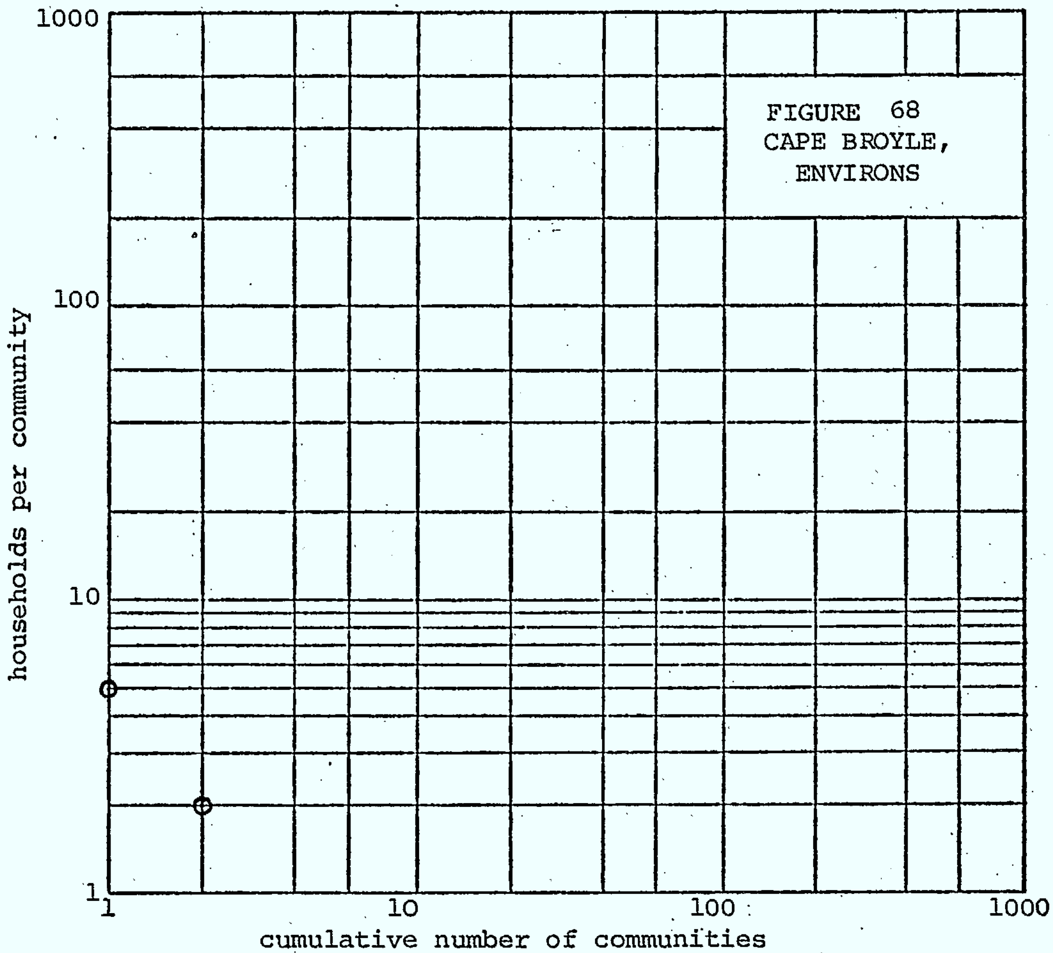
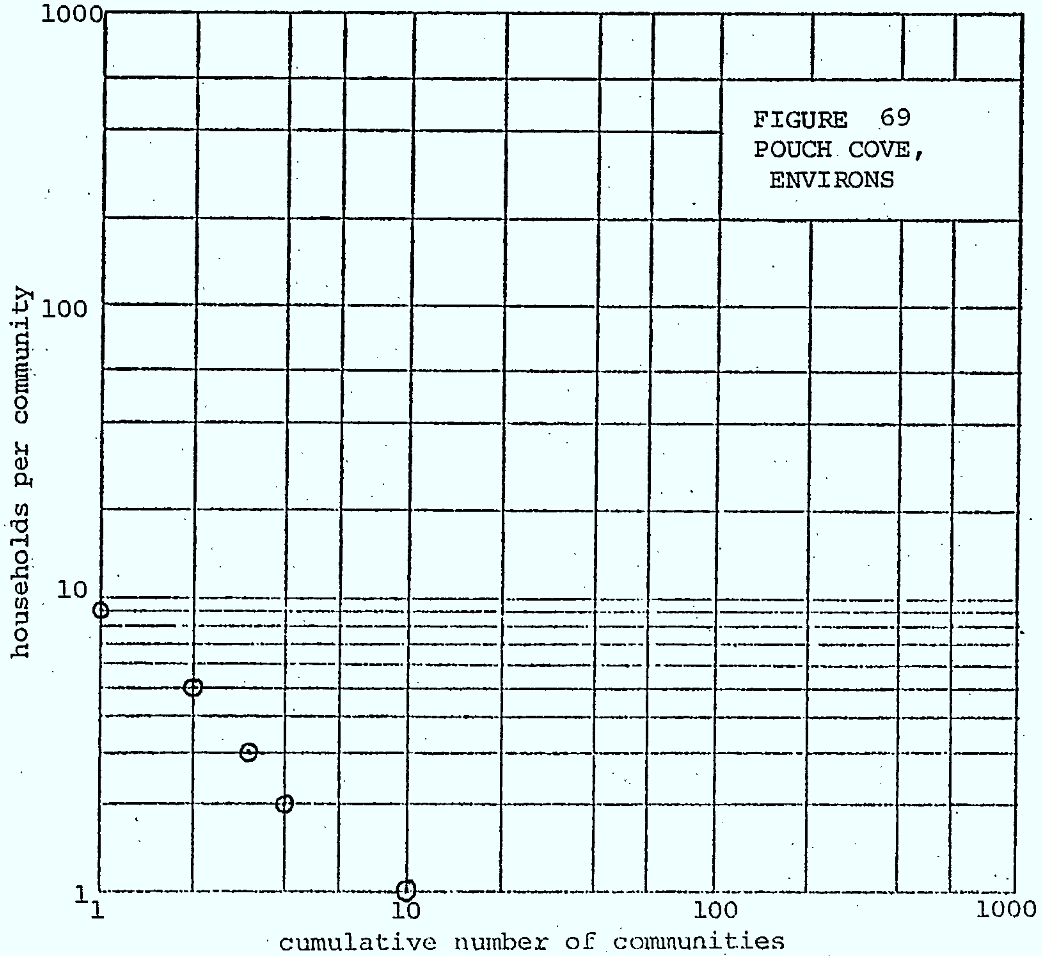


FIGURE 67
TYPE 5, SEMI-RURAL
households per community
cumulative number of communities
1000
100
10
1
1
10
100
1000


1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities
FIGURE 68
CAPE BROYLE,
ENVIRONS


1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities
FIGURE 69
POUCH COVE,
ENVIRONS

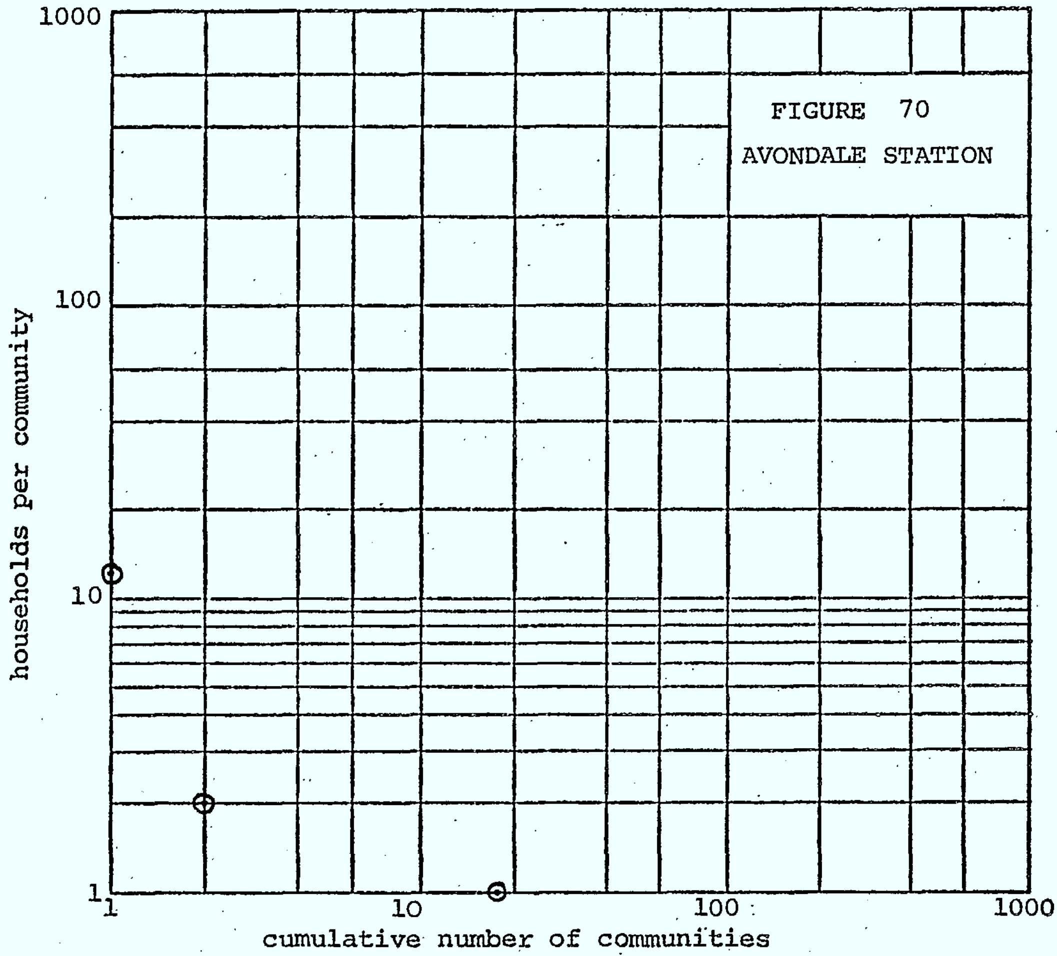


FIGURE 70
AVONDALE STATION
1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities

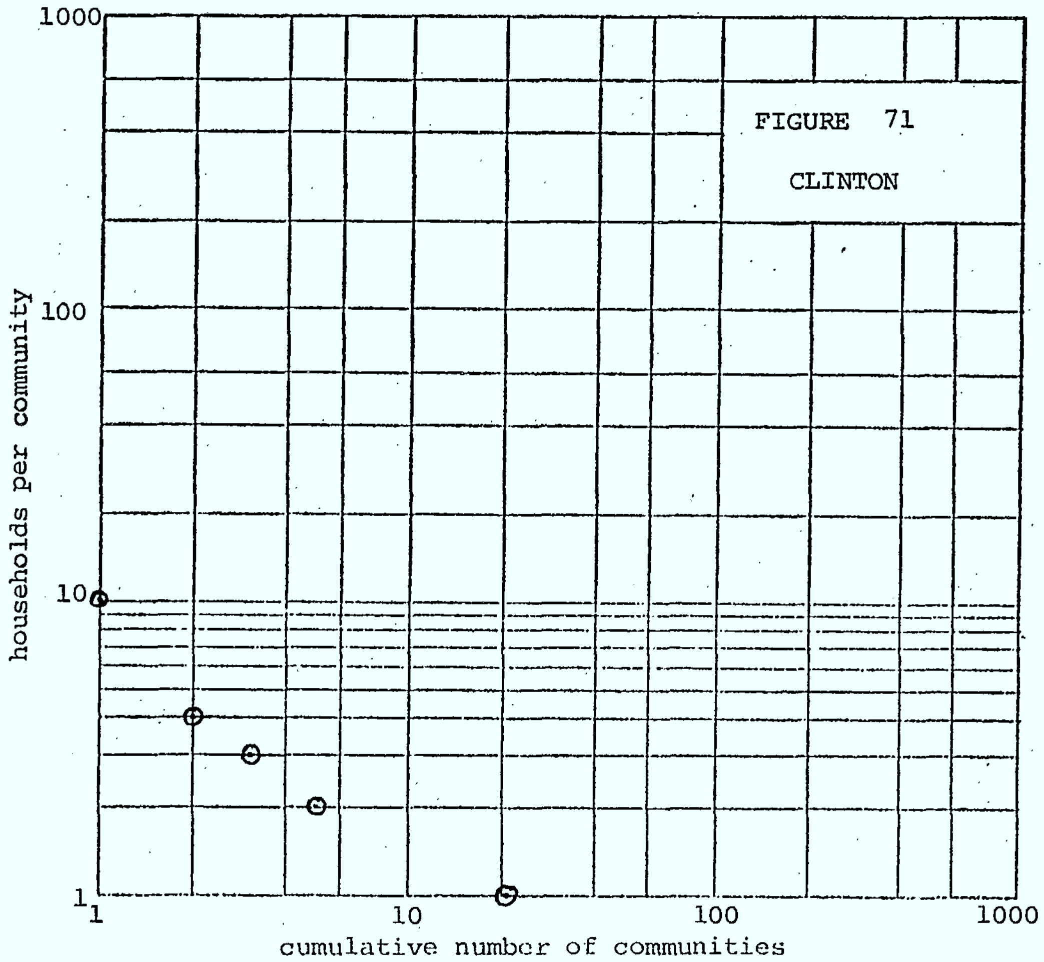


FIGURE 71
CLINTON
1000
100
10
1
households per community
1
10
100
1000
cumulative number of communities

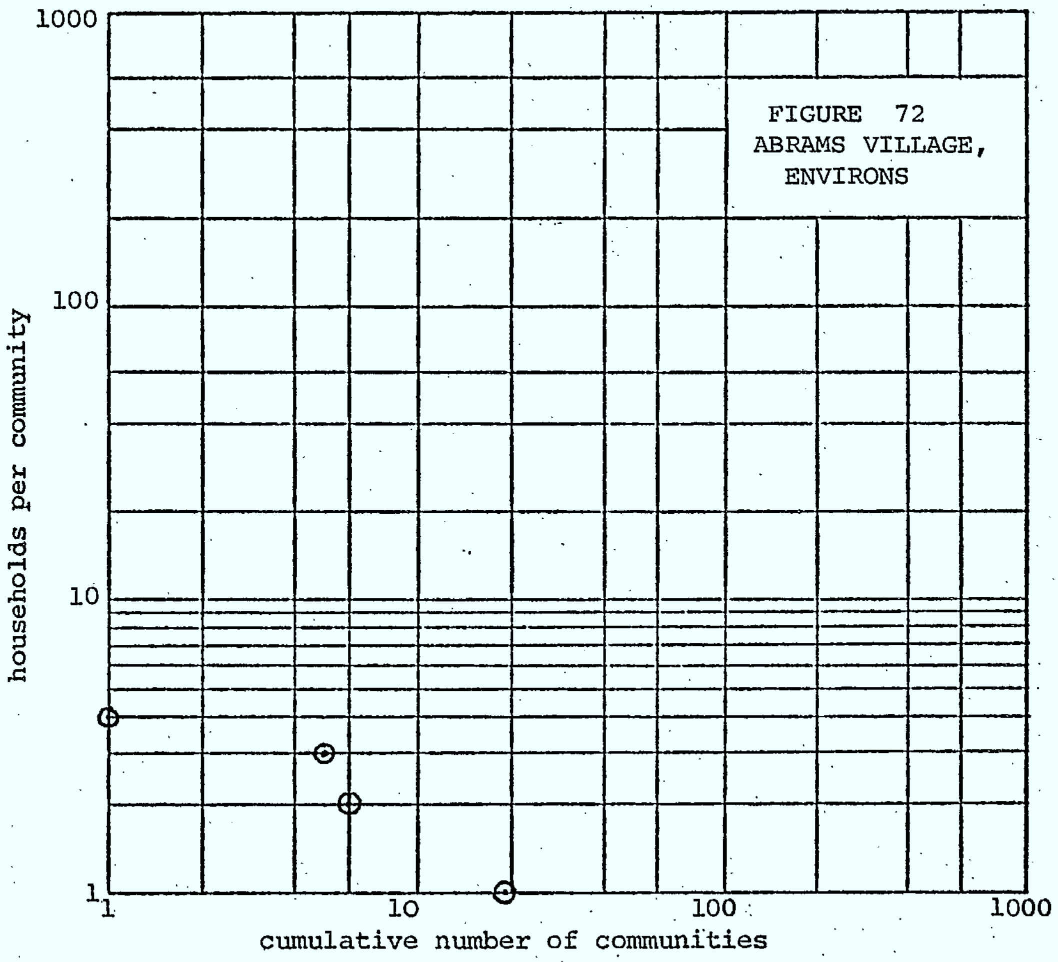


FIGURE 72
ABRAMS VILLAGE,
ENVIRONS
1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities

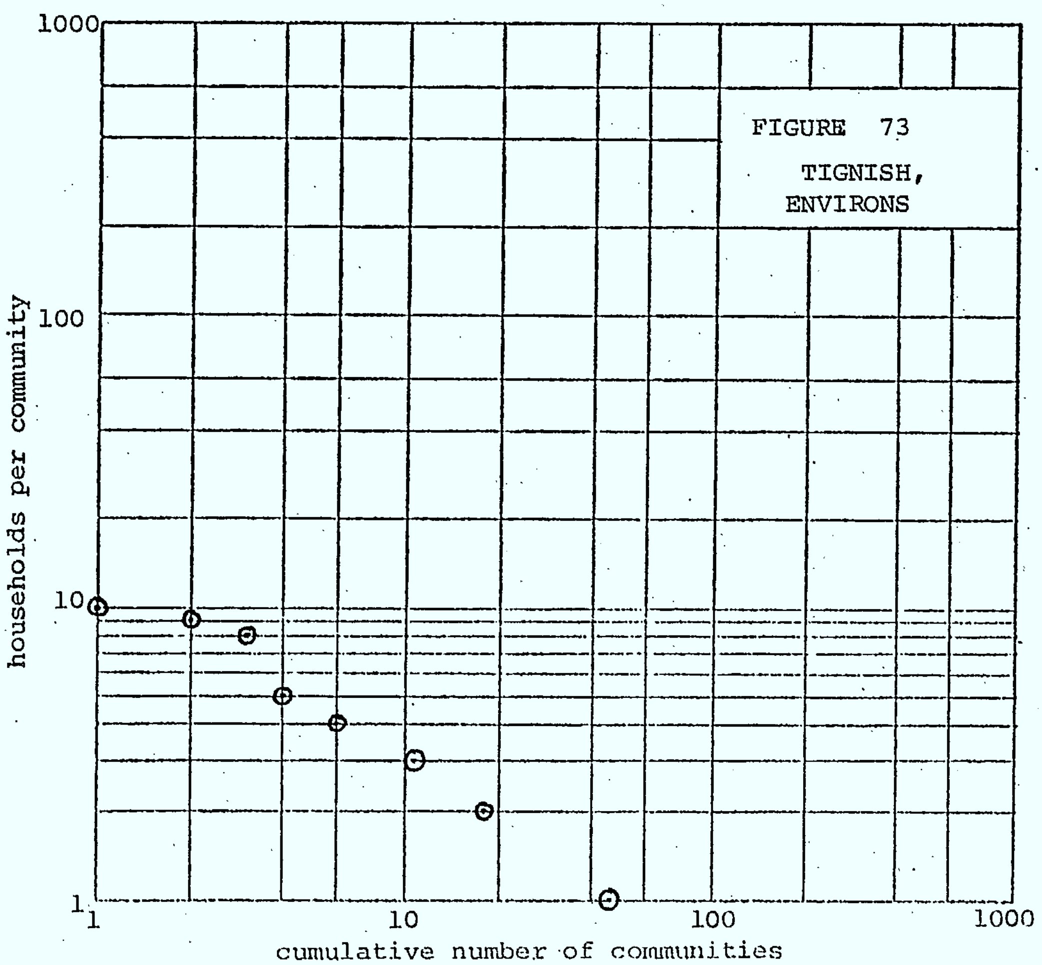


FIGURE 73
TIGNISH,
ENVIRONS
1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities

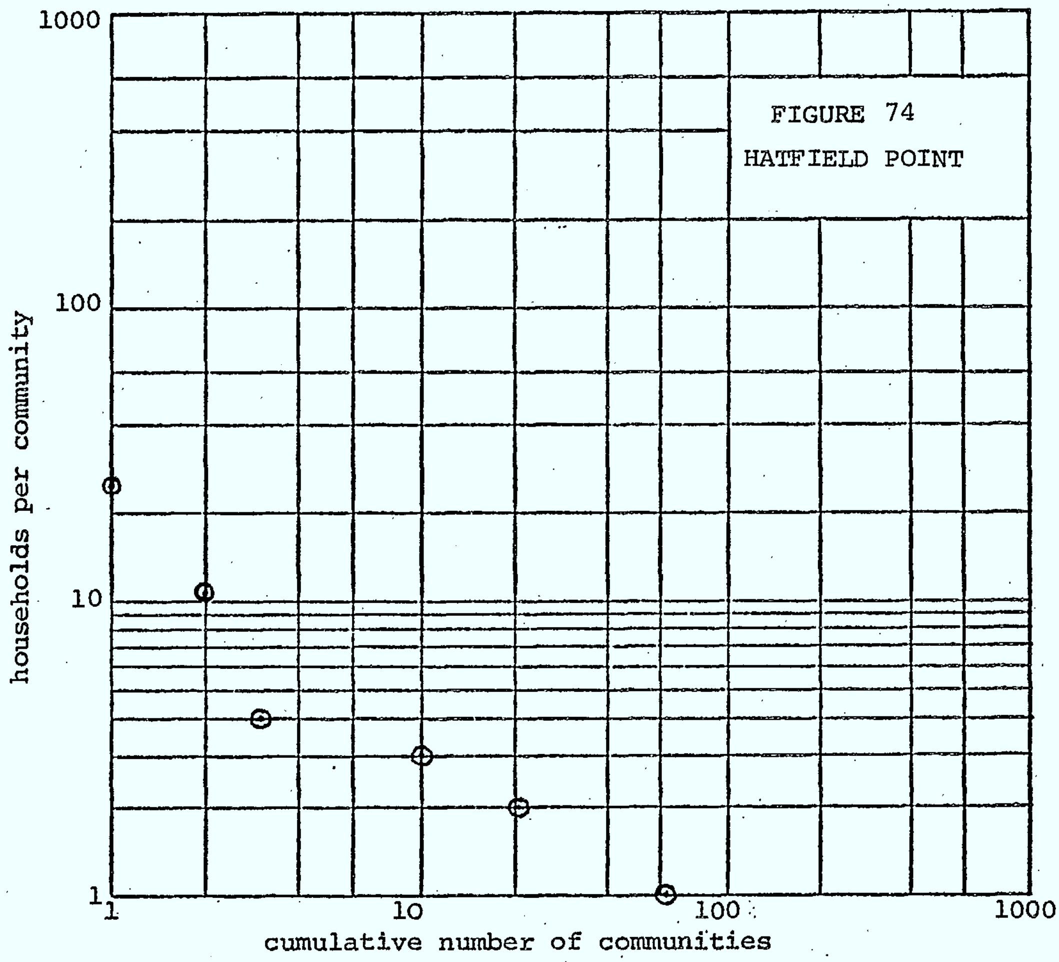


FIGURE 74
HATFIELD POINT
1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities

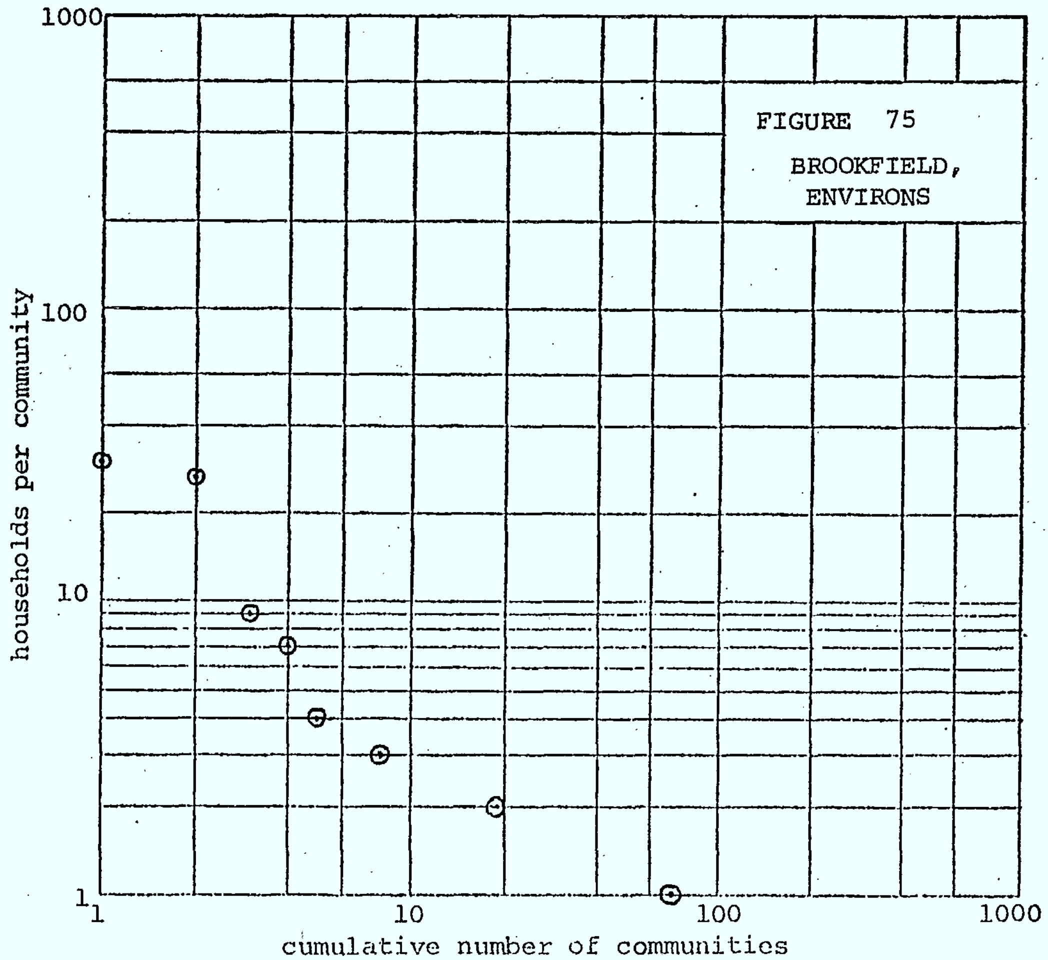


FIGURE 75
BROOKFIELD, ENVIRONS
1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities

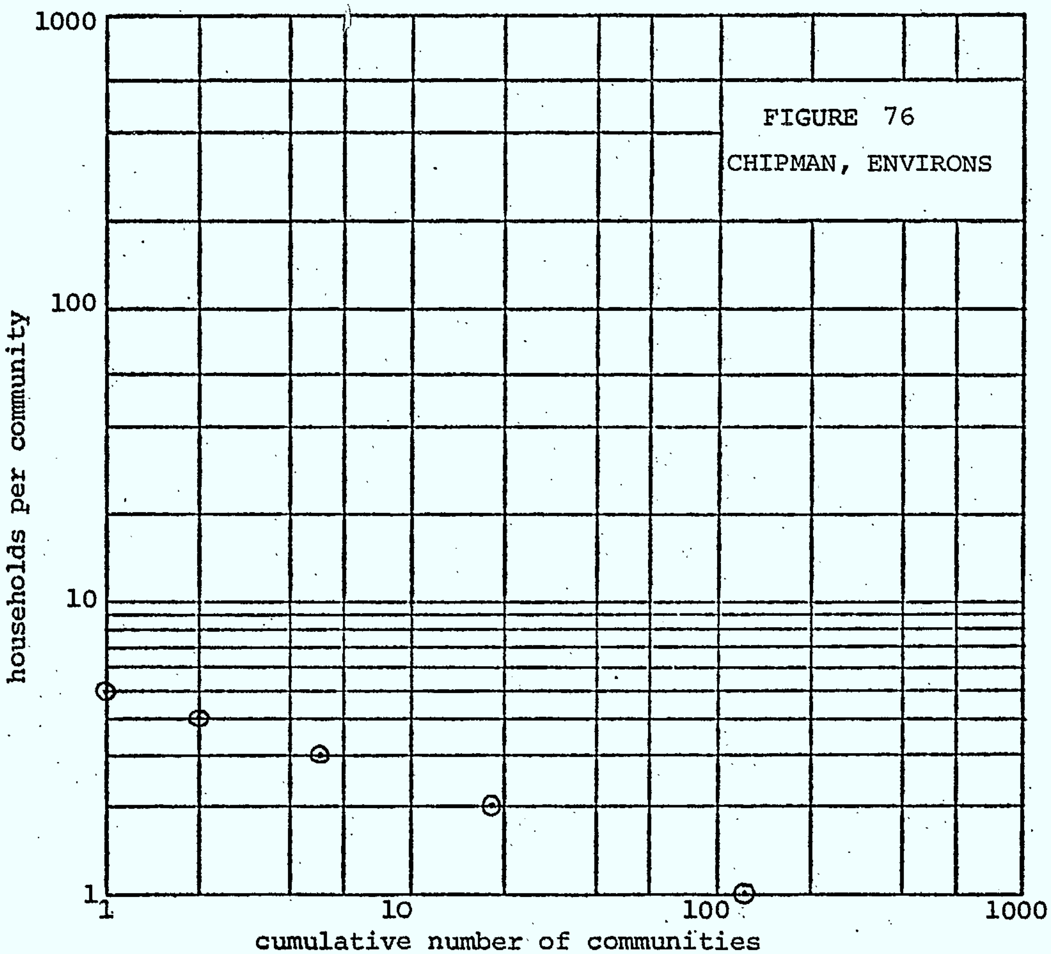


FIGURE 76
CHIPMAN, ENVIRONS
1000
100
10
1
1
10
100
1000
households per community
cumulative number of communities

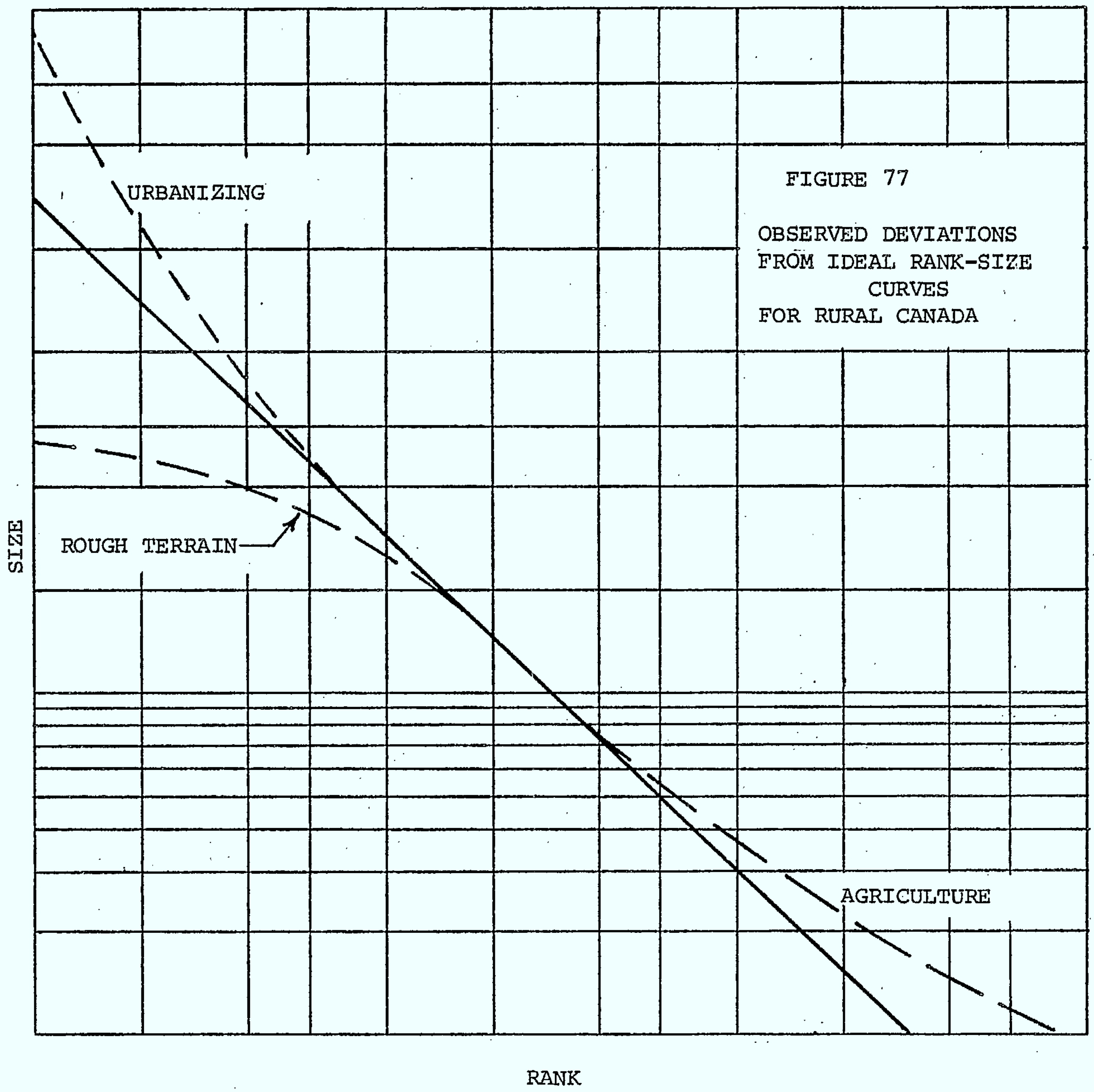


FIGURE 77

OBSERVED DEVIATIONS FROM IDEAL RANK-SIZE CURVES FOR RURAL CANADA

TA[redacted] 20

RANK-SIZE DATA FOR ALL OF RURAL CANADA, SIX-CELL MODEL

Size of Community	Total Number of Communities per Cell Type							Total Number of Communities	Cumulative No. of Communities		Number of Households
	i	ii	iii	ivA	ivB & v	ivC	vi		Total	Excluding vi	
households											
1	4,140	122,572	54,191	81,894	74,658	7,923		345,378	503,837	494,070	345,378
2	1,380	34,225	16,142	17,112	8,726	2,075	6,511	86,171	158,459	148,692	172,342
3		18,306	9,224	1,222	970	94		29,816	72,288	69,032	89,448
4	276	8,755	4,614					13,643	42,472	39,216	54,572
5	552	796	3,459					4,807	28,829	25,573	24,035
6	276		1,153		970	94		2,493	24,022	20,766	14,958
7	276	1,592						1,868	21,529	18,273	13,076
8		796	4,612					5,408	19,661	16,405	43,264
9	276							276	14,253	10,997	2,484
10	276	398						674	13,977	10,721	6,740
11			1,153					1,153	13,303	10,047	12,683
12			1,153					1,153	12,150	8,894	13,836
13			1,153					1,153	10,997	7,741	14,989
14						94		94	9,844	6,588	1,316
16	276	398						674	9,750	6,494	10,784
17						94		94	9,076	5,820	1,598
28		398						398	8,982	5,726	11,144
30		796						796	8,584	5,328	23,880
37		796						796	7,788	4,532	29,452
38		796						796	6,992	3,736	30,248
40	276							276	6,196	2,940	11,040
43				1,222		94		1,316	5,920	2,664	56,588
103		796						796	4,604	1,348	81,988
143	276							276	3,808	552	39,468
170							3,256	3,256	3,532		553,520
206	276							276	276	276	56,856

TOTAL 1,715,687

Size of Community (households)	Number of Communities Per Cell in Cell No.						
	i	ii	iii	ivA	ivB & v	ivC	vi
1	15	308	47	67	77	84	2
2	5	86	14	14	9	22	
3		46	8	1	1	1	
4	1	22	4				
5	2	2	3				
6	1		1		1	1	
7	1	4					
8		2	4				
9	1						
10	1	1					
11			1				
12			1				
13			1				
14						1	
16	1	1					
17						1	
28		1					
30		2					
37		2					
38		2					
40	1						
43				1		1	
103		2					
143	1						
170							1
206	1						

TABLE 21

COMMUNITY SIZE DATA FOR EACH CELL OF THE SIX-CELL MODEL

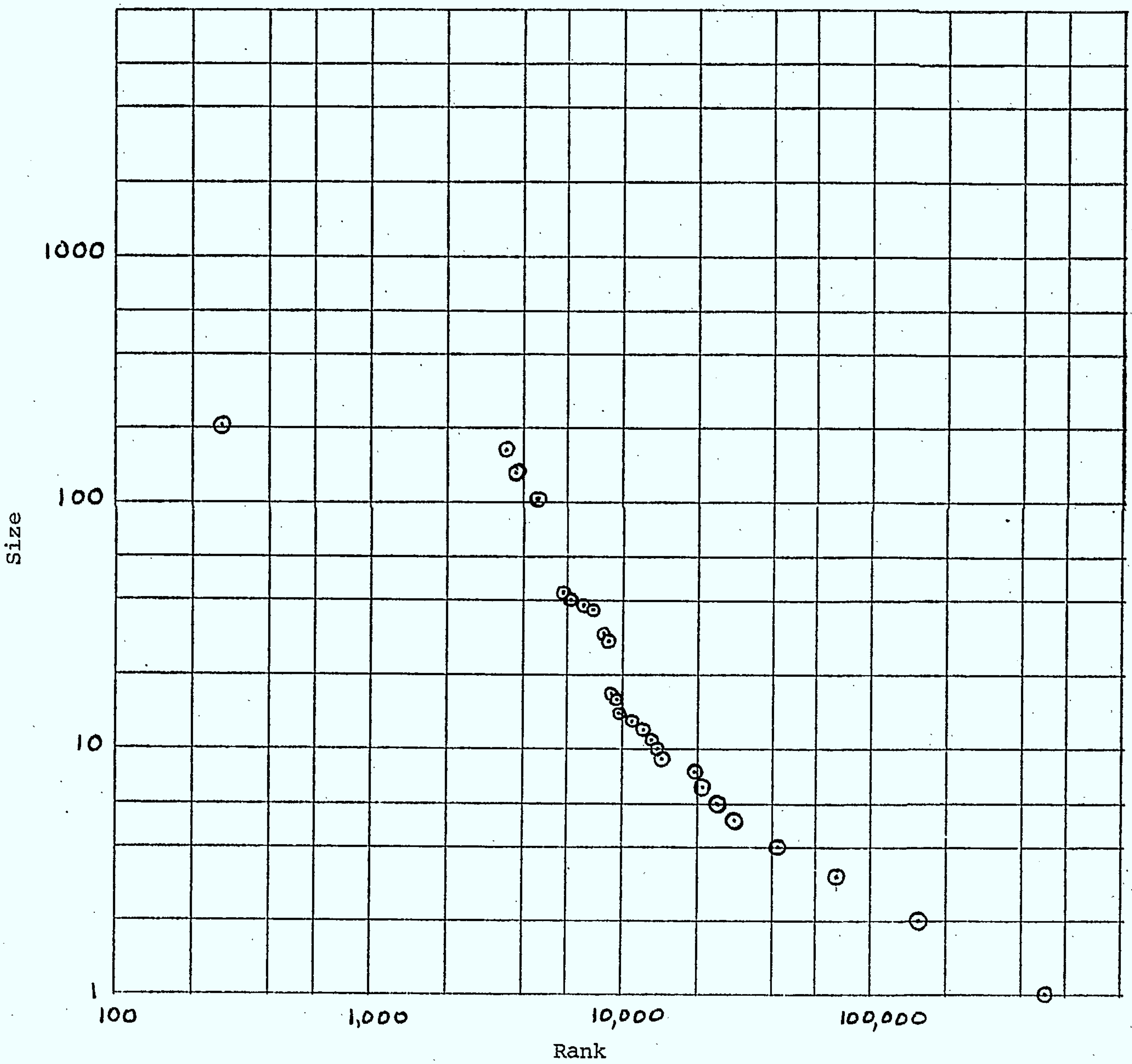


FIGURE 78, SIX-CELL MODEL RANK-SIZE CURVE

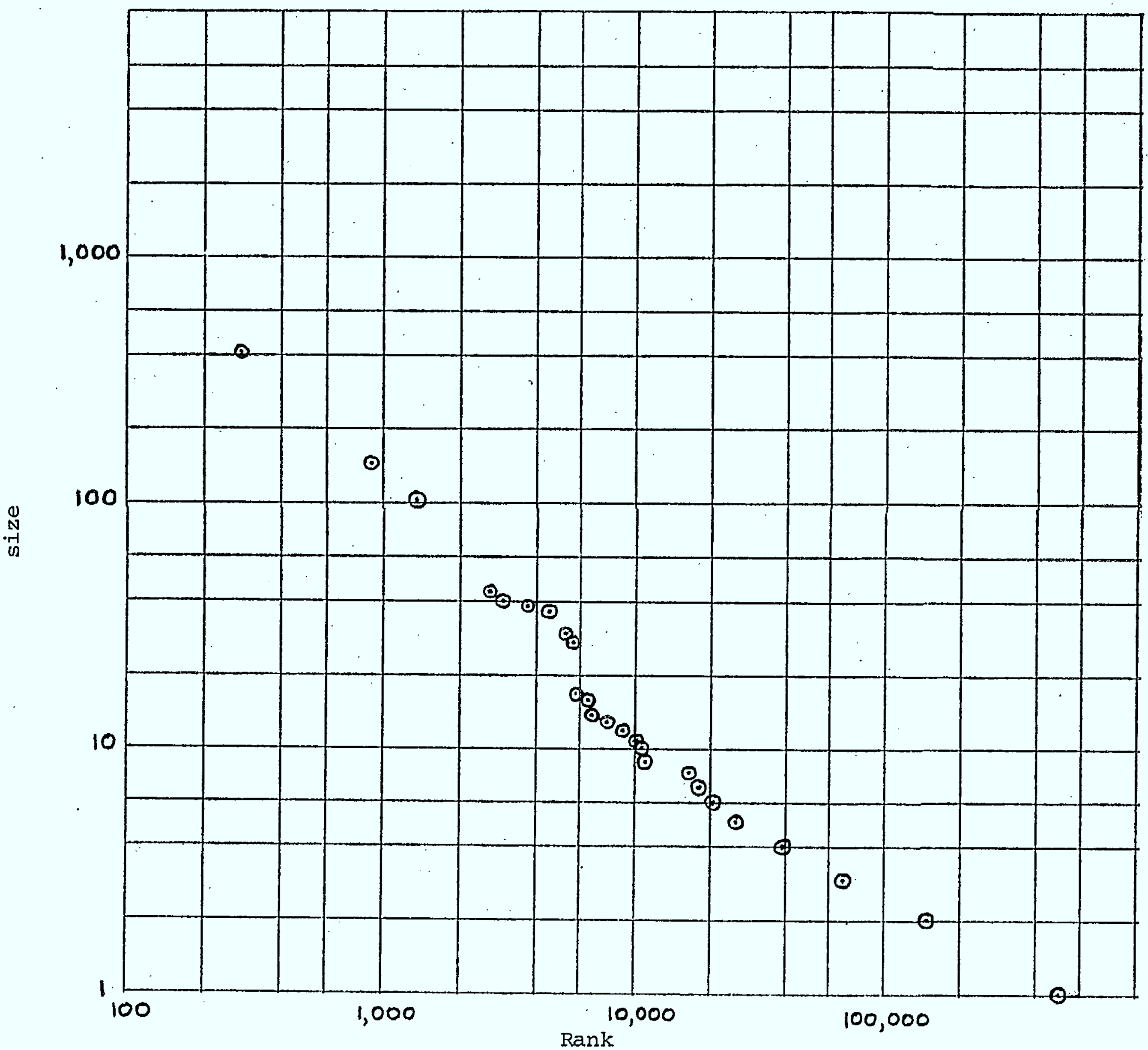


FIGURE 79, SIX-CELL MODEL RANK-SIZE CURVE
(excluding type vi), settlements)

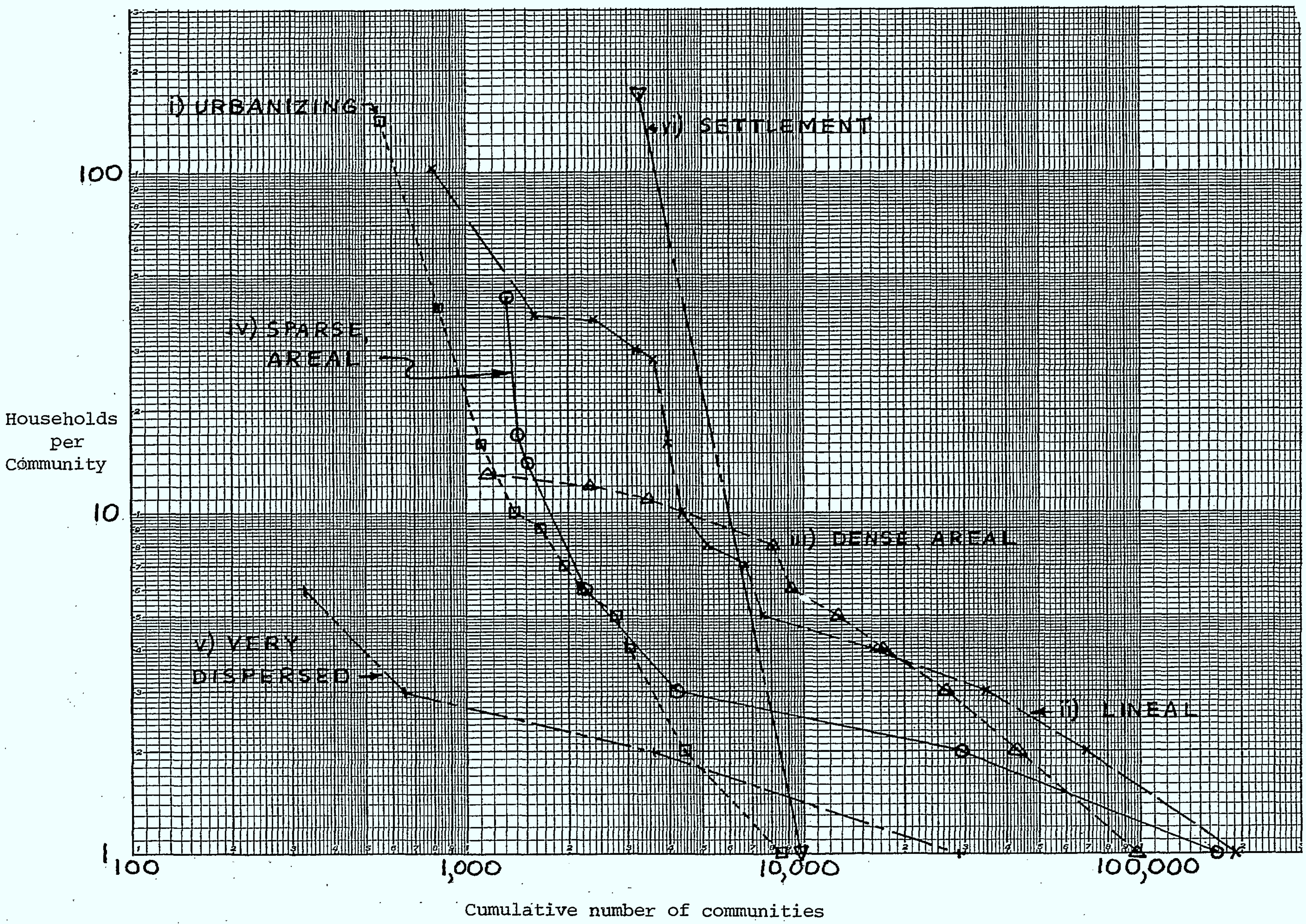


FIGURE 80. RANK-SIZE CURVES FOR EACH CELL TYPE IN THE SIX-CELL MODEL

Size of Community (Households)	Cell												
	Peace River	Cariboo	C Kootenay	Bella Coola	N. Okanagan	Langley	Tofino	Warfield	Tahsis	Rivers, Man	Typ. Sec. A	Typ. Sec. B	Typ. Sec. C
1	156	165	271			5	2		2	5	67	77	84
2		2	31		1	1	1		1		14	9	22
3		3	11			3					1	1	1
4			4						1				
5			2		1	1			1				
6			2									1	1
10			1										
12									2				
14													1
16									1				
17													1
29						1							
33						1							
43											1		1
55						1							
67						1							
71						1							
75									1				
82									1				
102				1									
150								1					
197							1						
210									1				
290					1								
395					1								
396										1			
491								1					
HH Total	156	178	414	102	692	276	201	641	411	401	141	104	211
Comm. Total	156	170	322	1	4	15	4	2	11	6	83	88	11

TABLE 22

COMMUNITY SIZE DATA FOR EACH CELL OF THE 32 CELL MODEL

Size of Community (Households)	CELL												
	Pioneer F	Dryland	Mennonite	Irrigation	French LL	Indian Res	Warren	Type 2	Type 3	Type 4	Type 5	New Melbourne	Cape Broyle (core)
1	173	77	124	146	216	124		308	47	68	15		
2	3	9	20	67	57	15		86	14	22	5		2
3		1	5	13	32			46	8	6			
4			1	4	17			22	4	7	1		
5			2	5	8	1		2	3	1	2		
6		1	2	2	9	1			1	1	1		
7			2	1	4			4			1		
8			1		4			2	4				
9					2					1	1		
10					2			1					
11									1	1	1		
12					1				1				
13					2				1				
14			1										
15			1										
16								1			1		
17			1										
18			1		1								
19			1		1								
21			1		1								
23					1								
25					1							1	
26					2								
27				1									
28			1					1					
30								2					
32					2								
34										1			
37			1					2					
38								2					
40											1		
44			1										
47			1										
49					1								
51					1								
52			1										
53			1										
61					1								
62					1								
67					1								
79					1								
103								2					
107					1								
143											1		
170													1
191							1						
206											1		
HH Total	179	104	658	406	1,440	165	191	1,230	204	212	476	36	174
Comms Total	176	88	172	239	371	141	1	481	84	107	31	2	3

TABLE 22 (Cont'd)

COMMUNITY SIZE DATA FOR EACH CELL OF THE 32 CELL MODEL

Size of Community (Households)	CELL: Cape Broyle, environs	Pouch Cove, core	Pouch Cove, environs	Avondale Station	Clinton	Abrams Village, core	Abrams Village, environs	Tignish, core	Tignish, environs	Hatfield Point	Brookfield, core	Brookfield, environs	Chipman, core	Chipman, environs
1		2	6	16	16	3	13	4	26	44		52	8	104
2	1		1	1	2		1	3	7	11		11	2	13
3			1		1		4	1	5	7		3	1	3
4					1		1	1	2	1		1		1
5	1		1						1				2	1
6													1	
7												1		
8		1						1	1					
9			1						1			1		
10					1				1					
11										1				
12				1									1	
24										1				
26												1	1	
29								1						
31												1		
58								1						
64						1								
76													1	
161								1						
199											1			
379		1												
478													1	
HH Total	7	389	25	30	37	67	31	273	95	126	199	160	623	148
Comms Total	2	4	10	18	21	4	19	13	44	65	1	71	18	122

TABLE 22 (Cont'd)

COMMUNITY SIZE DATA FOR EACH CELL OF THE 32 CELL MODEL

APPENDIX H

DEFINITION OF "COMMUNITY"

Statistics Canada recognizes various definitions for groupings of households. For example, city, town, incorporated village, unincorporated settlement, etc. Since all of these definitions are geo-political and depend upon the grouping being given a name, it is obvious that a new definition of a grouping is required if we wish to know, for example, the number of 4 household communities (such as might occur at the intersection of two roads) throughout rural Canada. Since this rural household study is communications oriented, a communications-based definition is warranted. One very simple definition that has proven useful is based solely on the location of households relative to others nearby.

This CATV oriented definition is that *a grouping of households constitutes a community if all households can be connected together with 500 ft. (or shorter) lengths of cable, without splicing.*

Thus, a village containing 150 households and environs containing 20 households may, upon measuring house-to-house distances, end up being considered as 5 communities, one having 155 households, one with 12 and three with only one household each.