HOUSEHOLD DISTRIBUTION IN THE RURAL AREAS OF THE ATLANTIC PROVINCES

A Study for
The Rural Communications Program
Communications Canada, Ottawa

by

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ACKNOWLEDGEMENT

The investigators would like to express thanks to a number of people who assisted in the various stages of this project. A special thanks to Catherine Tanner, our research assistant, who stayed with the project when it extended well beyond the scheduled time limit. Dr. George Cormack and Mr. Laurent Mougeot of the Department of Communications gave freely of their time and advice, and their efforts were much appreciated.

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SECTION 1: OBJECTIVES

OBJECTIVES

General: To provide information on household distribution relevant to the costing of broadcast and CATV delivery options.

Specific:

1. To present certain geographic factors which, a priori, would likely influence household distribution.
2. To select small areas which are representative of each possible combination of geographic factors, and present detailed maps displaying household locations for each such area selected.
3. To determine what portion of the Atlantic region each geographic type occupies.
4. To provide general formulas for estimating certain parameters for the Atlantic Region as a whole, based on the estimation of these parameters for the areas selected of each geographic type.
5. To illustrate the above estimation procedure by calculating the total households in the rural part of Atlantic Canada from household counts in study areas.

SECTION 2: METHODOLOGY

For the original methodology proposal submitted to the Department of Communications (Appendix I), the following factors were suggested as being important, a priori, as determinants of household distribution in a small geographic area (cell):

1. the extent of farming in the cell
2. the population of the community on which the cell is centered
3. the proximity of a major urban centre
4. the presence of natural barriers
5. the number of major through roads in the cell.

To control for these factors the Atlantic provinces were subdivided into geographic regions incorporating 1. and 4. Then within each region cells were defined using 2., 3. and 5.

2.1 Geographic Regions

The construction of regions started from the smallest level of disaggregation available -- the Census enumeration area (E.A.). Using a base map indicating all the enumeration areas in Atlantic Canada, two maps were developed: (i) population density by E.A., (ii) economic activity.

(i) Population Density: Each E.A. was determined by 1976 Census data to be one of three types

(1) density between 1 and 10 people/sq. mile (low)

(2) density between 10 and 100 (medium)

(3) density between 100 and 1000 (high)

A map was then completed indicating those E.A.'s which were of the above types.

(ii) Economic Activity: A map constructed for the Maritime Provinces Economic Council in 1967 outlined areas in the Atlantic provinces for the activities: Farming, Fishing, Forestry and Industry. The farming and fishing regions on these maps were transposed to the enumeration area maps. It was decided that these activities were the important ones effecting household distribution in rural areas.

These two maps were then compared with the objective of defining a small number of geographic regions. Since there was three density levels (low, medium, high) and three activity categories (farming, fishing, other), at most nine regions would result. However, since medium density and farming were in close agreement and high density was urban, the number of regions could be reduced to the following four:

REGION (1): Coastal enumeration areas without inland farming

REGION (2): Coastal enumeration areas with inland farming

REGION (3): Inland enumeration areas with medium density (farming)

REGION (4): Inland enumeration areas with low density.

A map was developed, therefore, indicating the area covered by each of these regions in the Atlantic Provinces. Note that a consideration of density and economic activity led to the control of factors 1. and 4. mentioned previously. Again, the density provided an estimate of the extent of farming and clearly fishing, being a coastal activity, indicated presence of natural barriers.

It would be anticipated that the household distribution within these regions is distinct. That is, the other factors to be considered (communities and roads) would vary from region to region.

2.2 Community Size Distribution by Region

Each of the four regions is now to be subdivided into small geographic areas or cells each of which is centered on a community. The first stage in this process is the determination of the distribution of communities by size in each of the regions. The base line information here is the Federal Electoral District maps for the Atlantic Provinces provided by Statistics Canada. They give the most complete enumeration presently available of communities by geographic location. Since the area of a cell associated with a community depends upon the size of the community, each of the communities on the Federal Electoral District maps was coded by size as:

(1) population between 50 and 250

(2) population between 250 and 1,000

(3) population between 1,000 and 2,500

(4) population between 2,500 and 10,000

(5) population more than 10,000

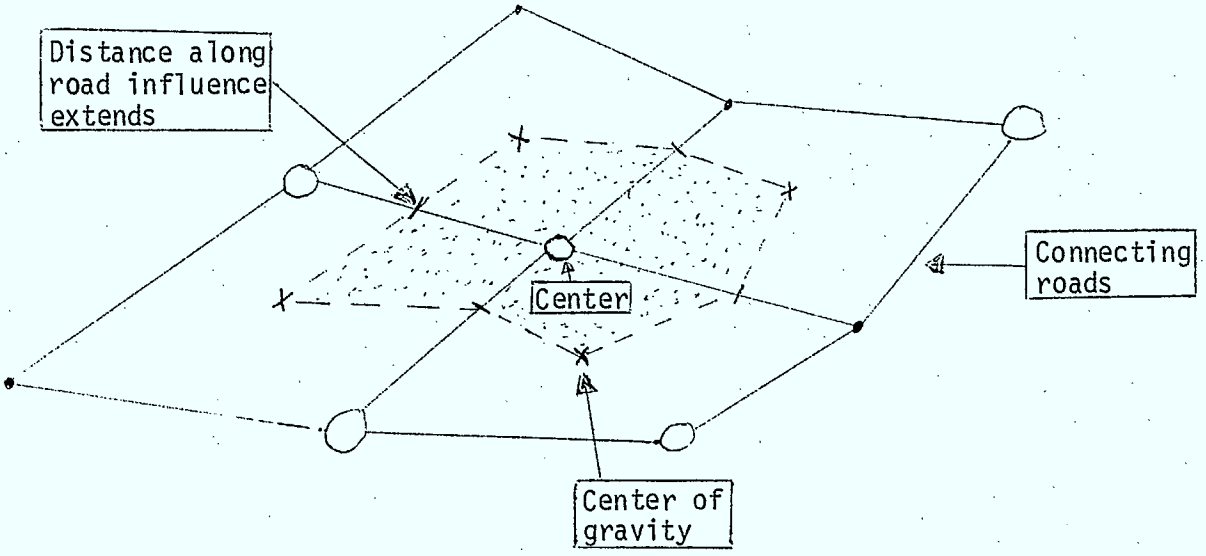
The population size was determined from Statistics Canada publications of populations of incorporated and unincorporated communities in 1971.

With each community coded by size, they were then located by geographic region and by province. This step produced a tabulation of the communities by size within each region by province and for the whole of the Atlantic Provinces.

The communities within a region are the centers for the cells constituting the region. So a list of the communities by type is equivalent to a list of the cells by type. It remains to define the area of influence (cell) associated with each community (center).

2.3 Area of Influence of a Community (cell)

Under the assumption that households are (i) located in communities (ii) along roads between communities or (iii) dispersed, it is necessary to specify what households along roads leading from a community are associated with the community and also to specify what households dispersed between roads are so associated. Suppose we have a configuration of center community and adjacent communities as given below:



If the parameters are defined as:

D = distance along road to adjacent community the influence of the center community extends

G = center of gravity for the closed polygon formed by connected communities

Now specification of D and G enables us to compute the area of influence shown by the shaded area in the diagram. In this study the following estimates were used.

$$\hat{D} = \left[\frac{\text{population of center community}}{\text{combined population of center and adjacent community}}\right] \times \left[\text{length of road between center and adjacent community}\right]$$

$$\hat{G} = \left[\text{point such that } \underline{\text{areas}} \text{ of triangles formed by joining the point to the } \underline{\text{corner}} \text{ communities are all } \underline{\text{equal}}\right]$$

Following this procedure we can subdivide the regions into cells centered on the communities. The shape of the cells is determined by the number of roads and the distribution of adjacent communities.

It should be noted that some communities, mostly in Newfoundland, are isolated (no adjacent communities and connecting roads). For these communities the area of influence will be defined as the community itself.

2.4 Selection of Typical Cells

The objective in subdividing the regions into cells is that there will only be a few distinct types of cells. If so, studying typical cells will yield a picture of the whole region. To get typical cells we make the following assumption:

> WITHIN A REGION CELLS WITH THE SAME SIZE CENTER COMMUNITY ARE EQUIVALENT.

Therefore, within each region three cells were selected with center community sizes 50-250, 250-1000, and 1000-2500 respectively. No cells with larger centers are chosen since they would be classified as urban. In addition, three isolated communities of sizes 50-250, 250-1000 and 1000-2500 were selected. This gives a total of 15 typical cells.

Community Size	Region				
	1	2	3	4	Isolated
50-250	T_1	T_4	T_7	T_{10}	T_{13}
250-1000	T_2	T_5	T_8	T_{11}	T_{14}
1000-2500	T_3	T_6	T_9	T_{12}	T_{15}

Clearly the above assumption is not totally valid. To minimize the resulting error, therefore, typical cells were selected after a consideration of supposedly similar cells. The cell selected was required to have an average number of through roads and a typical distribution of adjacent communities. In this way the cell could be deemed typical.

Once the typical cells were designated then detailed maps illustrating the household distribution within the cells were required. To construct such maps, census enumeration area maps were obtained from Statistics Canada for all the enumeration areas which composed the typical cells. These E.A. maps were pasted together where necessary to form the detailed maps for the typical cells.

2.5 Estimation of Region Population From Typical Cells

Each of the 15 maps for typical cells was studied to obtain a count of the number of households in that cell. Using the number of each type of cell per region by province as a scale up factor, the number of households per cell was blown up to get an estimate of the number of households in the rural part of each province. This figure was compared with the actual household count from the 1976 census as a test of the validity of the typical areas.

SECTION 3: RESULTS

The methodology described in the previous section presented the following sequence of stages in the study of household distribution in Atlantic Canada:

Stage 1: Construction of geographic regions

Stage 2: Community size distribution by region

Stage 3: Selection of typical areas

In the present section the results of these stages are given.

3.1 Geographic Regions

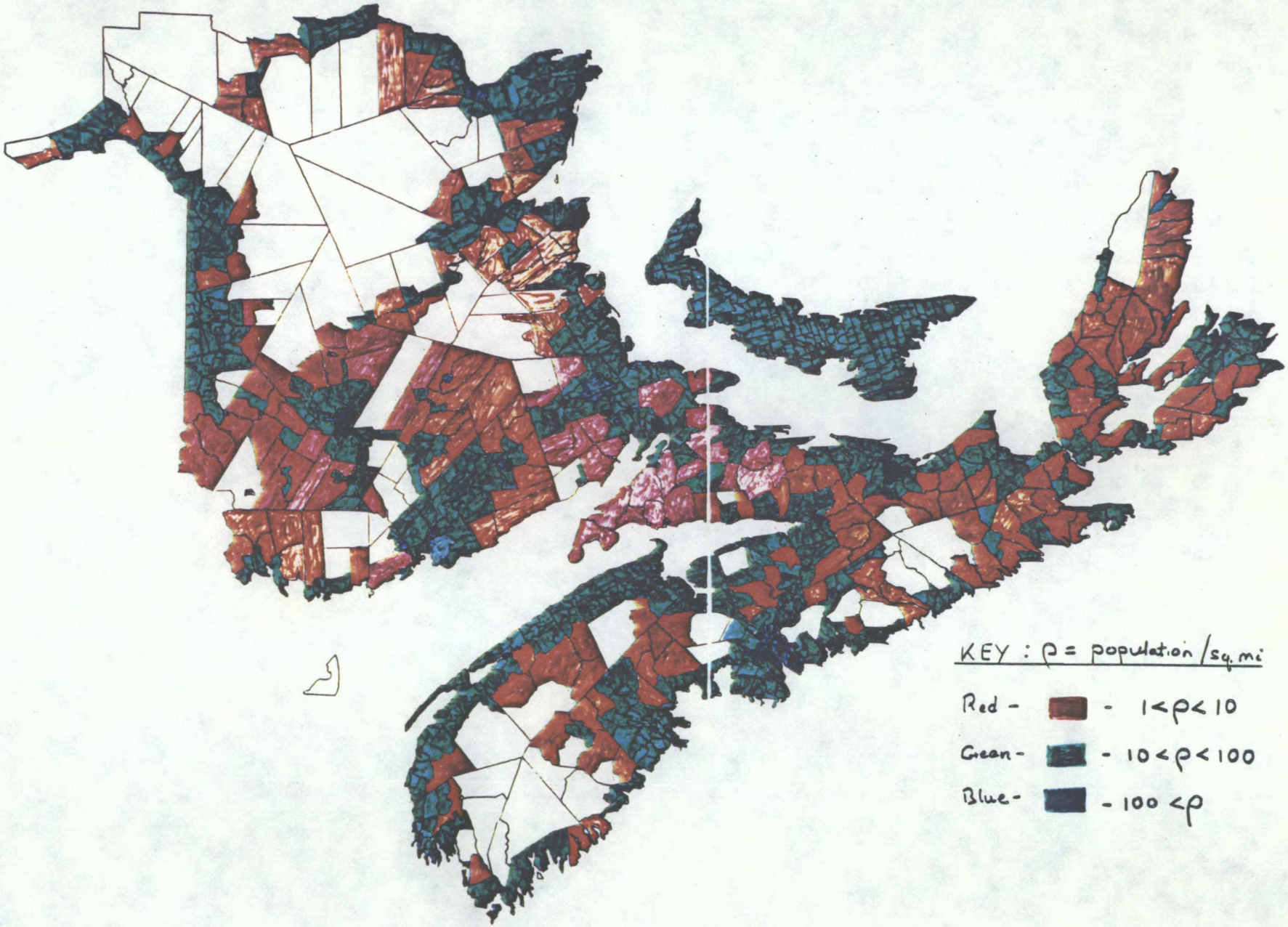
Referring to maps 1(a) and 1(b) we find the enumeration area density maps for the Atlantic Provinces. Maps 2(a) and 2(b) indicate the farming and fishing areas. The composition of the density and economic activity maps produced the geographic region maps 3(a) and 3(b). So the defined regions are:

REGION I: Coastal E.A.'s with no adjacent farming E.A.'s

REGION II: Coastal E.A.'s with adjacent farming E.A.'s

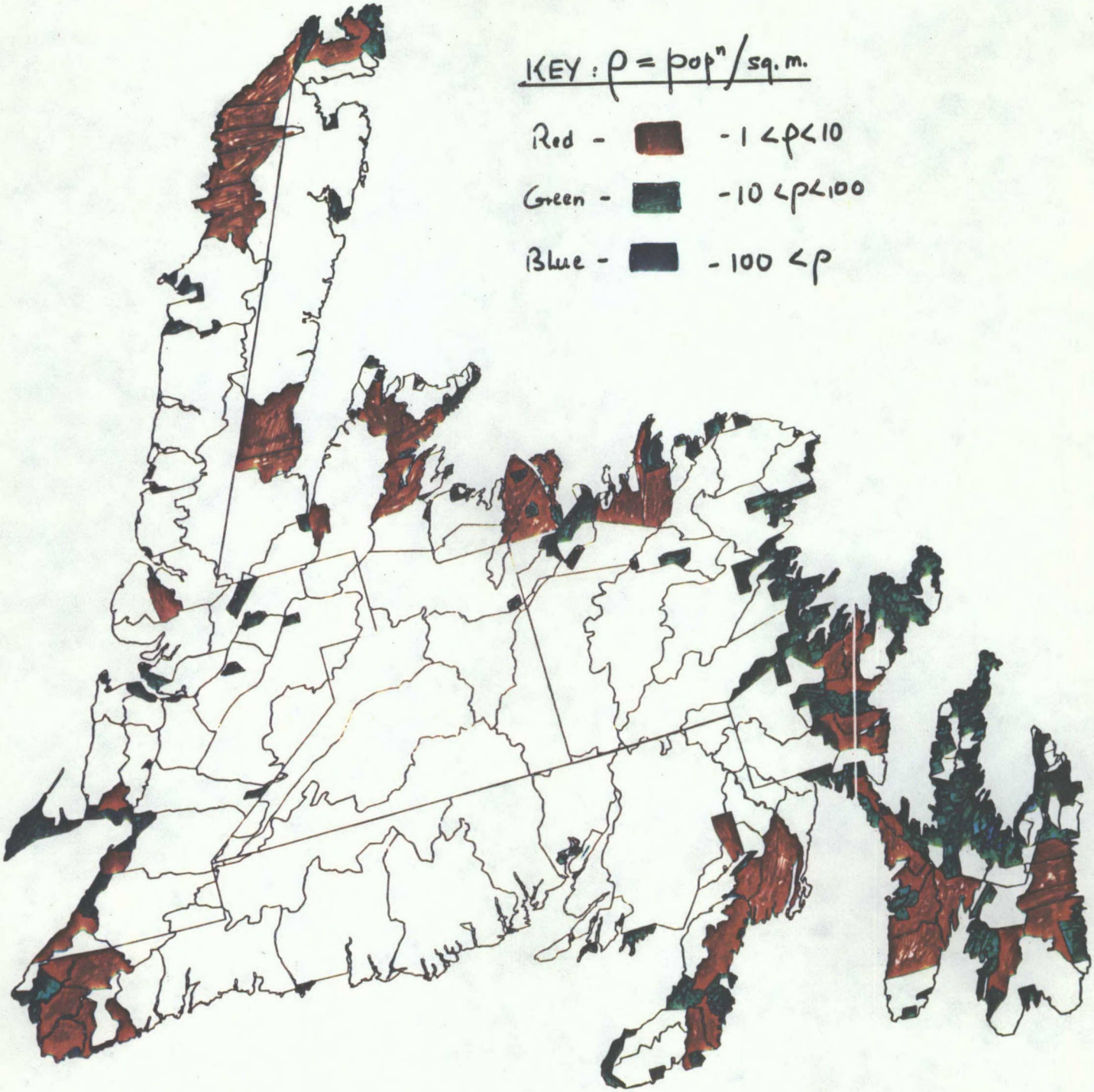
REGION III: Inland E.A.'s with high density (farming)

REGION IV: Inland E.A.'s with low density.



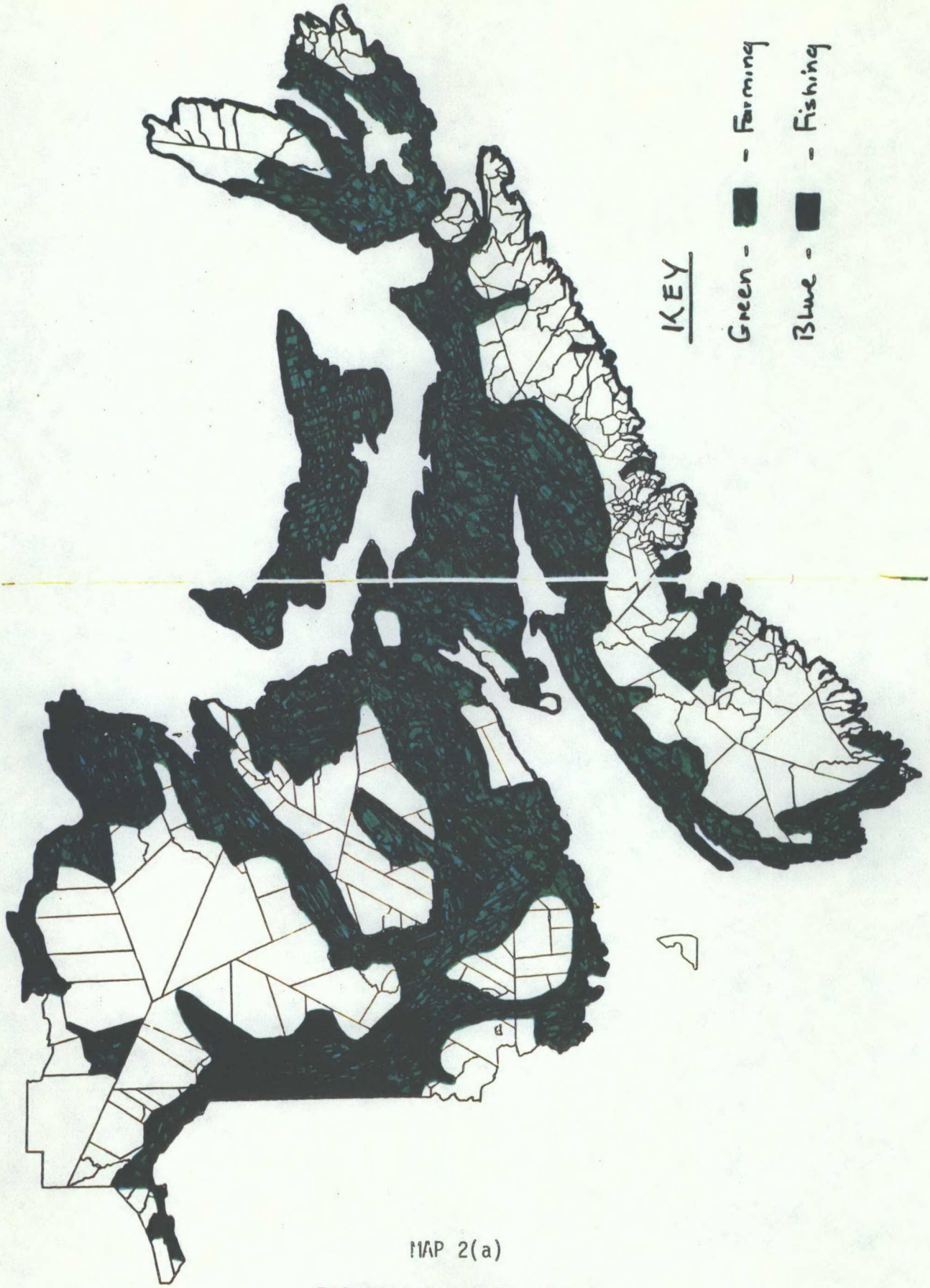
MAP 1(a)

POPULATION DENSITY BY E.A.
(Maritime Provinces)



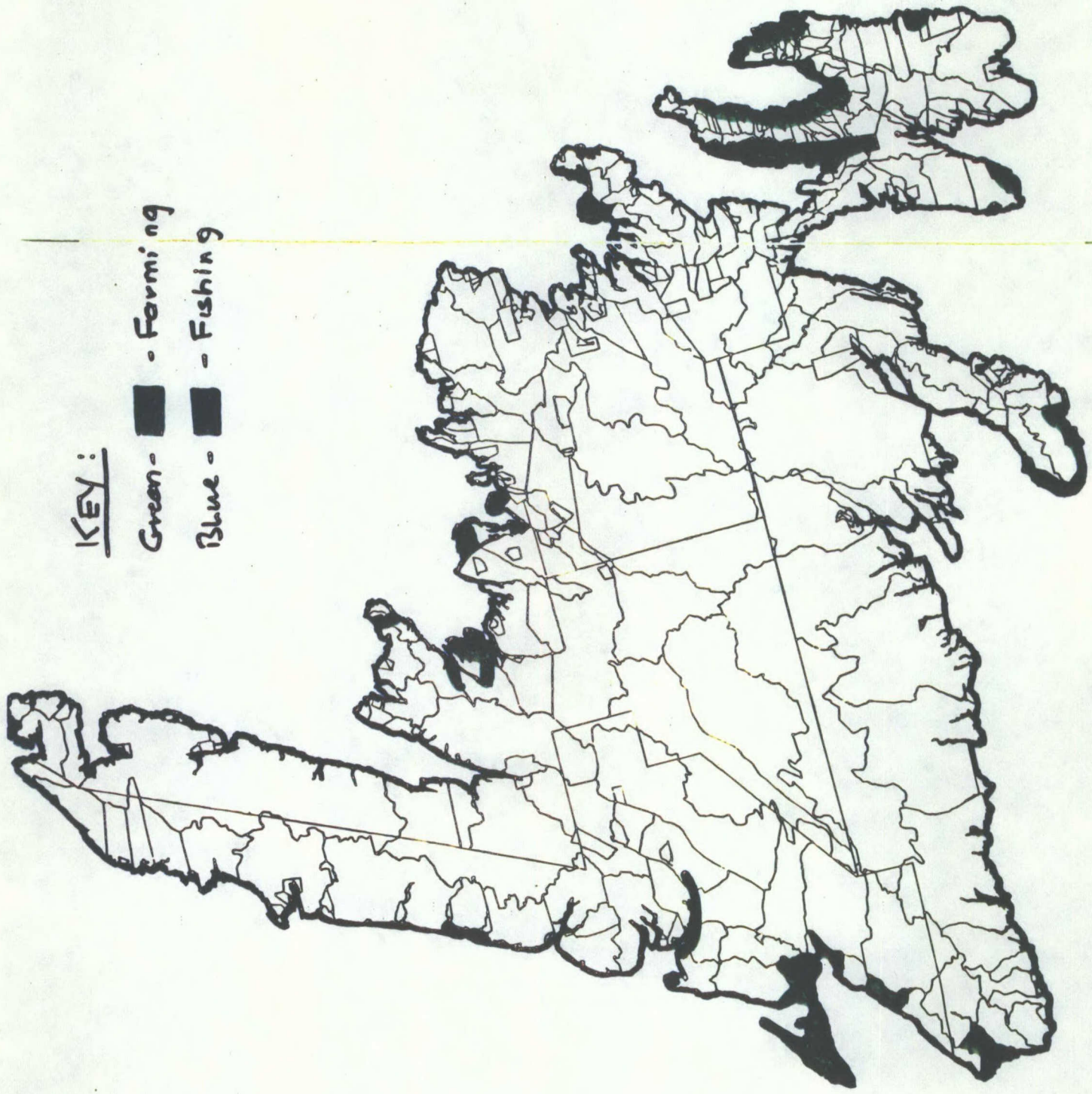
MAP 1(b)

POPULATION DENSITY BY E.A.
(Newfoundland)



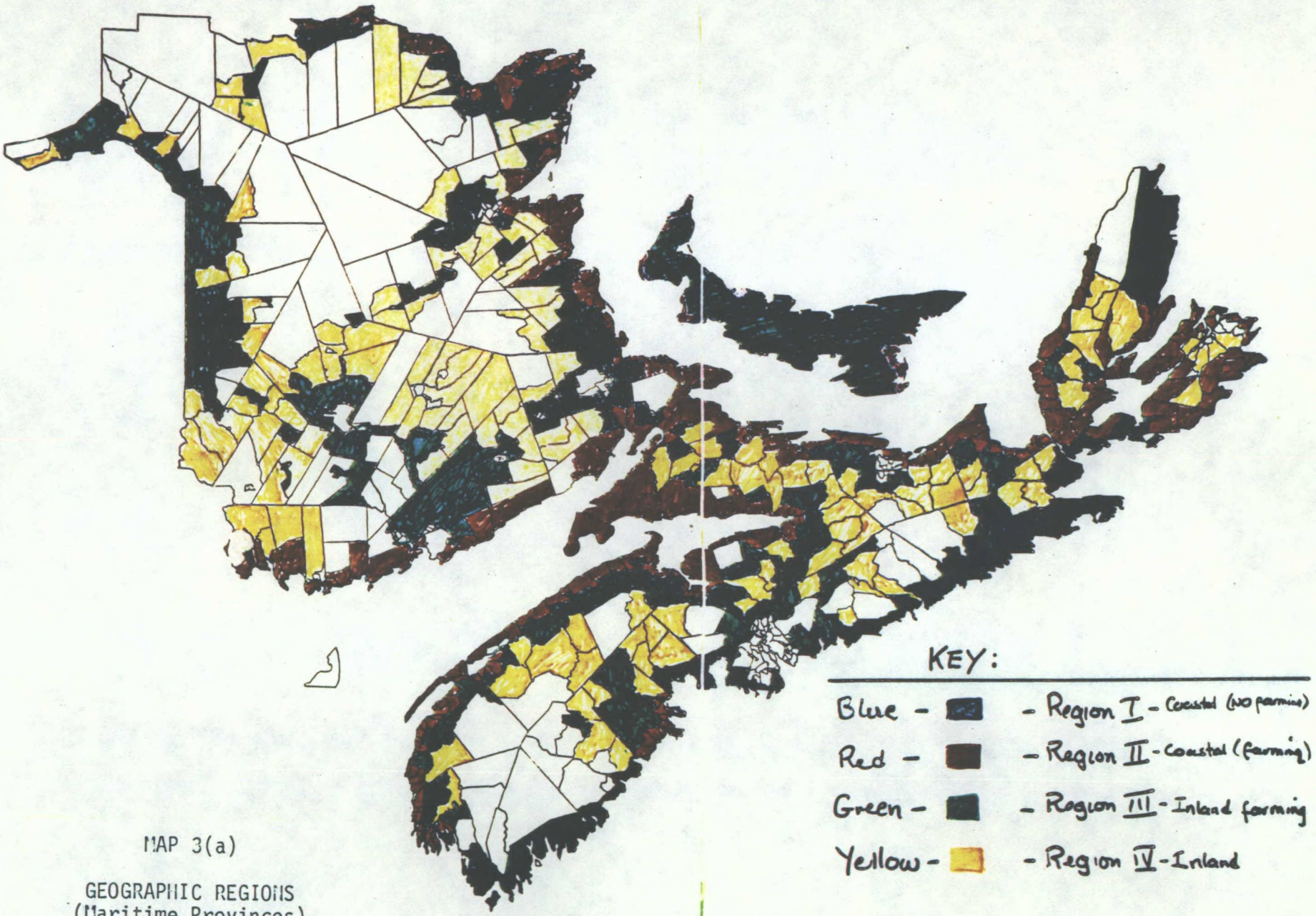
MAP 2(a)

ECONOMIC ACTIVITY BY E.A.
(Maritime Provinces)



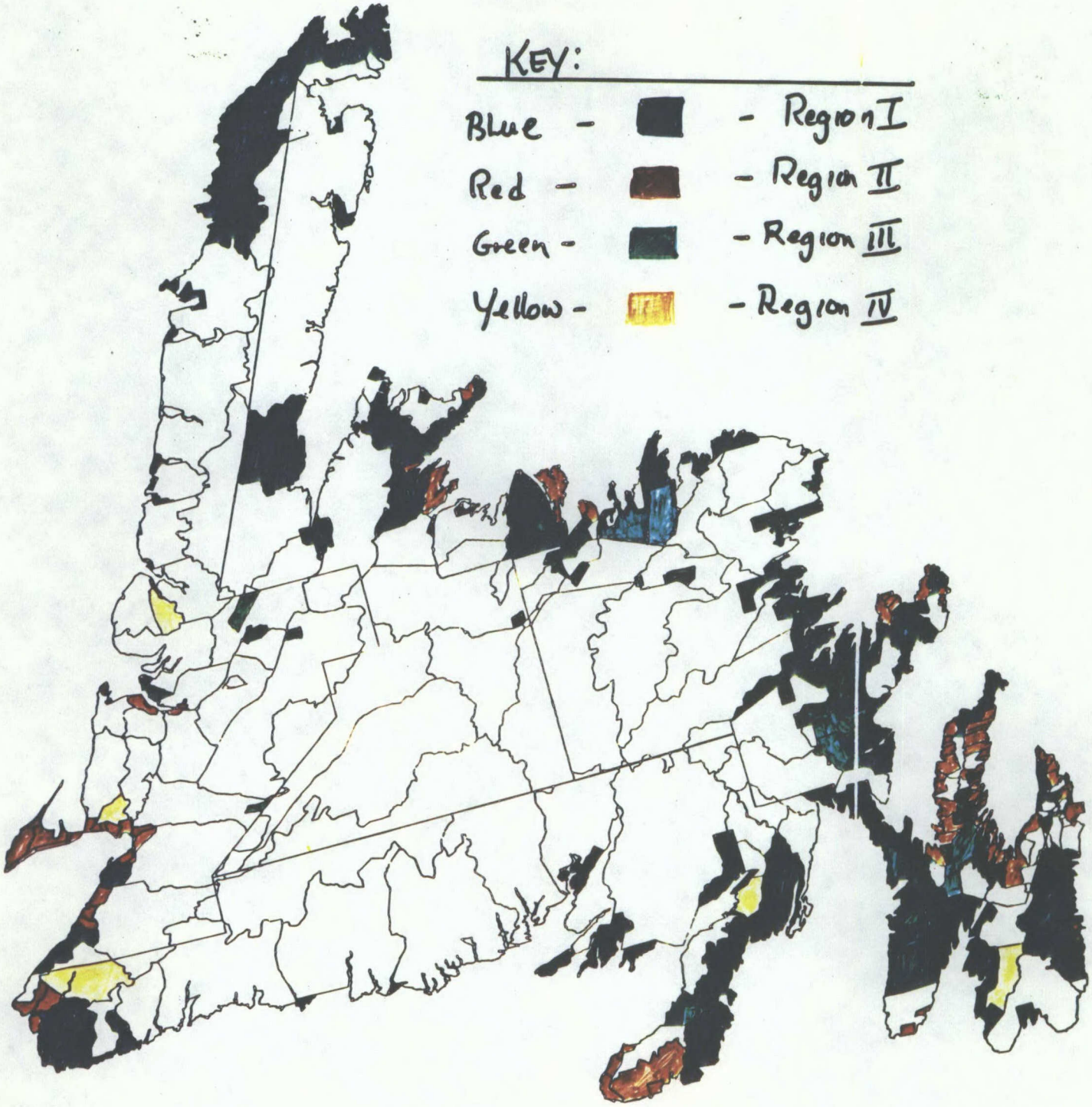
MAP 2(b)

ECONOMIC ACTIVITY BY E.A.
(Newfoundland)



MAP 3(a)

GEOGRAPHIC REGIONS
(Maritime Provinces)



MAP 3(b)

GEOGRAPHIC REGIONS
(Newfoundland)

3.2 Community Size Distribution

With the four regions as defined in Maps 3(a) and 3(b), the number of communities on the Federal Electoral District maps of the size 50-250, 250-1000, and 1000-2500 were tallied. The results for each of the Atlantic Provinces are shown in Tables 1(a), 1(b), 1(c) and 1(d). Table 2 gives the community size distribution for the total Atlantic Provinces and finally Table 3 has the size distribution for isolated communities. Tables 2 and 3 will provide the SCALE UP FACTORS to be used in the next section in the estimation of population in rural Atlantic Canada.

TABLE 1(a)

Community Size Distribution by Region

NOVA SCOTIA

	Community Size		
Region	50-250	250-1000	1000-2500
I	170	66	10
II	299	85	9
III	171	81	10
IV	146	11	1
Total	786	243	30

TABLE 1(b)

Community Size Distribution by Region

NEW BRUNSWICK

	Community Size		
Region	50-250	250-1000	1000-2500
I	--	--	--
II	108	56	17
III	226	95	13
IV	123	15	2
Total	457	166	32

TABLE 1(c)

Community Size Distribution by Region

PRINCE EDWARD ISLAND

	Community Size		
Region	50-250	250-1000	1000-2500
I	--	--	--
II	--	--	--
III	337	29	6
IV	--	--	--
Total	337	29	6

TABLE 1(d)

Community Size Distribution by Region

NEWFOUNDLAND

	Community Size		
Region	50-250	250-1000	1000-2500
I	170	94	16
II	56	63	14
III	17	17	6
IV	5	--	--
Total	248	174	36

TABLE 2

Community Size Distribution by Region

ATLANTIC PROVINCES

	Community Size		
Region	50-250	250-1000	1000-2500
I	340	160	26
II	463	204	40
III	751	222	35
IV	274	26	3
Total	1828	612	104

TABLE 3

Community Size Distribution

ISOLATED COMMUNITIES

	Community Size		
	50-250	250-1000	1000-2500
Number of Communities	44	8	3

3.3 Typical Areas

A single representative was selected from the communities in each size category and region. The objective at this stage was to obtain detailed maps indicating the household distribution in fifteen typical areas. A list of the typical areas plus a brief description, enumeration area location, map reference and household count is given in Table 4. The accompanying maps 4 to 13 inclusive provide the detailed household location information for each typical cell. Since requested maps for types T_5 and T_6 were not received. other similar cells were substituted.

All maps provided in this report are photographic reductions of large scale maps, copies of which are available on special request through the Director of the Rural Communications Program, 300 Slater Street, Ottawa, Ontario, K1A 0C8. The assistance of the Department of Communications Graphic Arts group in the preparation of these maps is gratefully acknowledged.

TABLE 4

Typical Areas

Area	Region	Description	E.A.'s	Map	Households
T_1	I	A coastal area centered on New Melbourne, Newfoundland. Population in the 50-250 range. A single through road heading east to Brownsdale and west to New Chelsea.	10-001-118 10-001-119	4	36
T_2	I	A coastal area centered on Cape Broyle, Newfoundland. Population in the 250-1000 range. Roads heading east to Admirals Cove, north to Brigus South and south to Calvert.	10-007-069 10-007-101	5	181
T_3	I	A coastal area centered on Pouch Cove, Newfoundland. population in the 1000-2500 range. Roads heading southeast to Shoe Cove and southwest to Bauline.	10-006-203 10-006-205 10-006-211 10-006-212 10-006-213	6	414
T_4	II	A coastal farming area centered on Avondale Station, Nova Scotia. Population in the 50-250 range. Roads heading to Barney's River Station, Bailey Brook, Lower Barney's River and Piedmont.	12-005-159 12-005-160 12-005-161 12-005-162	7	30
T_5	II	Maps unavailable for Port Maitland, N.S., substitute T_8	12-011-159 12-011-160	9	98 (T_8)
T_6	II	Maps unavailable for Digby, N.S., substitute T_9	12-011-263 12-011-264 12-011-265	10	368 (T_9)

Area	Region	Description	E.A.'s	Map	Households
T_7	III	A farming area centered on Clinton, P.E.I. Population in the 50-250 range. Roads leading east to New London, west to Norboro, south to Grahams Road and northwest to Margate.	11-004-020 11-004-021 11-004-101	8	37
T_8	III	A farming area (coastal) centered on Abrams Village, P.E.I., with population in the 250-1000 range. Roads leading to Urbainville, St. Timothy's, Maximville and Egmont Bay.	11-002-052 11-002-053 11-002-054 11-002-055 11-002-057	9	98
T_9	III	A farming (coastal) area centered on Tignish, P.E.I. with population in the 1000-2500 range. Roads leading to Tignish Shore, Ascension, Harper, Norway, St. Felix and DeBlois.	11-002-111 11-002-112 11-002-116 11-002-117 11-002-118 11-002-119	10	368
T_{10}	IV	An inland area with low density centered on Hatfield Point, New Brunswick. Center population in the range 50-250. Roads leading northeast to Springfield, northwest to Henderson Settlement and southwest to Lower Kars.	13-002-116 13-002-118 13-002-311	11	126
T_{11}	IV	An inland area with low density centered on Brookfield, Nova Scotia. Center population in the range 250-1000. Roads leading to Pleasant Valley, Brentwood, Middle Stewiacke and Hilden.	12-005-060 to 064 12-005-057 12-005-058	12	359

Area	Region	Description	E.A.'s	Map	Households
T_{12}	IV	An inland area with low density centered on Chipman, New Brunswick. Center population in the 1000-2500 range. Roads leading to Minto, Coal Creek, Bronson Settlement, Newcastle Creek and Gasperaux Forks.	13-002-355 13-002-356 13-002-362 13-002-363 13-002-364 13-002-365 to 368	13	771
T_{13}	ISOLATED	Community of Mose Ambrose, Newfoundland, population in the 50-250 range.	10-002-155	NO MAPS	
T_{14}		Community of Gaultois, Newfoundland, population in the 250-1000 range.	10-002-212		
T_{15}		Community of Ramea, Newfoundland, population in the 1000-2500 range.	10-002-218		

MAP 4

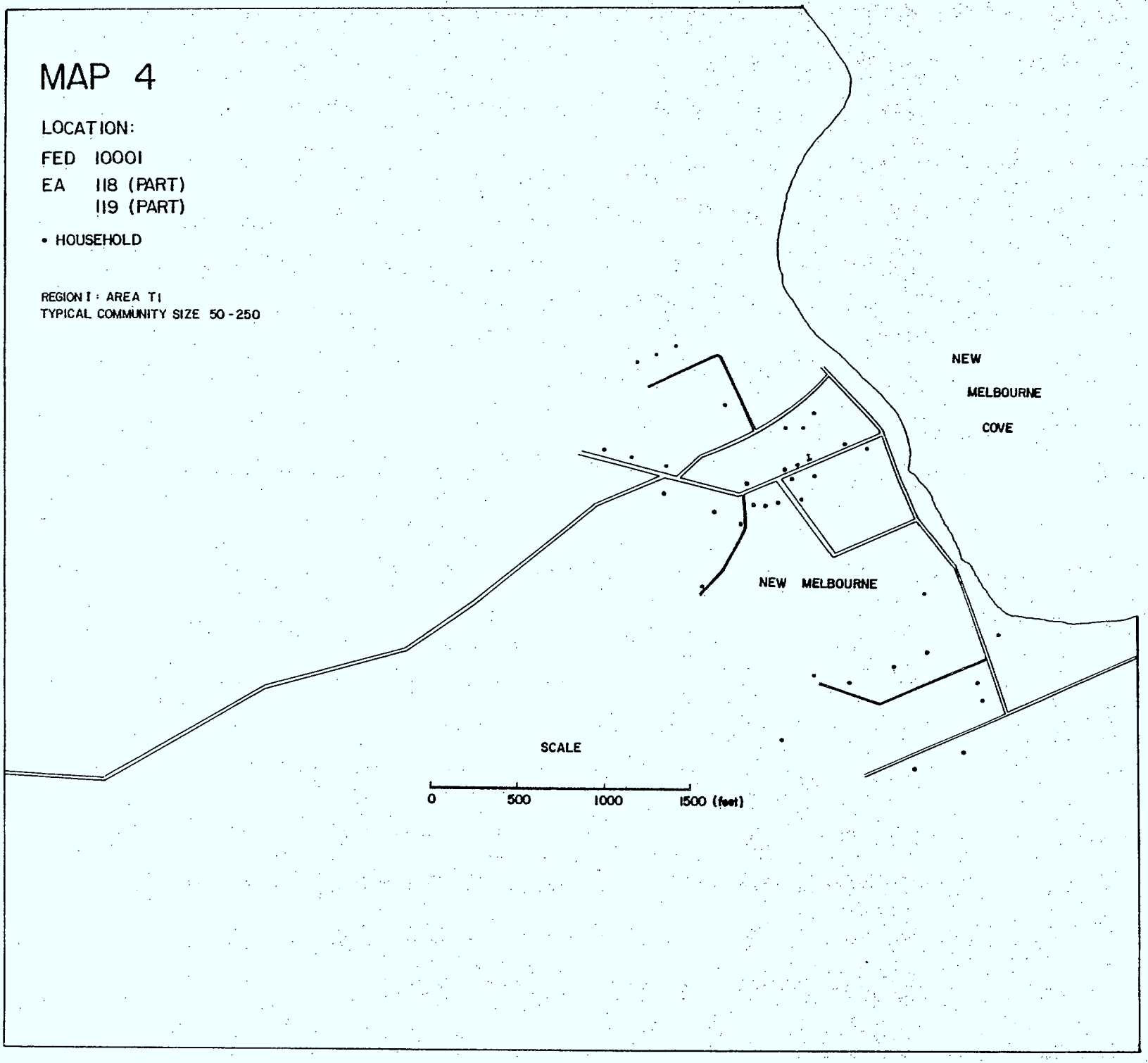
LOCATION:

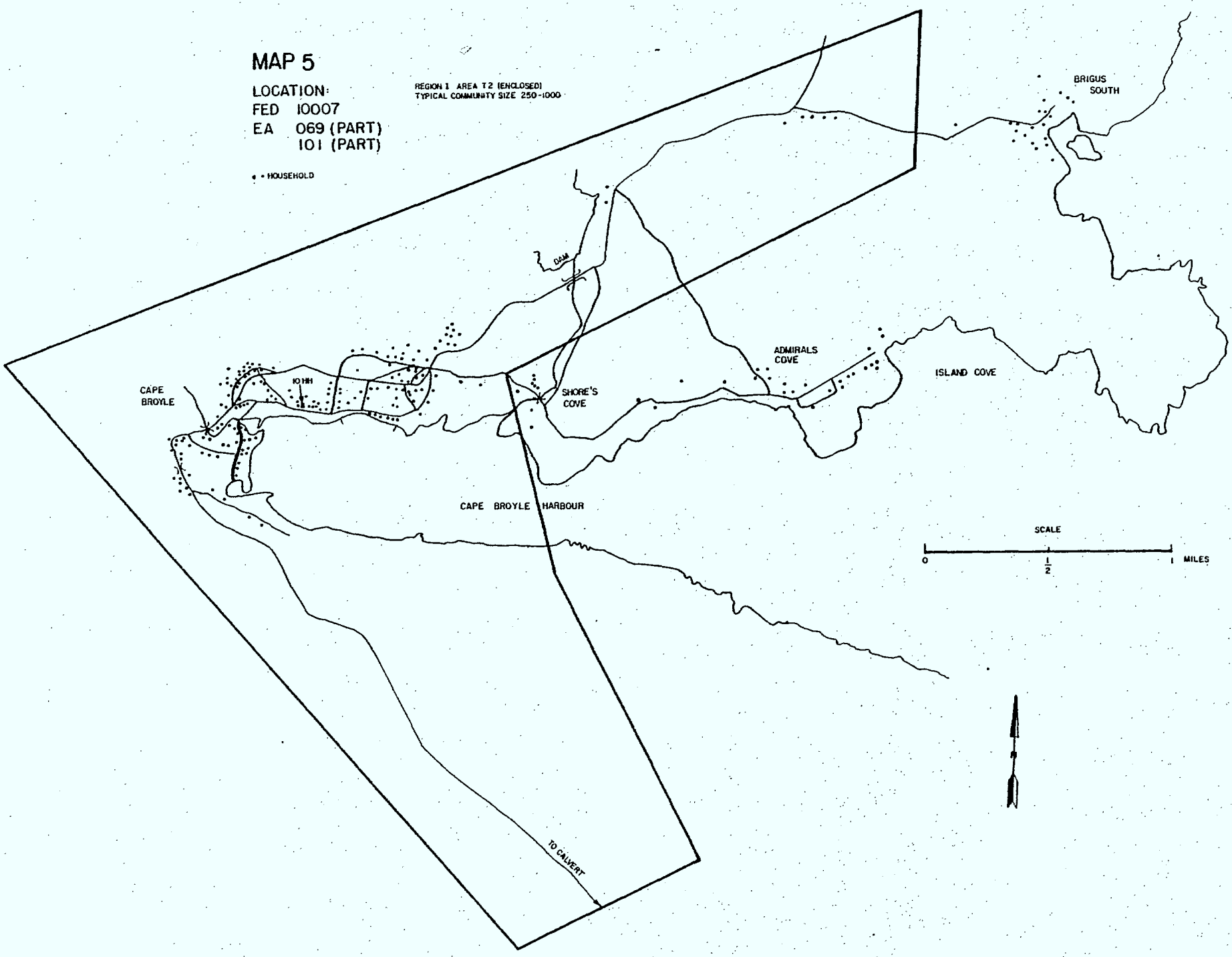
FED 10001

EA 118 (PART)
119 (PART)

• HOUSEHOLD

REGION I : AREA T1
TYPICAL COMMUNITY SIZE 50 - 250




MAP 5
LOCATION:
FED 10007
EA 069 (PART)
101 (PART)
REGION 1 AREA T2 (ENCLOSED)
TYPICAL COMMUNITY SIZE 250-1000
• HOUSEHOLD
BRIGUS SOUTH
DAM
ADMIRALS COVE
ISLAND COVE
CAPE BROYLE
10 HH
SHORE'S COVE
CAPE BROYLE HARBOUR
TO CALVERT
SCALE
0
1/2
1 MILES

MAP 6

POUCH COVE (NFLD.)

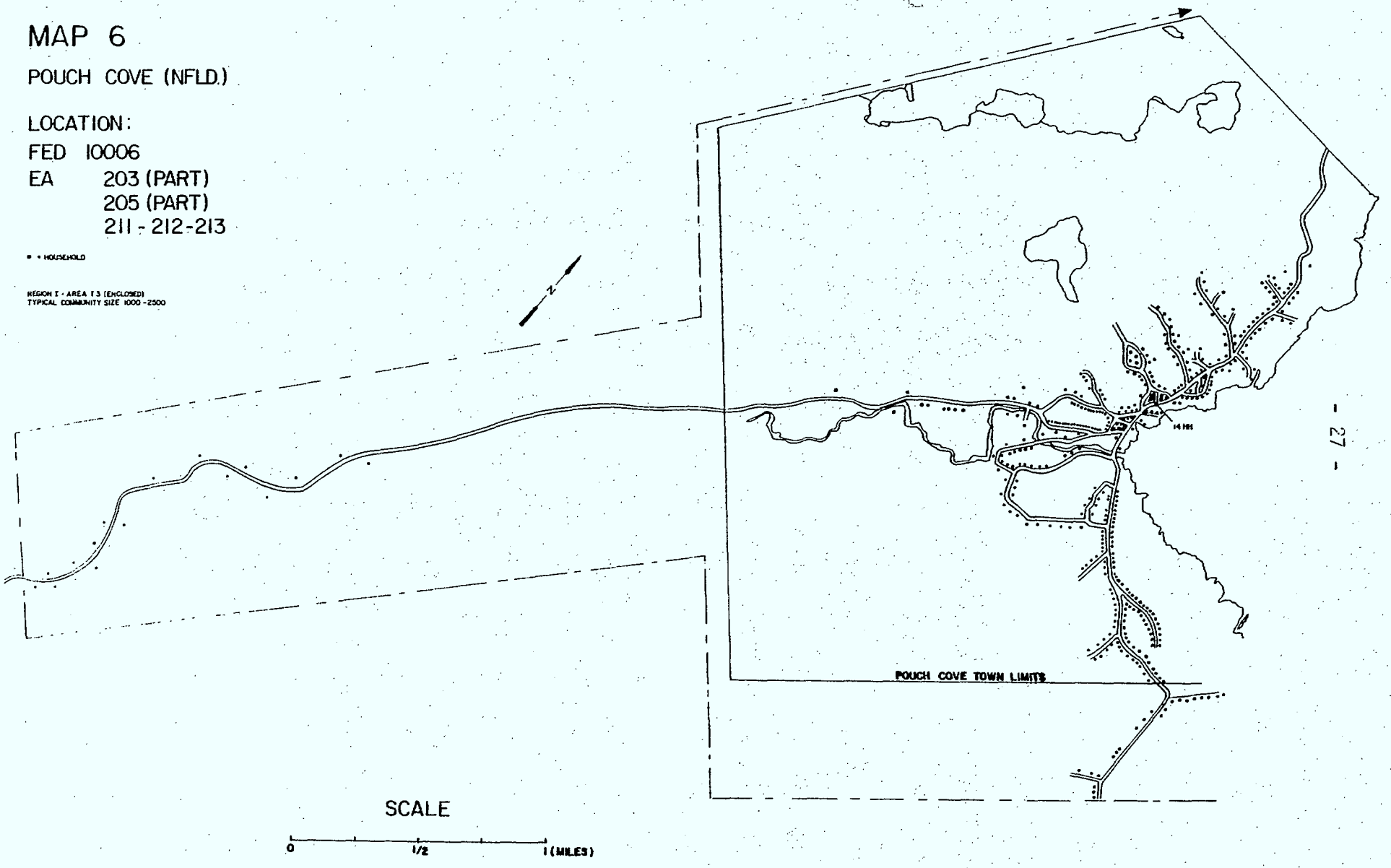
LOCATION:

FED 10006

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

• • HOUSEHOLD

REGION I - AREA I 3 (ENCLOSED)
TYPICAL COMMUNITY SIZE 1000 - 2500



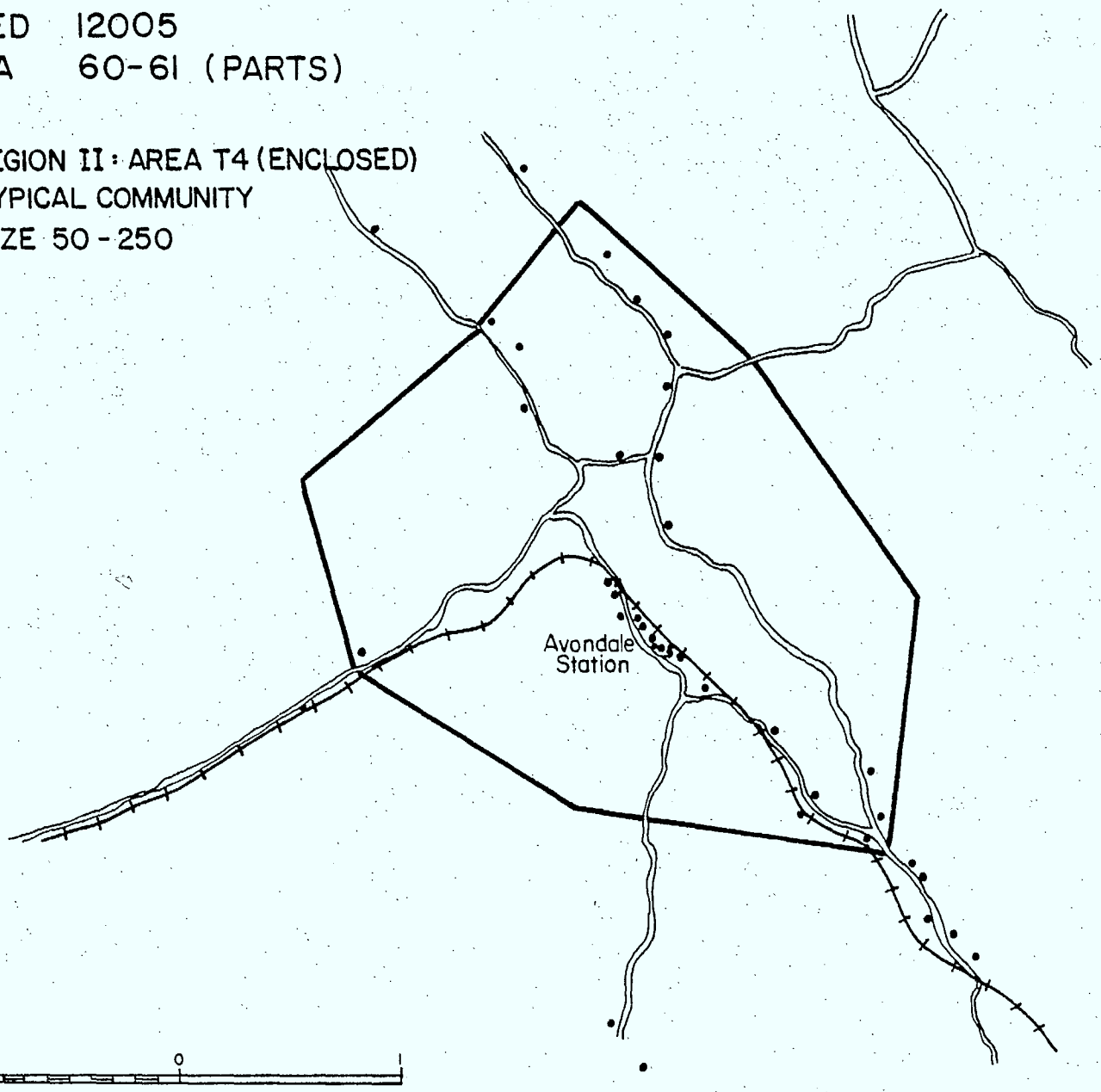
SCALE

0 1/2 1 (MILES)

MAP 7

LOCATION :
FED 12005
EA 60-61 (PARTS)

REGION II : AREA T4 (ENCLOSED)
TYPICAL COMMUNITY
SIZE 50 - 250



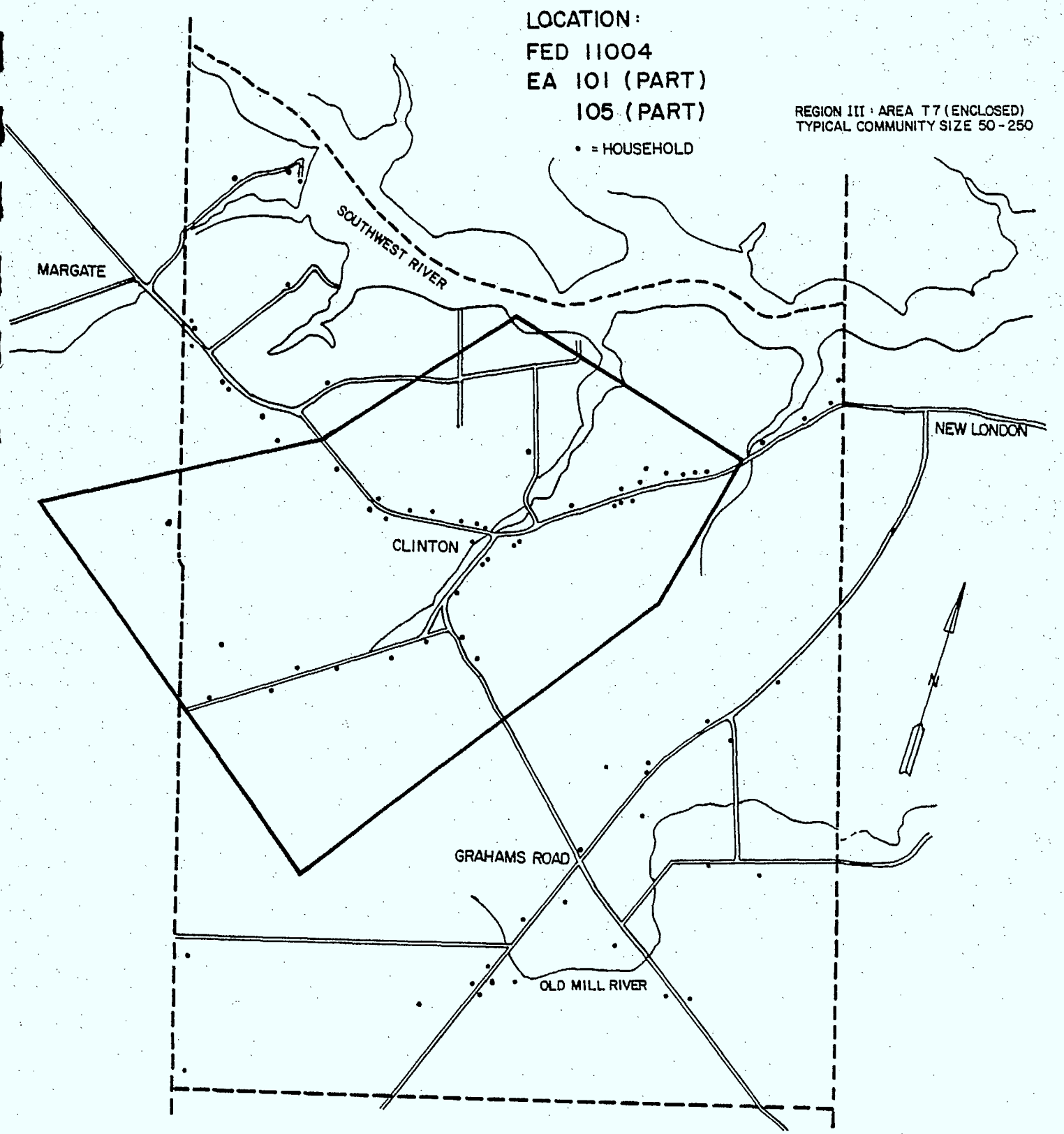
• = HOUSEHOLD

MAP 8

LOCATION:
FED 11004
EA 101 (PART)
105 (PART)

REGION III : AREA T7 (ENCLOSED)
TYPICAL COMMUNITY SIZE 50 - 250

• = HOUSEHOLD



SCALE

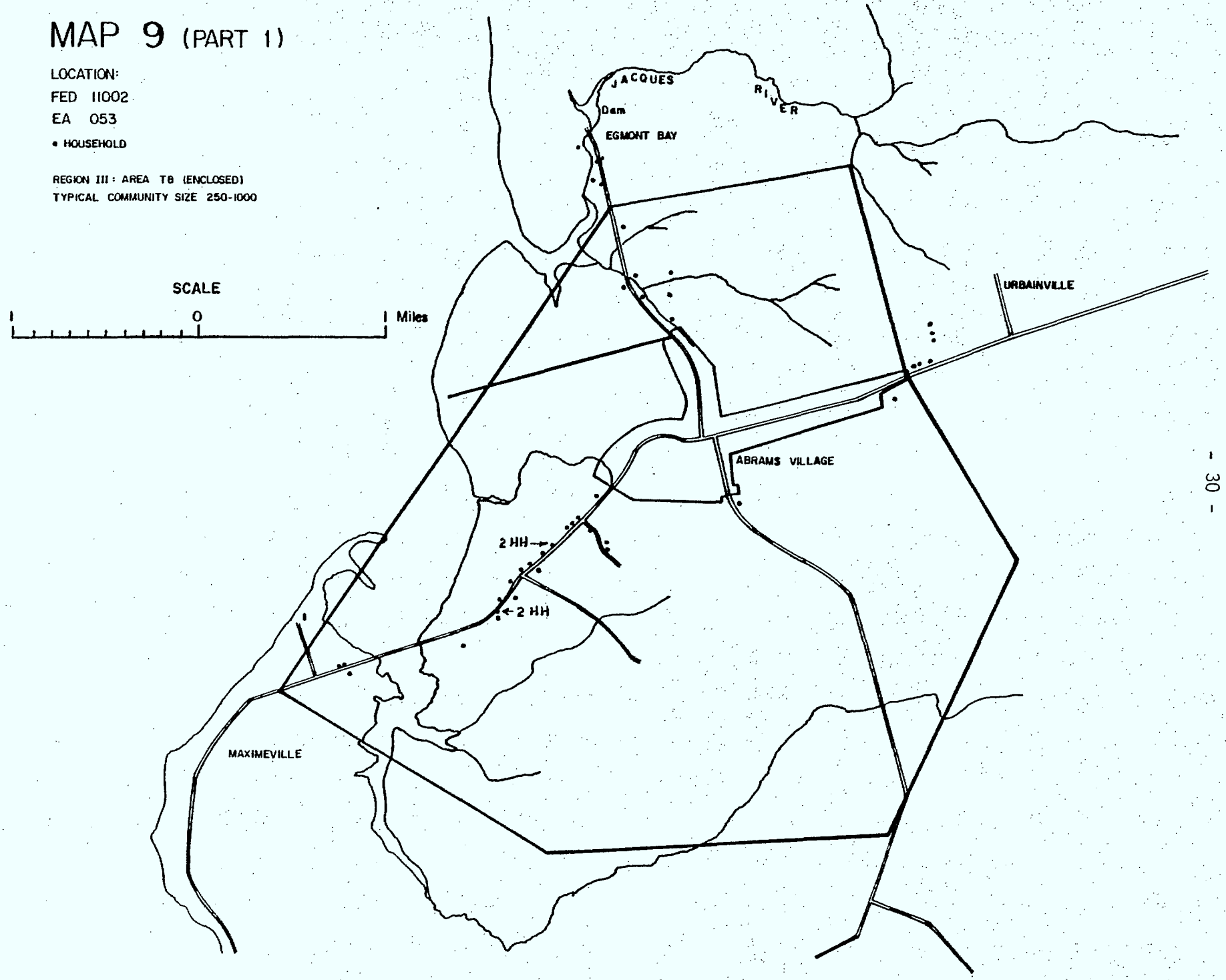
MILES 0

METRES 1000 0 1000

MAP 9 (PART 1)

LOCATION:
FED 11002
EA 053
• HOUSEHOLD

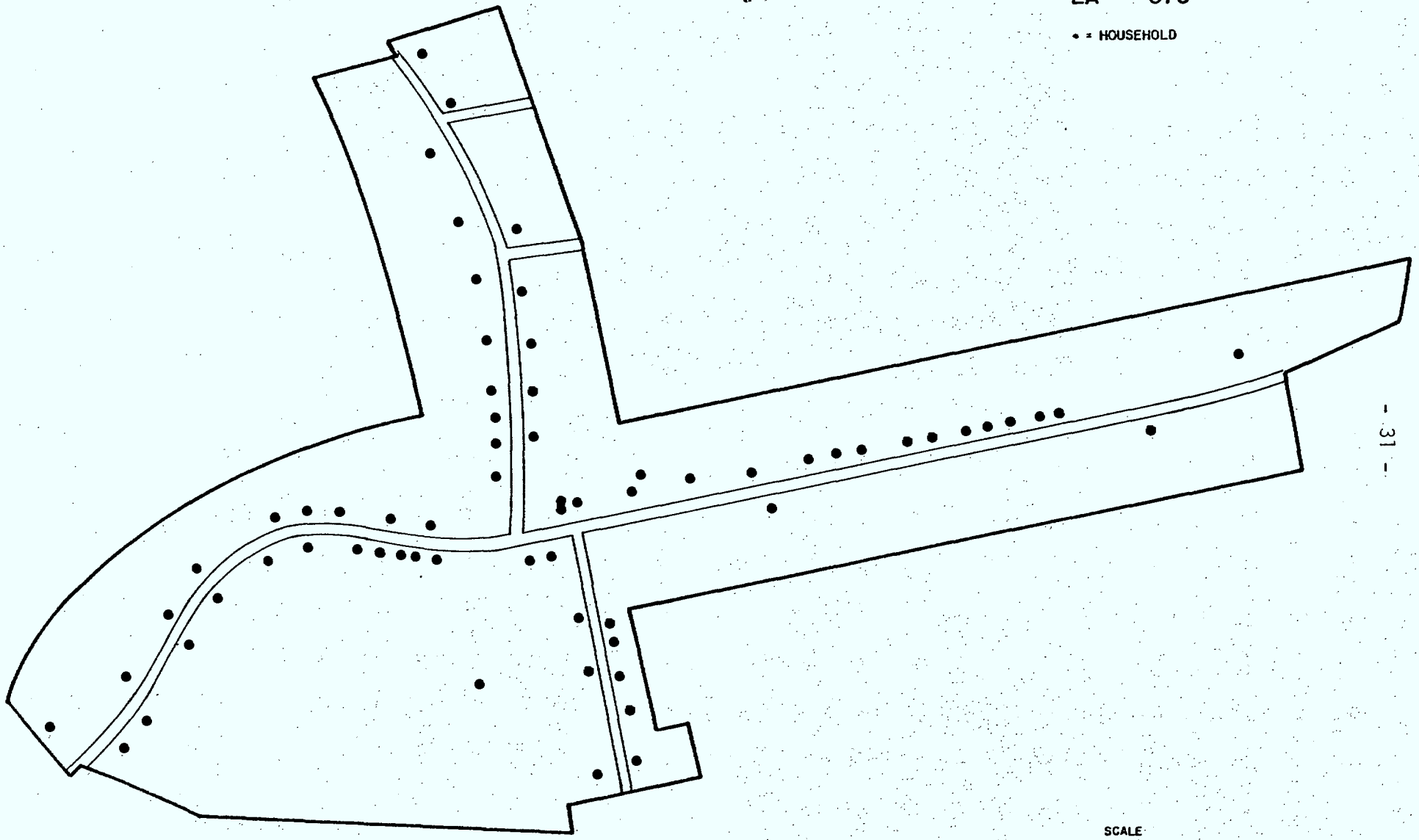
REGION III : AREA T8 (ENCLOSED)
TYPICAL COMMUNITY SIZE 250-1000



MAP 9 (PART 2) ABRAMS VILLAGE

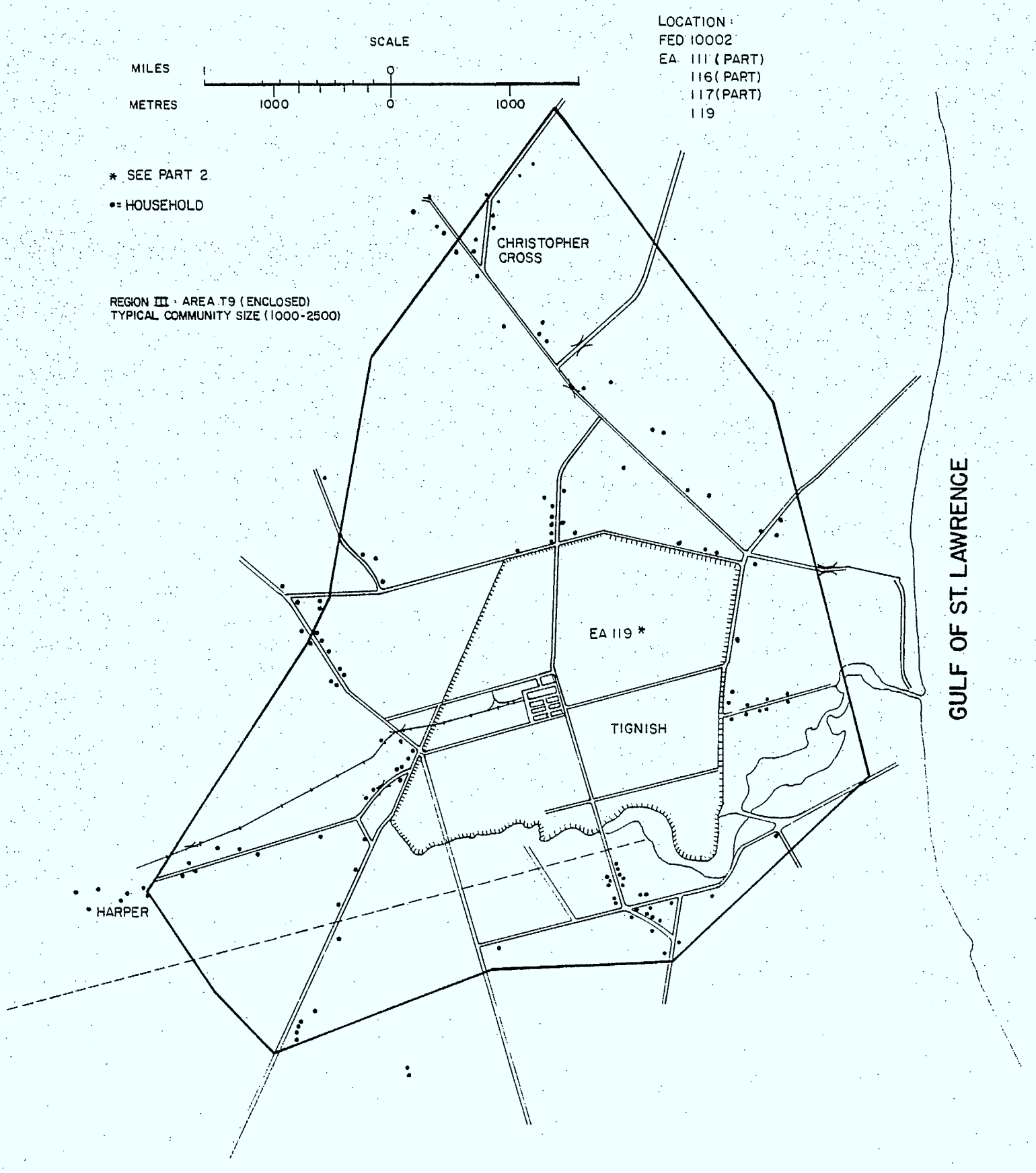
LOCATION:
FED 11002
EA 073

• = HOUSEHOLD



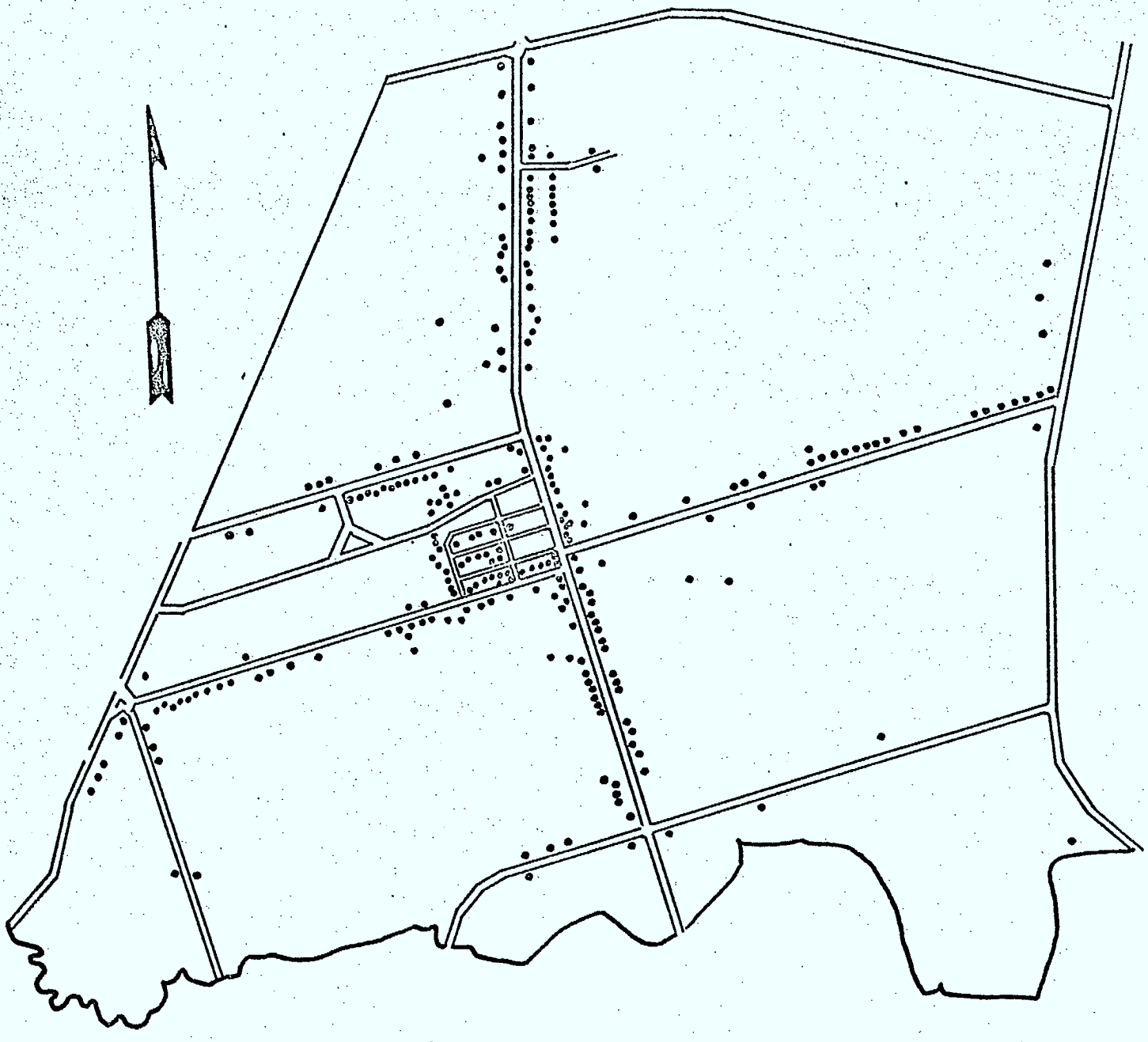
SCALE
0 1000 2000 (FEET)

MAP 10 (PART 1)


LOCATION :
FED 10002
EA 111 (PART)
116 (PART)
117 (PART)
119
SCALE
MILES
METRES
1000
0
1000
* SEE PART 2
•= HOUSEHOLD
REGION III - AREA T9 (ENCLOSED)
TYPICAL COMMUNITY SIZE (1000-2500)
CHRISTOPHER CROSS
EA 119 *
TIGNISH
HARPER
GULF OF ST. LAWRENCE

SCALE

0 1/2 1 mile



MAP 10 (PART 2) TIGNISH VILLAGE

LOCATION :
FED 10002
EA 119

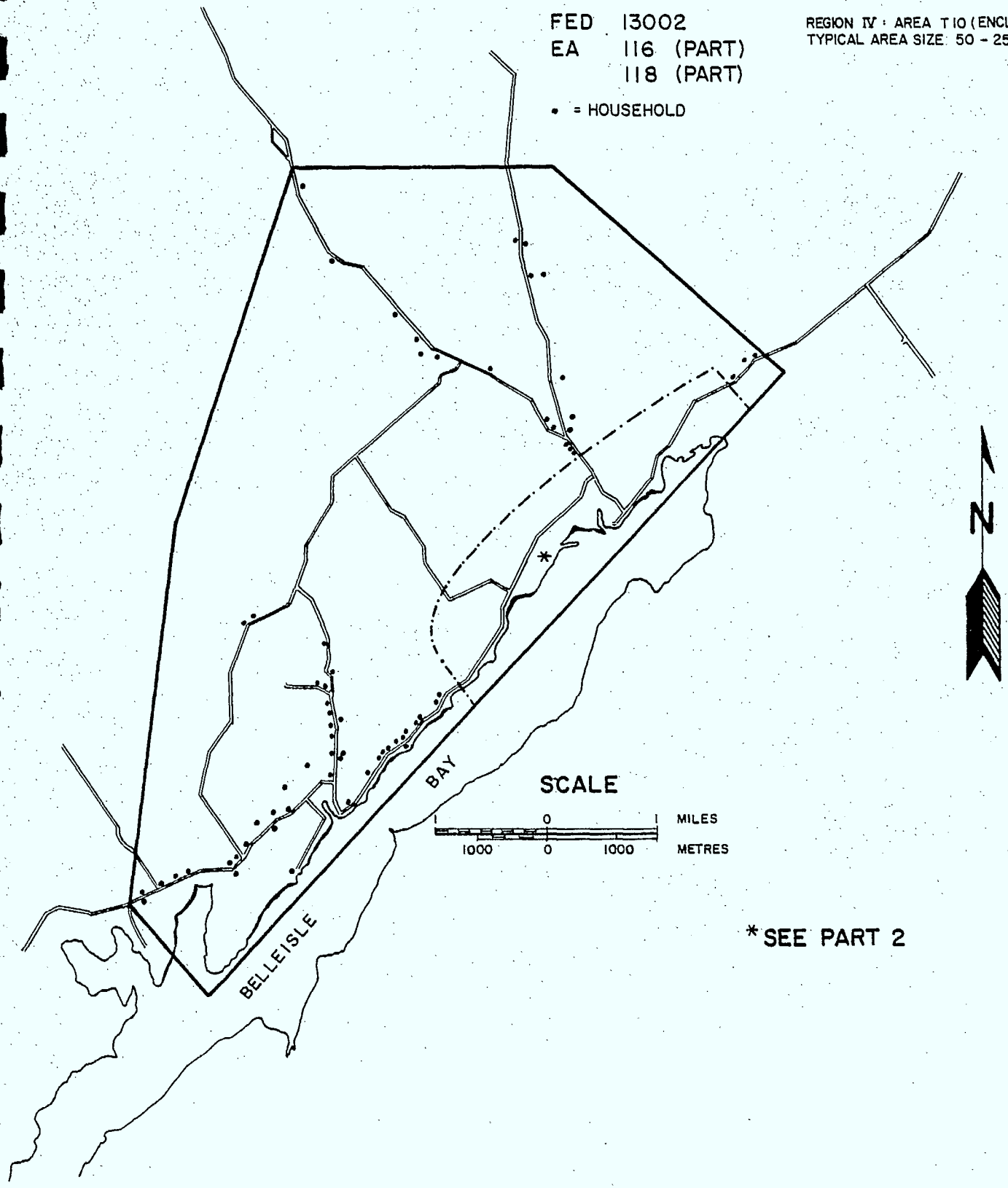
● = HOUSEHOLD

MAP II (PART 1)

LOCATION :
FED 13002
EA 116 (PART)
118 (PART)

• = HOUSEHOLD

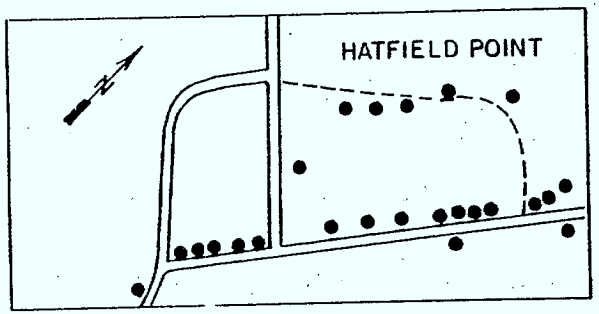
REGION IV : AREA T 10 (ENCLOSED)
TYPICAL AREA SIZE: 50 - 250



*SEE PART 2

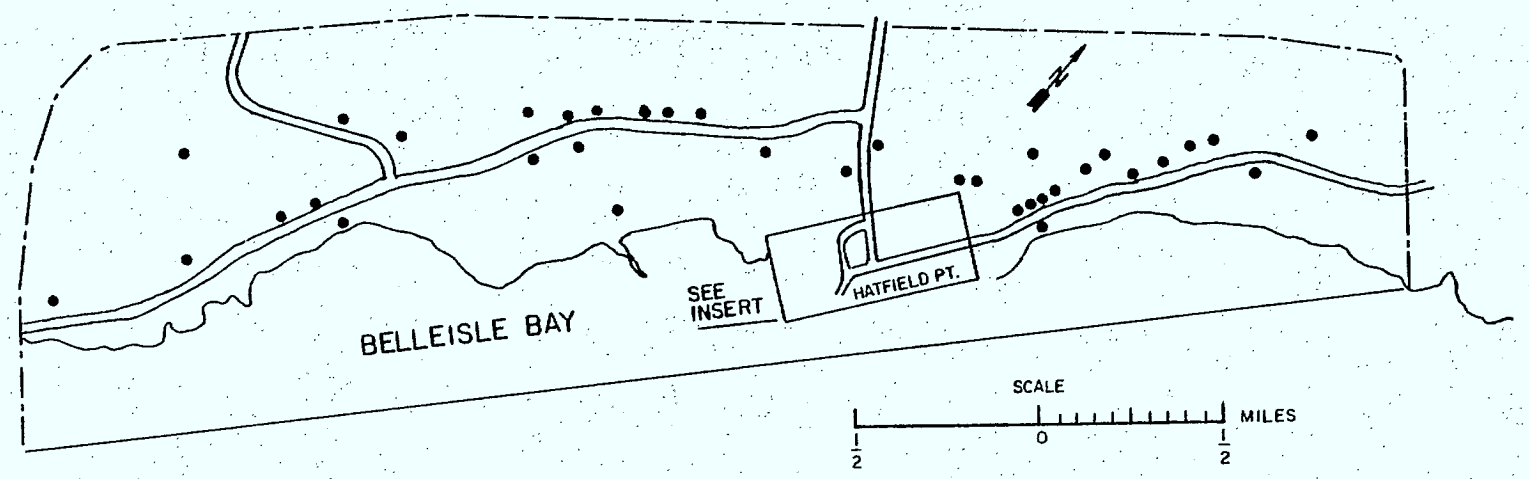
MAP 11 (PART 2)

LOCATION:
FED 13002
EA 118 (PART)



SCALE
0 ½ MILES

● = HOUSEHOLD



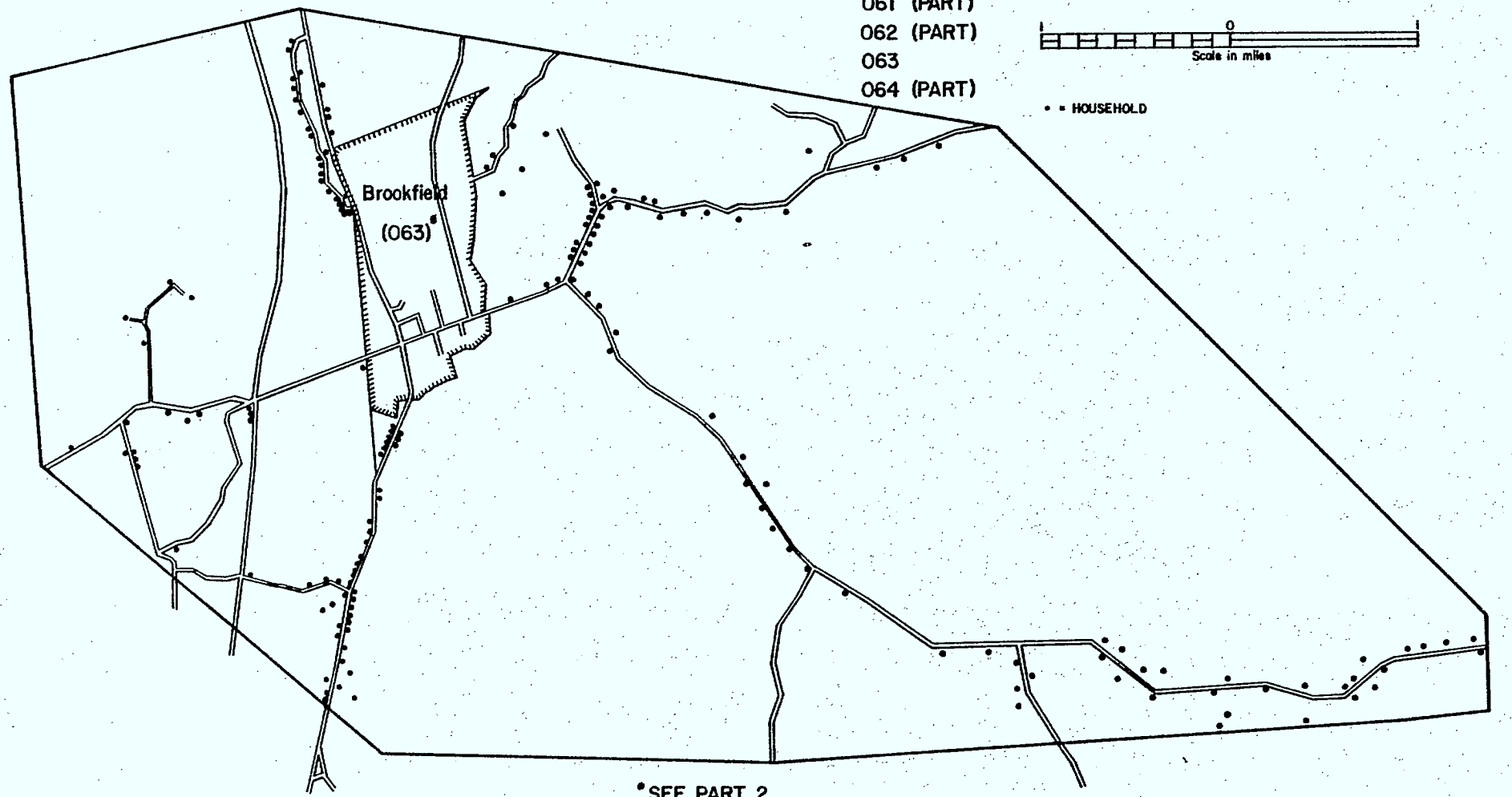
MAP 12 (PART 1)

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

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

0
Scale in miles

• = HOUSEHOLD

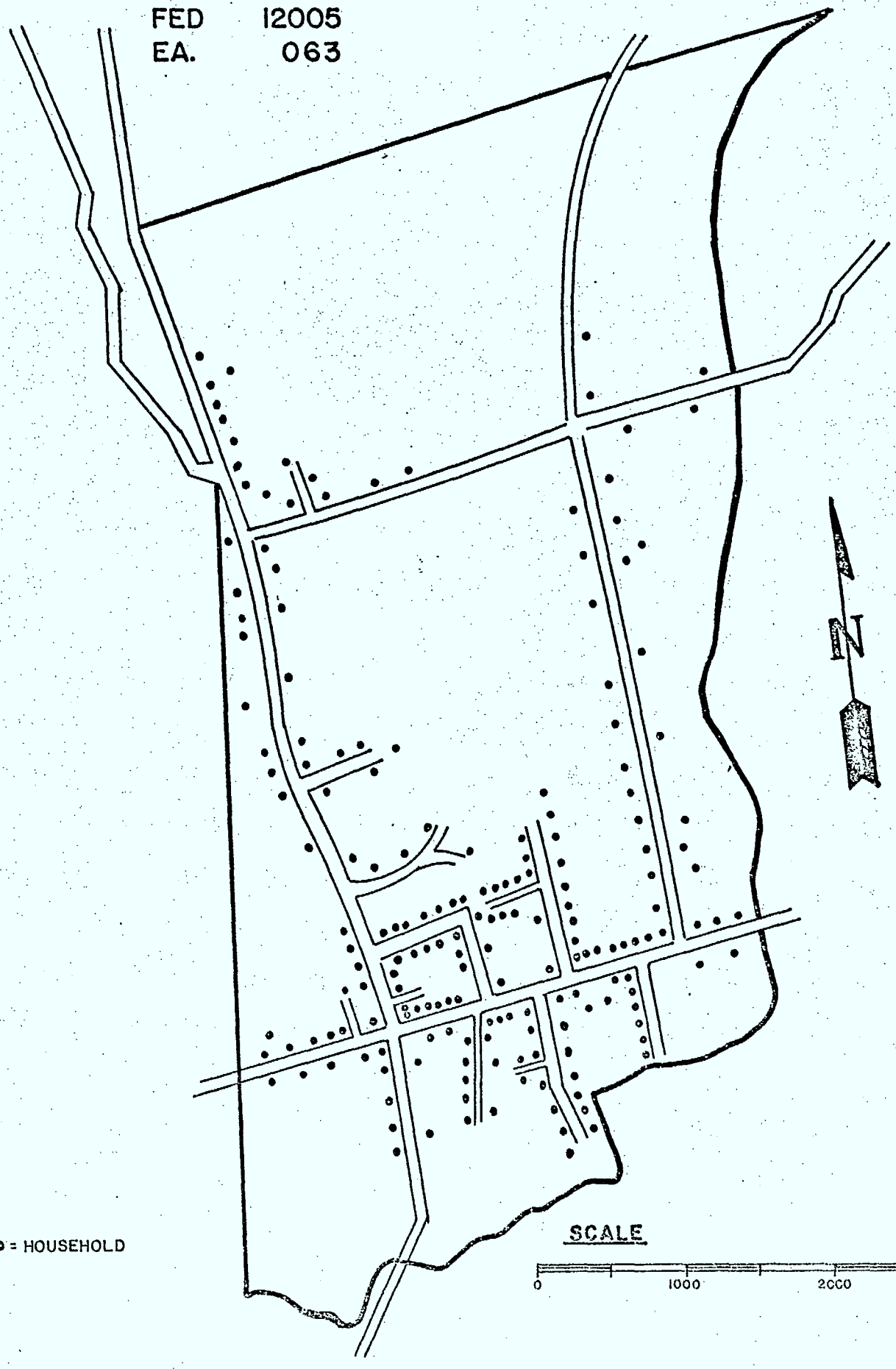


N

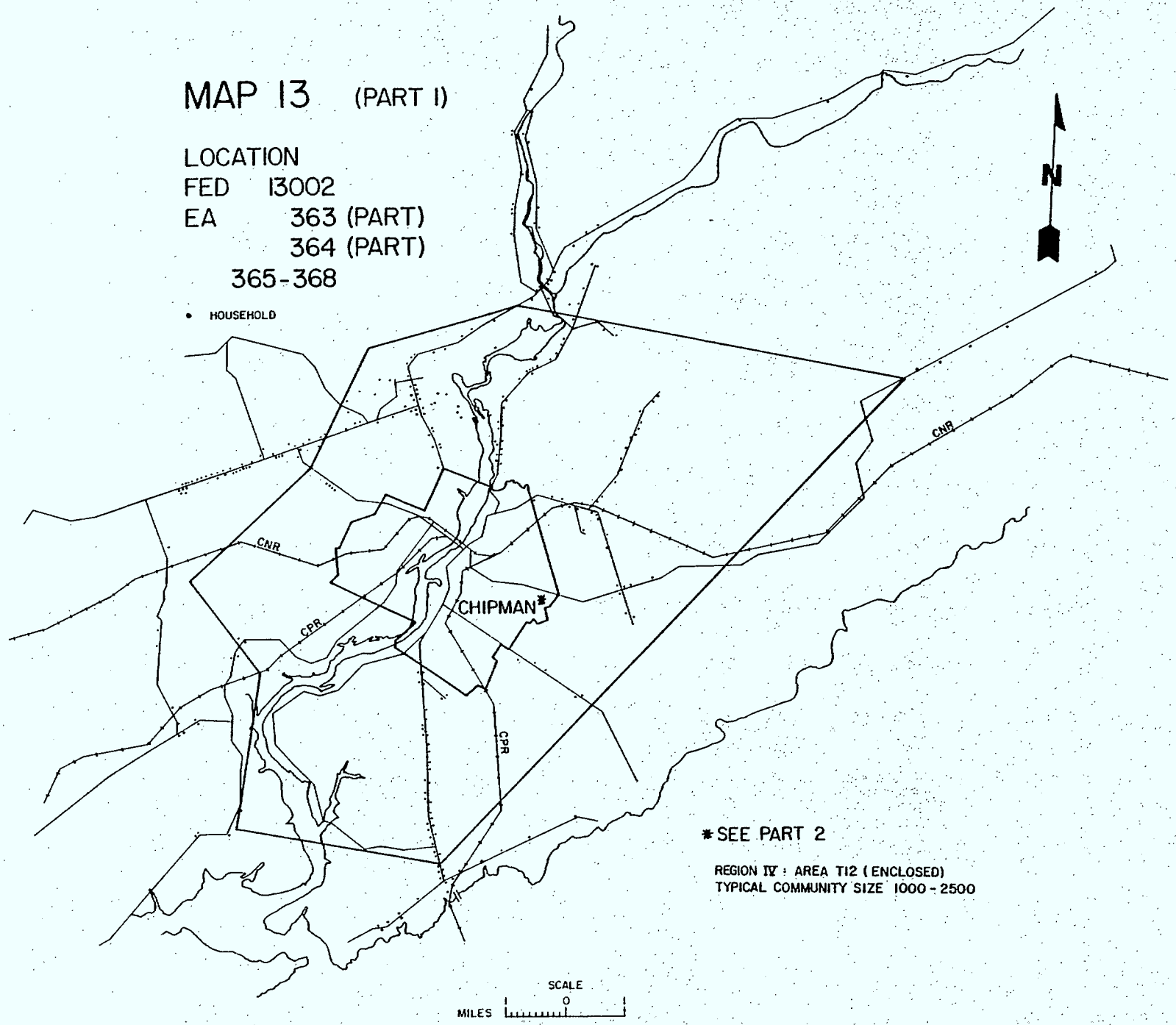
*SEE PART 2

MAP 12 (PART 2) BROOKFIELD

LOCATION:
FED 12005
EA. 063



● = HOUSEHOLD

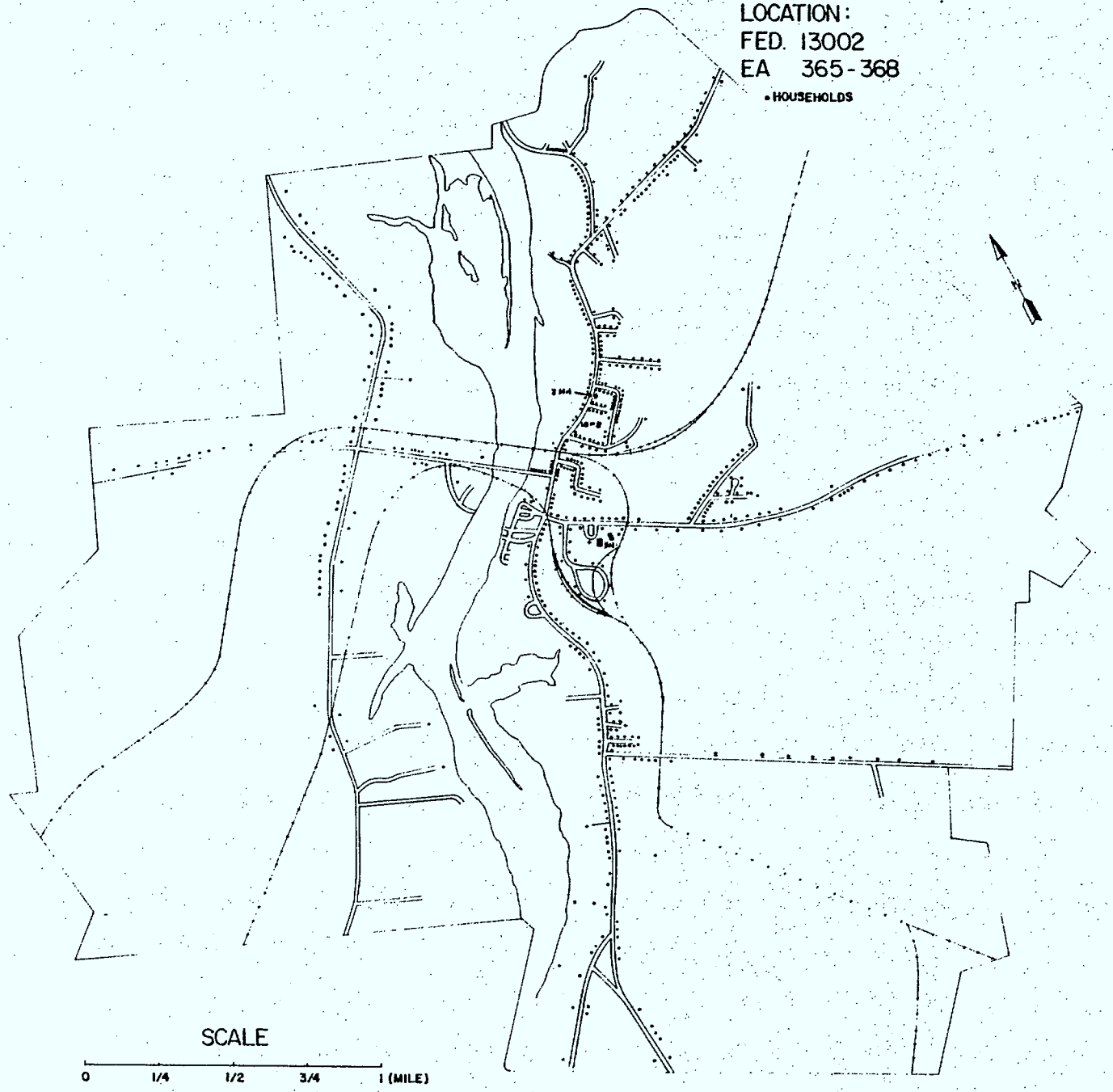

MAP 13 (PART I)
LOCATION
FED 13002
EA 363 (PART)
364 (PART)
365-368
• HOUSEHOLD
N
CNR
CNR
CPR
CPR
CHIPMAN*
*SEE PART 2
REGION IV : AREA T12 (ENCLOSED)
TYPICAL COMMUNITY SIZE 1000 - 2500
SCALE
0
MILES

MAP 13 (PART 2)

CHIPMAN

LOCATION:
FED. 13002
EA 365-368

• HOUSEHOLDS



SECTION 4: VALIDATION

As a test of the representativeness of the typical cells and of the validity of the scale-up factors, the number of households per typical cell and the number of communities per cell type were used to estimate the rural population in the Atlantic Provinces.

For the isolated communities, the population considered was the Census population (no maps included) since the typical area in this case would actually be the community.

The results of this estimation are shown in Table 5. The actual rural population in the Atlantic Provinces by the 1976 Census was 1,105,948. The estimated population by scaling up the typical cell data is 933,754 which is about 84% of the actual population. There are a number of factors to consider in this underestimate. First, since E.A. boundaries do not coincide with cell boundaries, 1976 census data for the population per cell (the second column in Table 5) was obtained by multiplying the household count from the enclosed maps by persons/household ratios (for rural portions, to be: N.S.: 3.7, N.B.: 4.2, P.E.I.: 4.5, Nfld: 4.7). Thus the assumption that these numbers are valid for the cells chosen will introduce some error. Furthermore, the question must remain open as to the representativeness of each chosen cell. There is also no doubt some error introduced by the substitution of two other cell examples for T_5 and T_6. Finally, a truly accurate calculation for T_{13}, T_{14} and T_{15} would entail summing the 1976 populations for all isolated communities, rather than simply scaling up the population of the three chosen communities.

Finally, the area surrounding a large town or city will often be allocated to the area of influence of that town. Thus the area attribution method will miss those households that are in rural E.A.s close to large centers.

TABLE 5

ESTIMATION OF ATLANTIC REGION POPULATION

Area	Population in typical area	Scale up (Number of Communities)	Total Population for Cell type
T_1	170	340	57,800
T_2	851	160	136,160
T_3	1946	26	50,596
T_4	111	463	51,393
T_5	441	204	89,964
T_6	1656	40	66,240
T_7	167	751	125,417
T_8	441	222	97,902
T_9	1656	35	57,960
T_{10}	529	274	144,946
T_{11}	1328	26	34,528
T_{12}	3238	3	9,714
T_{13}	68	44	2,992
T_{14}	558	8	4,464
T_{15}	1226	3	3,678
Total			933,754

HOUSEHOLD DISTRIBUTION IN THE RURAL AREAS OF THE ATLANTIC PROVINCES...
--MacLean, L.C.