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Electricity (coverage)

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ABERYSTWYTH.

DEPARTMENT OF AGRICULTURAL ECONOMICS

RURAL ELECTRIFICATION AND THE FARMING COMMUNITY IN WALES

by

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Agricultural Research Building, Penglais, Aberystwyth

Price: Three shillings and sixpence.

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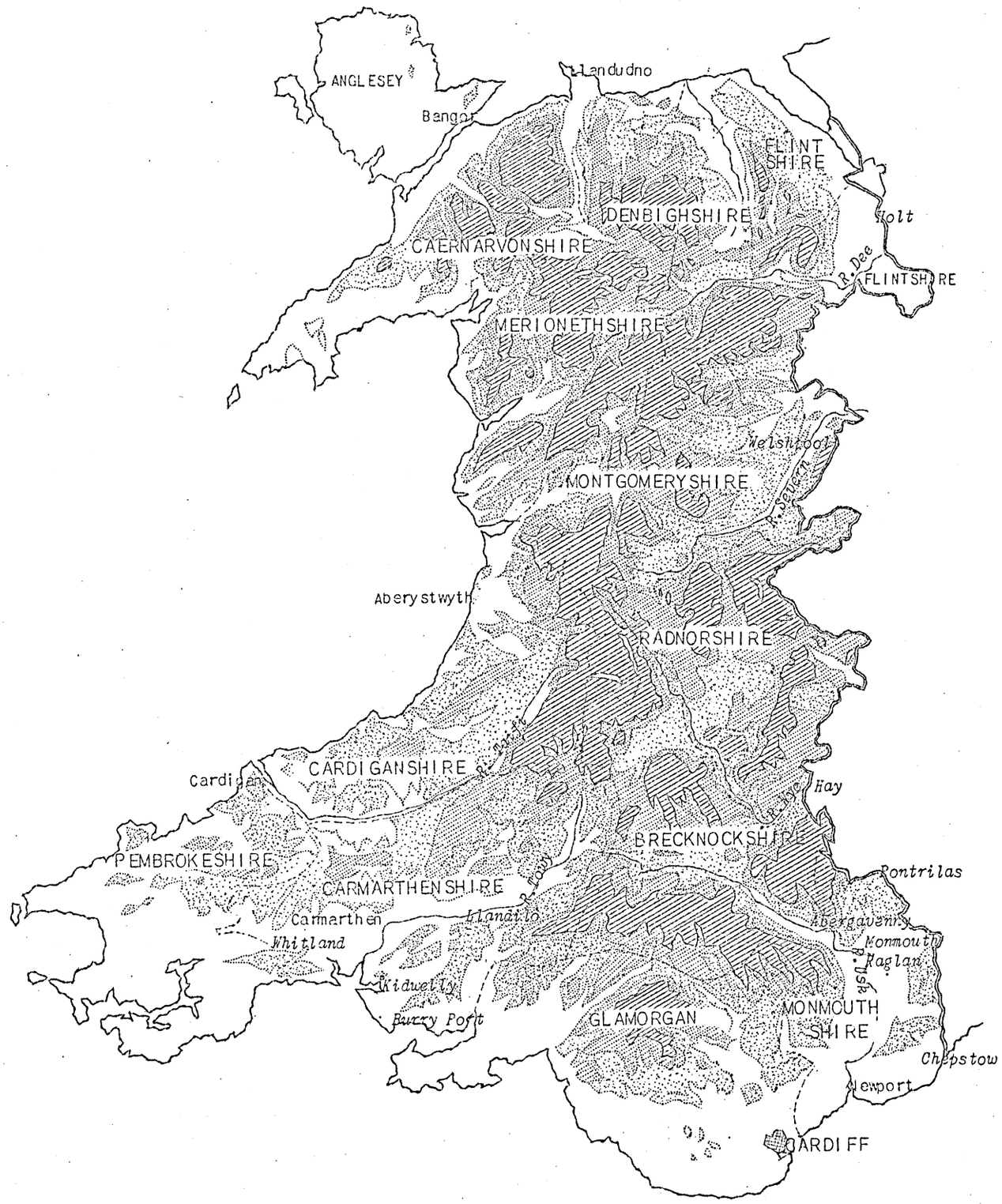
MAP OF WALES & MONMOUTH



Over 1200 ft
800–1200 ft
400–800 ft
0–400 ft

County Boundaries – – – –

FOREWORD.

There is no doubt that an adequate supply of electric power would be of great benefit to agriculture and to rural industries generally. In the first place, under modern conditions of farming, farms lacking such a supply are not efficiently equipped for production. In this respect the importance of this service ranks only second to that of an adequate supply of water. It has a bearing also on the labour problem, as the availability of electric power reduces materially the time required for performing many of the routine farm processes and further makes possible the introduction of the most up-to-date and efficient methods. Again, the provision of electricity not only aids the farmer in running his business and the farmer's wife in her household work but also helps in supplying the needs of other members of the rural community. Villages, rural industries, service agencies, institutions &c. would all benefit by a supply of electricity. Finally, it is an accepted fact that the absence of amenities, of which electricity is one, has been an important factor in the depopulation of the countryside; and the future of agriculture depends a great deal on giving the rural dweller that share of urban amenities to which he has a moral right.

With the nationalisation of the electricity supply in April, 1948, the newly formed Electricity Boards gave due consideration to the problem of extending supplies to the undeveloped rural areas in Wales and comprehensive plans were prepared for this purpose. It became obvious, however, from the figures obtained regarding the amount of capital and the quantities of material and labour that would be required, that the provision of supplies throughout each parish in the country would take many years.

In the Merseyside and North Wales area each county was divided into sections, and certain of these sections were chosen for an early stage of development, progress depending on the estimated resources which could be reasonably made available each year. As some indication of the magnitude of the task, it has been estimated that 3,000 miles of high voltage lines would be necessary to bring supplies within reach of every village, hamlet and farm.

The first stage of the plan was commenced in 1949, is scheduled for completion by May, 1953 and will provide supplies to 2,039 farms and 4,527 other premises.

In the South Wales area, rural development is planned in schedules of jobs, the cost of each schedule amounting to approximately £100,000. Three schedules have so far been approved, and others are in course of preparation. The rate at which each schedule can be completed depends upon the available resources.

In arranging priorities, it appears that both Boards refer the schemes to the Consumers' Consultative Council, who have an opportunity of guiding them where practicable. The Boards are of the opinion that the restriction on the availability of capital and the shortage of essential material is likely to control the progress of these schemes.

In Wales, the progress in the extension of electricity distribution to rural areas and specificially to farms has been disappointing. The position for the years 1941-43, as revealed by the National Farm Survey (1946), showed that only 8.2 per cent of the farm holdings were provided with a public supply of electricity as compared with 26.7 per cent in England. There are no figures that can be used for comparison in 1951, but during the debate on Welsh Affairs in the House of Commons on the 4th February, 1952, the figures* quoted by Mr. Roderick Bowen (Cardigan) in a statement on the electrification of rural areas indicated that far more progress had been made in connecting up farms in England than had been the case in Wales.

The progress made since vesting date by the Electricity Boards responsible for rural electrification in Wales is shown in the following statement:-

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* See Hansard, No. 207 (1st February - 11th February 1952) - pages 708-710.

Merseyside and North Wales Electricity Board.

(Premises connected in North Wales to the Board's electricity supply systems since 1948).(a)

Year.	Domestic.	Farm.	Commercial.	Industrial.	Total.
	No.	No.	No.	No.	No.
1948-49	5,412	193	473	123	6,201
1949-50	4,868	231	662	50	5,811
1950-51	5,498	287	546	18	6,349
Total	15,778	711	1,681	191	18,361

(a) In addition there have been a further 3,433 premises, including 77 farms, taken over from non-statutory electricity undertakings during the three years' period.

South Wales Electricity Board.

(Hamlets/ Villages and Farms connected in South Wales to the Board's electricity supply system since 1948.)

Year.	Hamlet/Villages.	Farms.
	No.	No.
1948-49	24	211
1949-50	48	267
1950-51	52	341

With regard to private supplies, we find that under the Hill Farming Act (1946) a total of 412 schemes, approved of formally or in principle, included the provision of electricity supplies to farms.

While some progress has been made since 1943, the position so far appears to be that development schemes for rural distribution are not being proceeded with on any appreciable scale. In view of the Government's decision in the autumn of 1951 that area Electricity Boards should spend only £3 millions on rural electrification this year instead of the £5 millions originally intended, there has been much concern regarding future developments. Conditions have, however, improved to some extent, in that the Government later decided to increase the amount to £4 millions; and this concession will make it possible not only for existing schemes to continue but for new schemes to be started.

It is recognised that extensive development of electricity in many rural areas may be unremunerative in the initial stages; but it is felt that, once supplies are available on reasonable terms, revenue-producing consumption will rise to economic levels. Farmers and other members of the rural community can assist the Electricity Boards by using electricity for all possible purposes, so that the revenue obtained by the Boards is sufficiant to cover the initial expense of connecting the farms, rural villages, small factories, workshops &c. Comprehensive electrification of rural areas on progressive lines and within a reasonable time, while contributing to an increased efficiency in agriculture and in other rural industries, will in itself stimulate an expanding market for a wide range of machinery, goods and services.

At a time when every farmer is expected to produce more food from the land, it must be recognised that electricity is required in the farming industry not only to meet requirements for domestic purposes but also as a factor in food production and as a source of power. Equally important are the needs of other members of the rural community for a supply of electricity for their homes, shops, institutions and industries. Rural Wales is ripe for electrical development, and it is now realised more than ever that the countryman is entitled to the enjoyment of those services and amenities of life which the urban dweller already possesses.

The Report that follows is a brief discussion of rural electrification in Wales and is an attempt to sketch in broad outline, some aspects of the problems involved in the extension of electricity supplies to rural districts. No detailed information on the extent to which electricity has been connected to farms in Wales has been collected since the National Farm Survey was recorded in 1941-3. All the figures in this Report are based on the information obtained then, and must therefore be treated with an element of reserve in view of more recent progress.

In indicating the transmission lines operated by the Electricity Boards for Wales, only the main high voltage distribution lines have been shown. These, studied in conjunction with the number of farms with or without electricity, give a rough but sufficiently useful indication of actual and potential developments to meet the purpose of this discussion. No attempt has been made to provide a more detailed picture of local distribution schemes.

The Department of Agricultural Economics, University College of Wales, Aberystwyth gratefully acknowledges the assistance given by the Electricity Boards (Wales) in furnishing the figures relating to the progress made in the provision of electricity supplies since vesting date, and in granting permission to include in the maps the main transmission lines operated by them. Thanks are also due to the Ministry of Agriculture and Fisheries (Welsh Office) for the data giving the number of schemes approved of formally or in principle, under the Hill Farming Act (1946), which included the provision of electricity supplies to farms.

May, 1952.

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Assistant Advisor in Agricultural Economics.

RURAL ELECTRIFICATION AND THE FARMING COMMUNITY IN WALES.

The Significance of Electricity in Agriculture.

The rising cost of farm labour has re-emphasised the advantages to be derived from the use of power equipment on the farm, and has made the availability of cheap electric power a consideration of primary importance not only to British agriculture but to the whole nation. Indeed, as Professor Edgar Thomas opined,* "There is no other single development which could ease the labour situation on the majority of farms more than the development of electricity - not forgetting the farmhouse." Undoubtedly, if a highly efficient agricultural industry is of such inestimable value to the nation as is generally supposed, it is of the utmost importance that the farmer should be given every means to make it so. Under present circumstances, however keen the individual may be, and however competent the advisory services, unless the farmer is given the opportunity to adopt the most efficient methods at his disposal, he is not in a position to counterbalance the steeply rising costs.

In an address to the Agricultural Economics Society in December 1946, Carslaw painted an even gloomier picture** ".....of energy and enterprise sapped by frustration, of endeavour weakened by disappointment, of the pleasure of craftsmanship destroyed, of ill-health resulting from the sheer physical effort of surmounting handicaps, of farmers' wives broken by drudgery, of young men who cannot get married because no intelligent girl will live in the house they have to offer, of skilled men and competent women leaving the countryside for no other reason than poor amenities." As he rightly points out, most farmers have to expend far too large a proportion of their time overcoming physical difficulties both on the farm and in the home.

With time and labour at a premium, as under present-day conditions they are, efficiency, and the means to achieve it, become a major preoccupation. For this reason potentialities of mechanical methods of farming received new emphasis at the Winchester Conference on Fixed Equipment. The saving of time and labour which results from the use of such apparatus as may be employed for heating soil, for poultry appliances, for field work, for chaffcutting, root pulping, cake breaking, corn grinding or wood sawing, for churning and separating milk, for milking and shearing and for lighting farm buildings was freely acknowledged. Equally recognised was the important relationship between efficiency and a home made comfortable by the amenities which electricity can provide. Not only time, labour and comfort, but also the use of leisure time in acquiring the specialised knowledge so essential to efficiency in farming today, are very closely allied to the availability of a good reading light. As Ashby and Jones remark,ø "The history of culture has been largely the history of domestic and civic illumination. Man's leisure comes with the twilight hours and with those of darkness....The means of illumination available and the period of lighting which could be afforded set the limits of their use of leisure in the exercise of crafts or the pursuit of personal development in other forms. Hence the importance of the quantity, quality and cost of illumination, and the safety, continuity and reliability of its sources, in the life of the family and the development of its members."

The present difficulties lie not so much in finding recognition of the significance and value of electricity on the farms, as in obtaining a cheap and ready supply of power for a widely scattered agricultural community.

The Problems of Rural Electrification.

The problems encountered in the electrification of farms in Wales are largely due to the physical difficulties associated with the organisation of a widely scattered community inhabiting a country where most of the fertile

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* "Machinery and Labour Use." Farmer and Stockbreeder, February 7, 1950, p. 403.

** "Obsolescence in Farm Equipment. The Need for New Capital." R. McG. Carslaw. Proceedings of the Agricultural Economics Society, Dec. 14-16, 1946. Vol. VII, No. 3. Page 238.

ø "Light, Heat and Power in Rural Areas: A Study of Uses of Electricity in South Wales." A. W. Ashby, M.A. and W. H. Jones, M.Sc. Page 4. 1933.

land is either on the seaboard or on the English border, where the hinterland is composed of an upland area traversed by a few comparatively narrow valleys, and where the soil is of poor to medium quality. These difficulties are further increased by the comparatively small size of the farms and of the fields within the farm, which, together with the configuration of the land, often makes the use of electrical equipment an uneconomic proposition for the individual farmer. For the electrical authority, the heavy capital cost involved in laying miles of transmission lines, and in the provision of the necessary transformers, involves expenditure out of all proportion to the population. This must either be justified by the existence of a potentially large demand or equalised by distributing costs between the concentrated industrial areas and the scattered agricultural communities.

Undoubtedly there exists a potential demand for power and light on farms which if fully utilised would make the provision of electricity a sound economic proposition to both supplier and consumer, particularly where specialised types of farming, such as market gardening, poultry and dairy farming, are practised. The farmer's demand for electricity can however only reach this economic level if he is able to obtain the costly apparatus necessary for the full electrification of his farm. The impoverishment of the land-owning class which in the past capitalised the farmer to some degree, means that under present-day conditions the farmer must rely either on his own capital resources or on borrowing. The latter he can only venture upon if the potential resources of the farm are such as to make the installation of electricity an economic proposition.

If a policy of spreading the burden of charges over the whole community is considered, the possible effect of increased charges on the costs of industrial production at the present time will present its own difficulties and complications.

Moreover, the uncertain nature of the demand from farming, and the unpredictable times at which the supply is required, compared with the fairly steady and ascertainable requirements of industry, make it difficult to anticipate the load which the generating plant will have to carry to provide for all the possible needs of the farm. Further, the demand is heaviest for industry when the domestic load is lightest, a fact which distributes the load more evenly through the day; but for farming the demand, being dependent on the vagaries of weather and livestock, may occur at any time, and this necessitates the provision of greater generating power to meet the exaggerated peak demands.

On the other hand, rural electrification can lead to the resuscitation of village life and rural industries, halt the exodus to towns and encourage the settlement of "secondary" populations in the country areas. In this way a steadier and more predictable demand can be achieved to balance the uncertain but potentially far-reaching nature of farming requirements.

The History and Present Extent of Electrification amongst Welsh Farms.

An investigation into the extent of electrification already in existence amongst farms in Wales reveals the magnitude of the undertaking necessary to make a supply of cheap electrical current available for the majority of farms.

The provision of electricity was of haphazard growth between 1880 and 1918, being supplied partly on the initiative of private persons, and partly by municipal corporations. No serious effort at co-ordination was made until the end of the 1914-18 War. From then on the importance of electricity in developing the economic and cultural life of the nation was increasingly realised. In 1925, the Weir Committee recommended a new central organisation - the Central Electricity Board (established 1927) - to co-ordinate production and reduce the cost of generation. Power was concentrated on a few highly efficient stations. Of the old stations 430 were closed, while 15 new stations were opened, leaving a total of 58 stations in operation. By the Electricity (Supply) Act of 1926, the Board was given the power to co-ordinate the production of electric power from all these stations, though they still remained under private ownership until they were taken over in 1948. Thus the "grid" system was established. Schemes for a wide extension of the use of electricity were envisaged, but were only partially realised when war broke out in 1939. The limited extent to which they had been

put into execution was evident from the data collected for the National Farm Survey in 1941. In Wales, particularly, progress had been slow. The information revealed that nearly 90 per cent of Welsh farms had no means of using electrical equipment. The typically rural counties of Radnor and Anglesey were in the worst position in this respect, closely followed by Cardigan, Montgomery, Pembroke, Brecon and Caernarvon, all of which had over 90 per cent of their farms without an electricity supply (see Table 1). The highly industrialised

Table 1.

Electricity on Farms in Wales.

County.	Farms with Electricity.		Farms without Electricity.		Total No. of Farms.
	No.	%.	No.	%.	No.
Anglesey	115	3.5	3,129	96.5	3,244
Brecon	148	6.3	2,165	93.7	2,313
Caernarvon	357	8.9	3,643	91.1	4,000
Cardigan	205	4.2	4,660	95.8	4,865
Carmarthen	729	10.1	6,487	89.9	7,216
Denbigh	474	11.3	3,676	88.7	4,150
Flint	540	20.9	2,036	79.1	2,576
Glamorgan	1,214	31.3	2,658	68.7	3,872
Merioneth	269	11.2	2,102	88.8	2,371
Monmouth	570	16.7	2,824	83.3	3,394
Montgomery	226	5.0	4,185	95.0	4,411
Pembroke	335	6.8	4,550	93.2	4,885
Radnor	64	3.3	1,834	96.7	1,898
Wales	5,246	10.5	43,949	89.5	49,195

county of Glamorgan had the highest proportion of farms with electricity, over 30 per cent of them being supplied; Flint, a partially commercialised county, had over 20 per cent, and Monmouth over 16 per cent. The close correlation between industrial development and the supply of electricity to farms is self-evident.

A more detailed enquiry revealed that, of the farms supplied with electricity, a little more than 2 per cent obtained their current from a privately-operated generator. Merionethshire farms secured the largest supply from this source, having 4.9 per cent of their number working from a privately-owned generating plant; in Flintshire, Denbighshire and Pembrokeshire 3 per cent or over of the farms were similarly supplied; but in Glamorgan where public supplies were more readily available only 1.3 per cent obtained power or light in this way (Table 2).

Table 2.

Source of Electricity Supply to Farms.

County.	Public Supply.		Private Supply.		% with no supply.
	No.	%.	No.	%.	%.
Anglesey	42	1.3	73	2.2	96.5
Brecon	119	5.1	29	1.2	93.7
Caernarvon	273	6.8	84	2.1	91.1
Cardigan	115	2.4	90	1.8	95.8
Carmarthen	608	8.4	121	1.7	89.9
Denbigh	326	7.8	148	3.5	88.7
Flint	447	17.3	93	3.6	79.1
Glamorgan	1,164	30.0	50	1.3	68.7
Merioneth	151	6.3	118	4.9	88.8
Monmouth	504	14.8	66	1.9	83.3
Montgomery	95	2.1	131	2.9	95.0
Pembroke	188	3.8	147	3.0	93.2
Radnor	46	2.4	18	0.9	96.7
Wales	4,078	8.2	1,168	2.3	89.5

On account of the limiting nature of small generating plants, which cannot usually carry a heavy load, the development of electrical apparatus on this group of farms is often confined to the provision of light, which, while an important acquisition, is limiting in scope. This limitation is particularly obvious when, within each county, a comparison is drawn between the number of dairy cows per 100 acres of total area and the number of farms supplied with electricity from a privately-owned source. From the information given in Table 3 there does appear to be some relationship between the density of cow population and numbers of farms generating their own electricity where the public supply is inadequate. The fact that, despite expense and restriction of use, such supplies have come into existence, serves to emphasise the need, and to indicate the further uses for an increased and cheaper supply of light and power on farms.

Table 3.

Proportion of Farms with a Private Electricity Supply.

County.	Percentage of farms with Electricity.	Dairy Cows per 100 Acres Total Area.	Percentage of Farms over 100 acres Total Cultiv. Area.
Merioneth	4.9	4.8* (16.6)	12.3
Flint	3.6	26.3	13.0
Denbigh	3.5	14.4	16.7
Pembroke	3.0	14.9	19.2
Montgomery	2.9	8.3	17.9
Anglesey	2.2	13.1	12.3
Caernarvon	2.1	10.7	5.5
Monmouth	1.9	12.7	21.1
Cardigan	1.8	9.9	15.4
Carmarthen	1.7	16.3	14.2
Glamorgan	1.3	11.5	15.4
Brecon	1.2	6.9	24.5
Radnor	0.9	5.0	30.8
Wales	2.3	11.3	16.1

* $\frac{1}{3}$ of this county is rough grazing - the bracketed figures give cows per 100 acres of cultivated area.

There remain, then, little more than 8 per cent of the farms in Wales in a position to make full use of an adequate supply of electricity, though within each county the position varies considerably. In Anglesey, Radnor, Cardigan and Montgomery little more than 2 per cent of the farms are connected with the grid system, whereas in Glamorgan the proportion is 30 per cent.

As might be anticipated, the counties in which the highest proportion of electrified farms were found were on average those with the highest density of population. (See Table 4.) In view of the heavy costs of distribution the areas with the greatest potential returns for the least possible outlay are not unnaturally the first areas to obtain electric supplies. The Electricity Commission in its report for 1928 estimated that the urban consumption for lighting purposes was between 100 to 300 units per annum for the average middle and working-class houses. Where power was utilised for cooking, heating or other domestic purposes, this figure became 1,000 to 3,000 units per year, and with recent developments may be even higher. An assured demand of this size easily compensates for the uncertain nature of farm requirements. Even in the area of the outer urban ring, an average estimated consumption of 60 units per head of population would give an assured return for expenditure. The real problem lies in the electrification of the rural belt where consumption is estimated at only 30 to 40 units per head of total population, and the cost of supplies is in inverse proportion to the returns. Into this category fall Cardigan, Montgomery and Radnor where the average number of persons per 100 acres of agricultural land** is between eight and nine compared with 67 in

timated on the basis of total population less urban population (1948).

Table 4.

Public Supply of Electricity to Farms and Density of Rural Population.

County.	Percentage of Farms with Public Supplies.	Density of Rural Population per 100 Acres Agricultural Land.	Average Rental Value of Agricultural Land Per Acre.
	%	No. of Persons.	s. d
Glamorgan	30.0	67.4	17. 3
Flint	17.3	87.1	32.10
Monmouth	14.8	69.3	24. 3
Carmarthen	8.4	24.4	17. 6
Denbigh	7.8	29.5	19. 2
Caernarvon	6.8	23.9	13. 4
Merioneth	6.3	11.6	6.10
Brecon	5.1	16.0	12. 4
Pembroke	3.8	18.4	19.10
Radnor	2.4	8.0	12. 3
Cardigan	2.4	9.1	10. 1
Montgomery	2.1	7.7	13. 4
Anglesey	1.3	28.5	23.11
Wales	8.2	26.7	15.10

Glamorgan, 69 in Monmouth, and 87 in Flint. Though the potential demand for current when used to full capacity for farms and farmhouses may be from 4,000 units per year on arable and stock farms to 14,000 on large dairy farms, the extent of this demand depends on the farmers' enterprise in installing small power plants to use supplies in slack periods, and in making sufficient use of the supply to justify the cost of lines and installation. How far such enterprise is possible and justified depends upon numerous factors including the value and potential productiveness of the land, the type of farming practised, the size of farm, the nature of the tenancy and the type of farmer. The justification for the electrification of the more scattered farming areas must be allied to an assessment of the expected utilisation per farm, and the number of customers. A more detailed analysis of the present distribution of electrified farms in Wales may suggest likely lines of development, and future policy.

Relationship between Supplies of Electricity and certain Factors.

(a) The Rental Value of Agricultural Land.

In considering the provision of a public supply of electricity, the question of the financial return resulting from such a supply must inevitably be the major deciding factor, and to this end a satisfactory assessment of both the potential demand for and the profitability of the enterprise is essential. This depends on the consideration of a number of aspects of the farming economy.

One of the most important reflections of the potential and present value of the farm is the rental value of the agricultural land. Though the rental value is by no means altogether indicative of the fertility of the soil, and may be influenced by the position of the farm and the size and condition of farmhouse and buildings, it does very largely reflect the capital value of the farm. As Table 4 indicates, there is a significant tendency for the counties with the highest proportion of electrified farms to be also those with the most highly rented land. The marked exception to this is Anglesey. A more detailed examination by parishes shows this correlation more clearly. (See Table 5.)

Of the parishes where the average rental value of the agricultural land was under 10 shillings an acre (according to the National Farm Survey of Wales in 1941), approximately 33 per cent of the parishes had no electricity supply to

Table 5.

Rental Value per Acre of Land (National Farm Survey 1941) Associated with Parishes which include electrified Farms.

Rental Value of Land per acre by Parishes.	Under 10s.		10s. to 20s.		20s. to 30s.		30s. to 40s.		40s. and over.		Total
Existence of Electrified Farms per parish.	None	Some	None	Some	None	Some	None	Some	None	Some	All Parishes.
Anglesey	-	-	4	6	15	28	-	8	1	-	62
Brecon	10	10	28	17	7	14	-	2	-	1	89
Caernarvon	3	8	-	20	3	12	-	3	-	3	52
Cardigan	9	9	19	33	-	5	-	1	-	1	77
Carmarthen	1	3	6	30	2	20	1	6	-	2	71
Denbigh	4	4	15	10	6	9	2	24	1	6	81
Flint	-	-	-	1	-	10	2	24	1	10	48
Glamorgan	3	20	3	34	4	38	6	28	1	4	141
Merioneth	-	24	1	9	1	3	-	1	-	-	39
Monmouth	-	2	2	19	5	33	4	19	1	3	88
Montgomery	8	10	9	9	9	9	1	5	-	2	62
Pembroke	4	-	41	25	32	40	5	7	2	5	161
Radnor	5	2	31	14	7	2	-	1	-	1	63
Wales & Monmouth	47	92	159	227	91	223	21	129	7	38	1034

any farms within their boundaries. The proportions were higher among parishes where the average rental was assessed at between 10 and 20 shillings an acre, though the total number of parishes within this group was more than twice as large. Here 227 parishes contained farms in possession of electricity, while in 159 no farms were supplied. For parishes within the next group, averaging 20 to 30 shillings an acre, possessing no electrified farms, the proportion was approximately 29 per cent. Within the next rental group, with average rentals ranging from 30 to 40 shillings an acre, only approximately 14 per cent of the parishes had no electrified farms within their boundaries. This proportion was similar with about 15 per cent for the parishes with rentals of over 40 shillings an acre, though the numbers were smaller. Only 7 parishes in this group had no farms with electricity, compared with 21 in the previous group, and 91 in the group where the average rental was between 20 and 30 shillings an acre of agricultural land.

The evidence clearly suggests that the proportion of parishes associated with electrified farms tends to increase as the rental value of the land rises. This would appear to indicate that the use of electricity can most profitably be associated with the more highly rented land, and that a study of these areas in relation to intensive farm electrification might prove a useful starting point for a campaign to introduce it. In this connection, parts of Flint, Montgomery, Monmouth, Pembroke and Carmarthen might be worth further investigation, as reference to the county maps shows. (See Appendix I).

(b) Type of Farming.

As already indicated, some types of farming give more scope for the profitable use of electricity than others. In dairy farming particularly, as W. L. Hearle has indicated (see Table 6), - costs, time, and labour can be considerably reduced by the employment of electrical apparatus. Such a saving will be possible also in intensive poultry farming enterprises, or the production of market garden and glasshouse produce. Moreover, the provision of electricity on a large scale for these operations will be a profitable undertaking for the electricity authority, since on large dairy farms the annual demand may reach 14,000 units a year, or more, compared with 4,000 on arable and stock-raising farms. Indeed according to a report* from a dairy farm in the North of

* "Some Impressions with Grass Drying in 1949". Economic Report No. 14, North of Scotland College of Agriculture: Agricultural Economics Department.

Scotland where a grass drier was in continuous use, the total annual consumption reached 41,012 units in 1949, of which, it was estimated, 31,400 units were required for the drier.

Map B (Wales and Monmouth - Appendix II) shows the main types of farming areas and the county maps (Appendix I) delineates the location of

Table 6.

Comparison of Costs with and without Electricity on a Sample Farm (275 acres) with a Herd of 40 Cows producing 100 gallons of milk daily.*

Operation.	Method.	Electricity at 1d. per unit.	Labour.	Total Cost.
	Annual Running Costs with Electricity.			
		£. s. d	£. s. d	£. s. d
Milking	1½ H.P. electric motor	5. 0. 0	-	5. 0. 0
Steam Raising	2 kW heater	17. 0. 0	-	17. 0. 0
Water Heating	2 kW heater	18. 0. 0	-	18. 0. 0
Water Pumping	¼ H.P. electric motor	1.10. 0	-	1.10. 0
Grinding	3 H.P. electric hammer mill	2.10. 0	3.10. 0 (inc. mixing)	6. 0. 0
Milk Cooling	⅓ H.P. chilled water unit	5. 0. 0	-	5. 0. 0
Lighting	5 at 100 watts	0.10. 0	-	0.10. 0
Proportion of Farm tariff Fixed Charge	£. s. d 6.11. 2			6.11. 2
Total Annual Farm Electricity	56. 1. 2			59.11. 2

Average Electrical Cost per gallon of milk produced (including proportion of fixed charge on farming tariff) = 0.48d.

Operation.	Method.	Fuel.	Labour.	Total.
	Annual Running Costs without Electricity.			
		£. s. d	£. s. d	£. s. d
Milking	1½ H.P. petrol engine	20. 0. 0	-	20. 0. 0
Steam Raising	Coal fired boiler	27. 0. 0	18. 0. 0	45. 0. 0
Water Heating (& carried from house)	do.	-	15. 0. 0	15. 0. 0
Water Pumping	Hand pump	-	50. 0. 0	50. 0. 0
Grinding	Tractor	5. 0. 0	10. 0. 0	15. 0. 0
Milk Cooling	Farm Water Supply	65,000 gals.	-	-
Oil Lighting	Oil	8. 0. 0	4. 0. 0	12. 0. 0
				157. 0. 0

Average Cost per gallon of milk produced for the above operations = 1.25d.

* From H. L. Hearle, Farmer and Stockbreeder, June 20, 1950.

the electricity transmission lines. It will be seen that while some areas, particularly in Flint, Denbigh and Monmouth, are favourably placed in regard to electricity supplies, other predominantly dairying districts in Pembroke, South Cardigan, North Monmouth, parts of Carmarthen and Montgomery are without access to a supply. These areas might possibly be focal points for the extension of electric light and power to rural areas.

(c) Size of Farm.

In the Bristol Province*, the possession of electricity supplies was found to be closely related to size of farm - the larger farms being more frequently in possession of them. It has not been found possible in this investigation to relate electricity supplies to size of farm for the whole of Wales, but a detailed investigation was made in Denbigh - a county typical of a partly industrial, partly rural area - and in Montgomery - a characteristically rural county. This investigation was related to the public supply of electricity to farms, and to supplies obtained from privately generated power. The results indicated that a supply of electricity was found on a larger proportion of the smaller farms (even on those of less than 25 acres) when a public supply was available, whereas on farms supplied from a private source, the highest proportion was discovered amongst those of more than 100 acres (see Table 7 and Table (a) Appendix III). It seems that the cost of installing private generators was the deciding factor in this trend.

Table 7.

Electricity Supply and Size of Farm.

	Public Supply.		Private Supply.	
	Denbigh.	Mont-gomery.	Denbigh.	Mont-gomery.
	%.	%.	%.	%.
Under 25 acres	42	44	21	26
26 - 100 "	39	43	33	36
Over 100 "	19	13	46	38

These figures do, however, bring out the fact that, where a reasonable public supply is available, even farms with less than 25 acres of cultivated land find it worth while to obtain the power, and do, moreover, form a fair proportion of the farms of all sizes which have installed electricity.

(d) Type of farmer.

For the purpose of the survey of farms made in 1941, farmers were termed "full-time farmers" when they gave all their time to the farm, and received the whole of their income from it. The term "full-time farmer", therefore implies the possession of a farm of sufficient productivity to maintain the farmer and his family. On these grounds it would be anticipated that the majority of farms with electricity would be in the occupation of full-time farmers. This is substantially borne out by the information given in Table 8 (and Table (b) Appendix III).

Table 8.

Electricity Supply and Type of Farmer.

	Public Supply.		Private Supply.	
	Denbigh.	Mont-gomery.	Denbigh.	Mont-gomery.
	%.	%.	%.	%.
Full-time Farmers	64	66	67	68
"Other" Types	36	34	33	32
All Farmers	100	100	100	100

The proportion of "full-time" farmers for each county in Wales is shown in Table 9. In general the proportions vary from about two-thirds to three-quarters of the total.

* National Farm Survey Studies No. 1 - "Electricity and Water Supplies" - Vernon Baker. University of Bristol (Agricultural Economics Department).

Table 9.

Classification of Farms according to Type of Farmer.
(National Farm Survey, 1941.)

County.	Full-time.		Others.		Total.
	No.	%.	No.	%.	No.
Anglesey	2,035	71.1	827	28.9	2,862
Brecon	1,658	77.1	491	22.9	2,149
Caernarvon	2,587	68.5	1,190	31.5	3,777
Cardigan	3,494	76.4	1,077	23.6	4,571
Carmarthen	5,329	76.1	1,679	23.9	7,008
Denbigh	3,078	74.1	1,075	25.9	4,153
Flint	1,733	69.8	749	30.2	2,482
Glamorgan	2,752	73.8	977	26.2	3,729
Merioneth	1,649	78.7	447	21.3	2,096
Monmouth	2,328	70.0	969	30.0	3,297
Montgomery	3,224	73.1	1,187	26.9	4,411
Pembroke	3,192	70.6	1,331	29.4	4,523
Radnor	1,333	74.3	461	25.7	1,794
Wales & Monmouth	34,392	71.3	12,460	28.7	46,852

(e) Type of Tenure.

Where the supply of electricity on farms was from a public authority, the distribution of such farms in Denbigh and Montgomery was fairly evenly spread between those in the occupation of their owners, and those occupied by tenants. On the other hand, where the supply of electricity was obtained from a private plant, owner-occupied farms were in the majority (see Table 10 and Table (c) Appendix III); a tendency which suggests that, if the tenanted farms are to have the same opportunities for development as those in the occupation of owners, the supply of power and light by public authorities is an essential requirement.

Table 10.

Supply of Electricity and Tenure.

Class of Tenure.	Public Supply.		Private Supply.	
	Denbigh.	Mont-gomery.	Denbigh.	Mont-gomery.
	%.	%.	%.	%.
Tenants ...	42	38	33	36
Owners ...	33	48	50	58
Part-tenants, Part-owners	25	14	17	6
	100	100	100	100

The numbers and percentages of tenanted farms in Wales and the Welsh counties which are shown in Table 11 reveal the substantial proportion of farms which are affected in this respect.

Table 11.

Classification of Farms according to Tenure - Wales & Monmouth. (National Farm Survey, 1941.)

County.	Tenant.		Owner.		Part-tenant, Part-owner.		Total.
	No.	%	No.	%	No.	%	No.
Anglesey	1,787	62.4	887	31.0	188	6.6	2,862
Brecon	1,189	55.3	719	33.5	241	11.2	2,149
Caernarvon	2,396	63.4	1,151	30.5	230	6.1	3,777
Cardigan	2,080	45.5	2,087	45.7	404	8.8	4,571
Carmarthen	3,688	52.6	2,908	41.5	412	5.9	7,008
Denbigh	2,332	56.2	1,297	31.2	524	12.6	4,153
Flint	1,463	59.0	799	32.2	220	8.8	2,482
Glamorgan	2,554	68.5	775	20.8	400	10.7	3,729
Merioneth	1,390	66.3	595	28.4	111	5.3	2,096
Monmouth	2,014	61.1	923	28.0	360	10.9	3,297
Montgomery	2,208	50.0	1,959	44.4	244	5.6	4,411
Pembroke	2,511	55.5	1,575	34.8	437	9.7	4,523
Radnor	1,085	60.5	569	31.7	140	7.8	1,794
Wales and Monmouth	26,697	57.0	16,244	34.7	3,911	8.3	46,852

(f) Nature of Supply.

Experience in Denbigh showed that nearly two-thirds of the farms with a supply of electricity used it for light only, whether the source of supply was a public authority or a private plant. On the other hand, in Montgomery the information obtained indicated the reverse of this position (see Table 12 and Table (d) Appendix III.) In either case, there was little variation

Table 12.

Nature of Electricity Supply to Farms.

Nature of Supply	Public Supply.		Private Supply.	
	Denbigh.	Mont-gomery.	Denbigh.	Mont-gomery.
	%	%	%	%
Light and Power	40	71	33	68
Light only	59	26	65	30
Power only	1	3	2	2
	100	100	100	100

between the proportion of public and private supplies. The only noticeable tendency was for a slightly lower percentage of farms to use both light and power when operating from a private generating plant, compared with a little higher proportion which did so when supplied from a public utility company - but again there were variations between districts. In the Colwyn Bay district, for instance, 95 per cent of the farms able to obtain a supply from a public authority used it for both light and power; while, in the Machynlleth area, of the farms obtaining current from a private plant, only 4 per cent restricted its use to light only. This variation suggests that the extent to which light and power are used may be determined by a factor apart from the source of the electricity supply and possibly associated with cost of, or lack of knowledge of, electrical equipment suitable for farming operations other than the supply of light.

Only a very small proportion of the farms with either a public or private supply used it for the farm alone (with the exception of one district in Denbigh - see Appendix III, Table (e)). Of the remainder, amongst those

utilising a public supply, approximately 50 per cent used it for house and farm, and 50 per cent for the house only. (See Table 13). The proportions

Table 13.

Use of Electricity Supplies to Farms.

Use of Supply.	Public Supply.		Private Supply.	
	Denbigh.	Montgomery.	Denbigh.	Montgomery.
	%	%	%	%
House and Farm	40	51	55	64
House only	55	48	39	33
Farm only	5	1	6	3
	100	100	100	100

varied considerably between district and district, and even between county and county. In Denbigh much less than half of these farms used the supply of electricity for both house and farm; in Montgomery slightly more than half did so. Of those farms using a private supply nearly two-thirds used electricity in both house and farm, and one-third in the house only. A possible explanation of these results may lie in the fact that the farms generating their own supply tend to be the larger owner-occupied farms with rather more capital at their disposal.

The proportion of 50 per cent or less seems a relatively small ratio of farms to be making full use of an adequate supply of electricity. Whether this is due to lack of adequate information about the electrical appliances available, or to lack of capital to purchase them, the problem is one that requires further investigation on this subject, and the organisation of a system, perhaps on the lines of a co-operative society by which farmers could be furnished with their needs. There is, moreover, room for research into the possibilities of producing simpler and cheaper machinery which would be easy to operate and possibly more adequate from the farmer's point of view.

Future Policy.

Since the conclusion of hostilities, plans are again being reviewed for the extension of electricity supplies, particularly in the light of the great technical advances made in recent years, and the emphasis on rural development. The debateable question has been whether policy should advocate utility provision of public services or place reliance on private enterprise. It has been suggested that by uniting farms in larger units, and by co-operative effort, it would be possible by private enterprise to create the supplies necessary to provide power for the farming community, particularly in Wales. From the information which has been obtainable, it seems clear that such a policy has considerable drawbacks. It presupposes a reservoir of capital and initiative that is frequently unavailable, and a scope for planning that is not always possible within existing local limitations. It tends to bar the smaller tenant farmer from participation, and to confine the use of electricity to a limited number of farms, and a restricted number of uses. The public utility service, with its wider powers, and larger capital resources, is better equipped to provide the necessary power in the most economical way.

It is obvious that both large scale, and long-term planning is required, and that any scheme which aims to provide electricity for all farms is facing an undertaking of tremendous magnitude. It seems equally obvious that the question will have to be tackled by carefully planned stages over a number of years. Hand in hand with each extension plan will need to go a carefully planned, and imaginative publicity campaign, showing the uses, costs and working of electric farming devices, together with the outline of a scheme by which the initial costs of installation to the farmer can be met. Judging by the results of the Norwich* Demonstration Scheme in 1931, a rapidly increas-

* Rural Electrification: Norwich Demonstration Scheme. Electricity Commission, London, 1931.

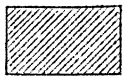
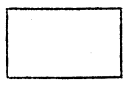
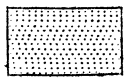
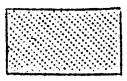
ing demand would shortly not only enable costs to be met, but also provide a profit. In this way an ever widening circle of farms might gradually be incorporated. In considering each extension, some guidance as to the likely profitability of the venture could be obtained from details of the size and fertility of the farms in the area, and the type of farming practised, together with reference to the farmers' capacity for improvement, both according to circumstance and to financial resources.

A review of previous policy suggests that any rural planning for the provision of electricity supplies in the future requires that more specialised attention should be given to the farm and its problems. The time would be well spent, both from the point of view of national food production and from the standpoint of profitability for the farmer and the electricity authority.

APPENDIX I

Maps showing farm electricity supplies (by parishes) for every county in Wales, based on data collected for the National Farm Survey in 1941.

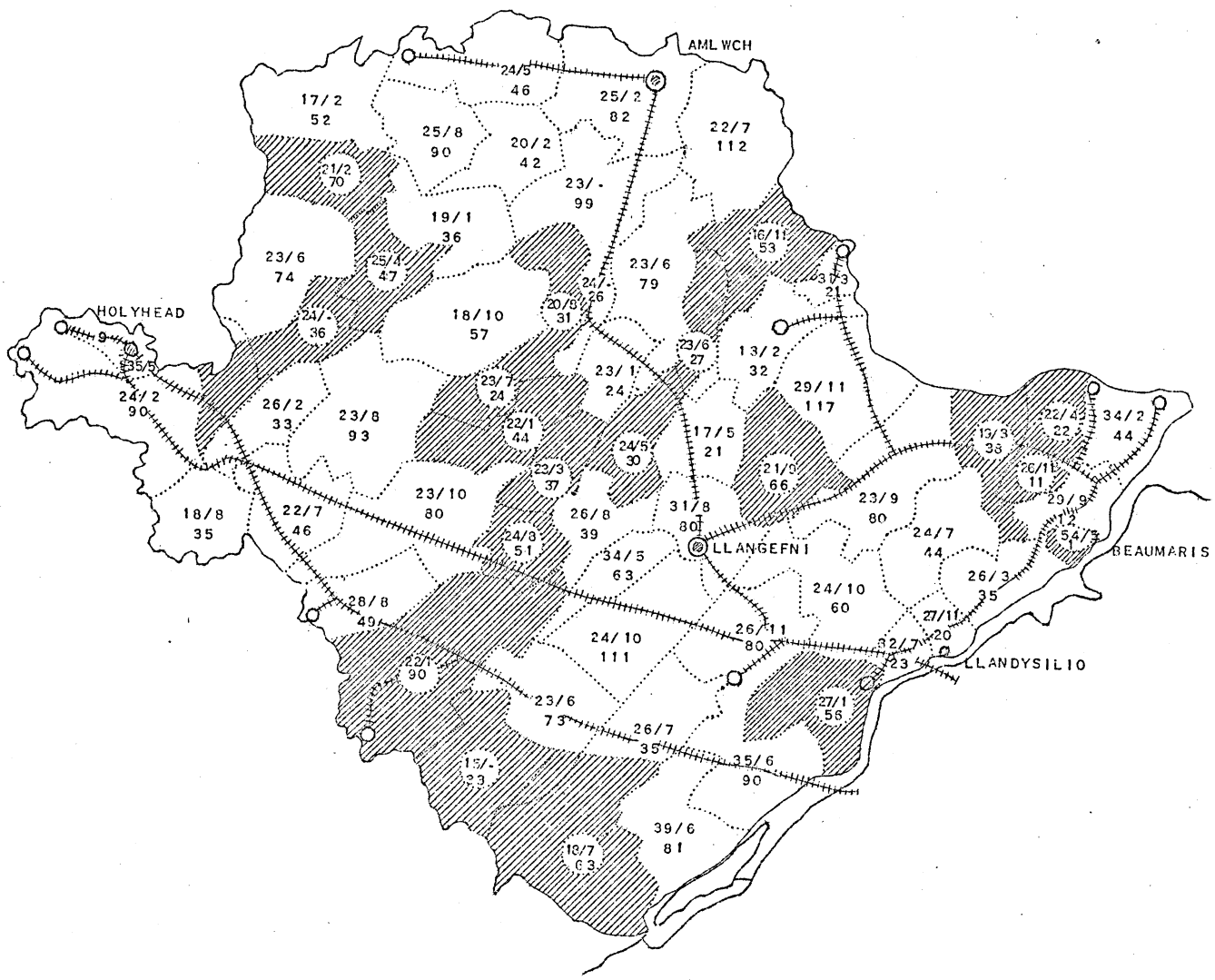
KEY

Numerals	—	Total No. of Farms per parish.
-/-	—	Rental value of land per acre (in shillings and pence)
	—	No farms with electricity.
	—	1 to 10 farms with electricity.
	—	11 to 50 farms with electricity.
	—	Over 50 farms with electricity.

APPENDIX I

Map A (I)

A N G L E S E Y

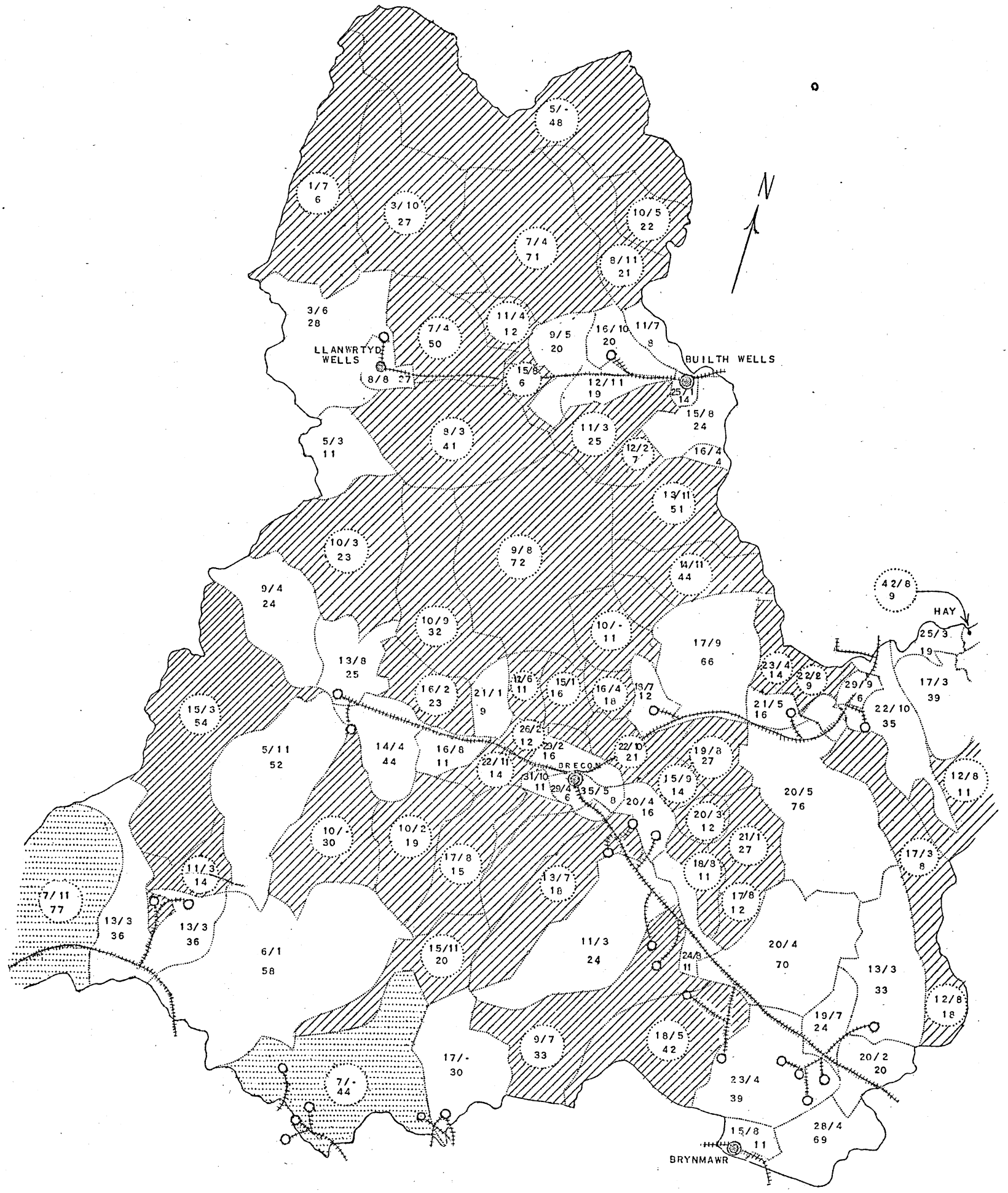


(Mersey and North Wales Electricity Board)

APPENDIX I

Map A (II)

BRECKNOCKSHIRE



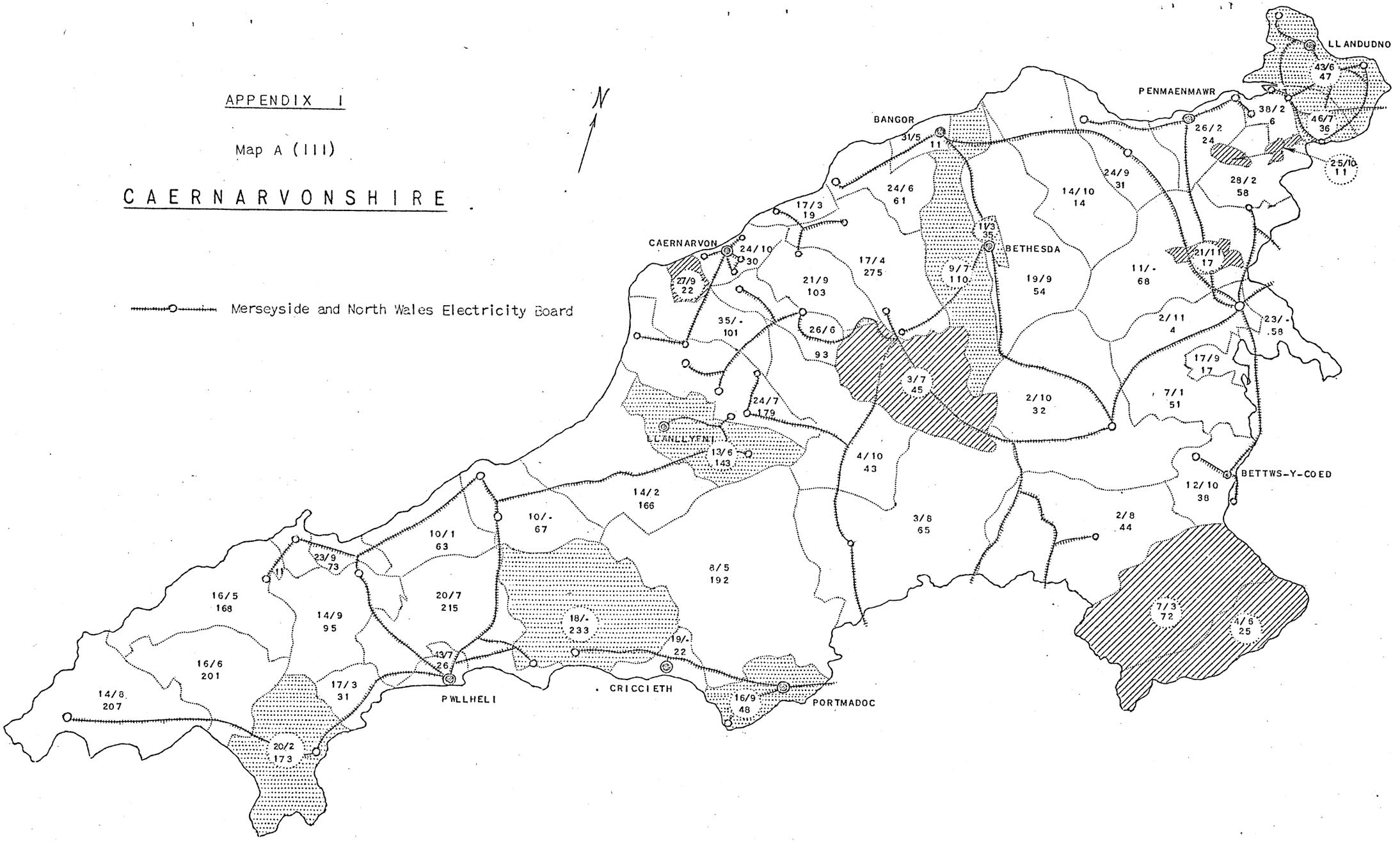
South Wales Electricity Board

APPENDIX I

Map A (III)

CAERNARVONSHIRE

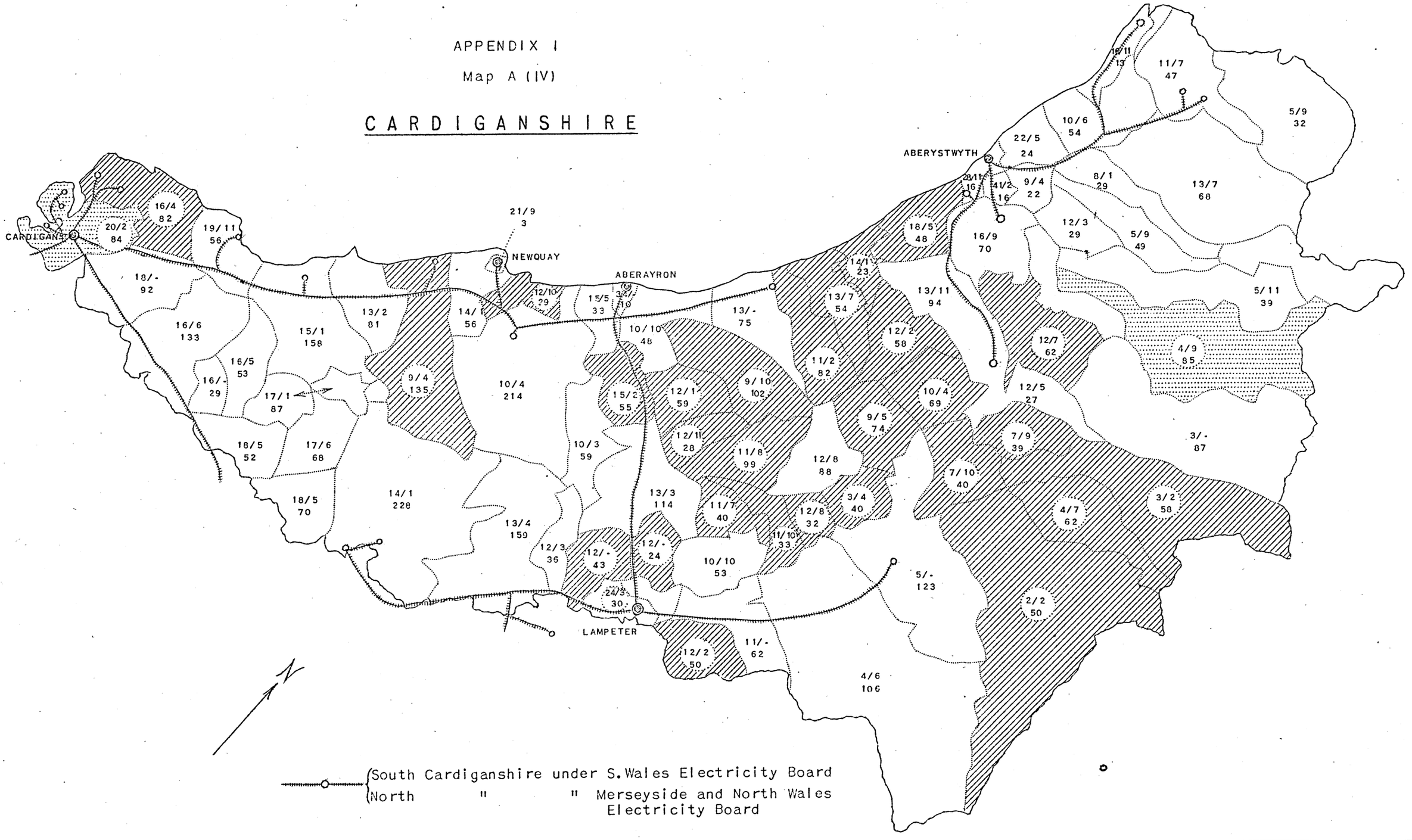
Merseyside and North Wales Electricity Board



APPENDIX I

Map A (IV)

CARDIGANSHIRE

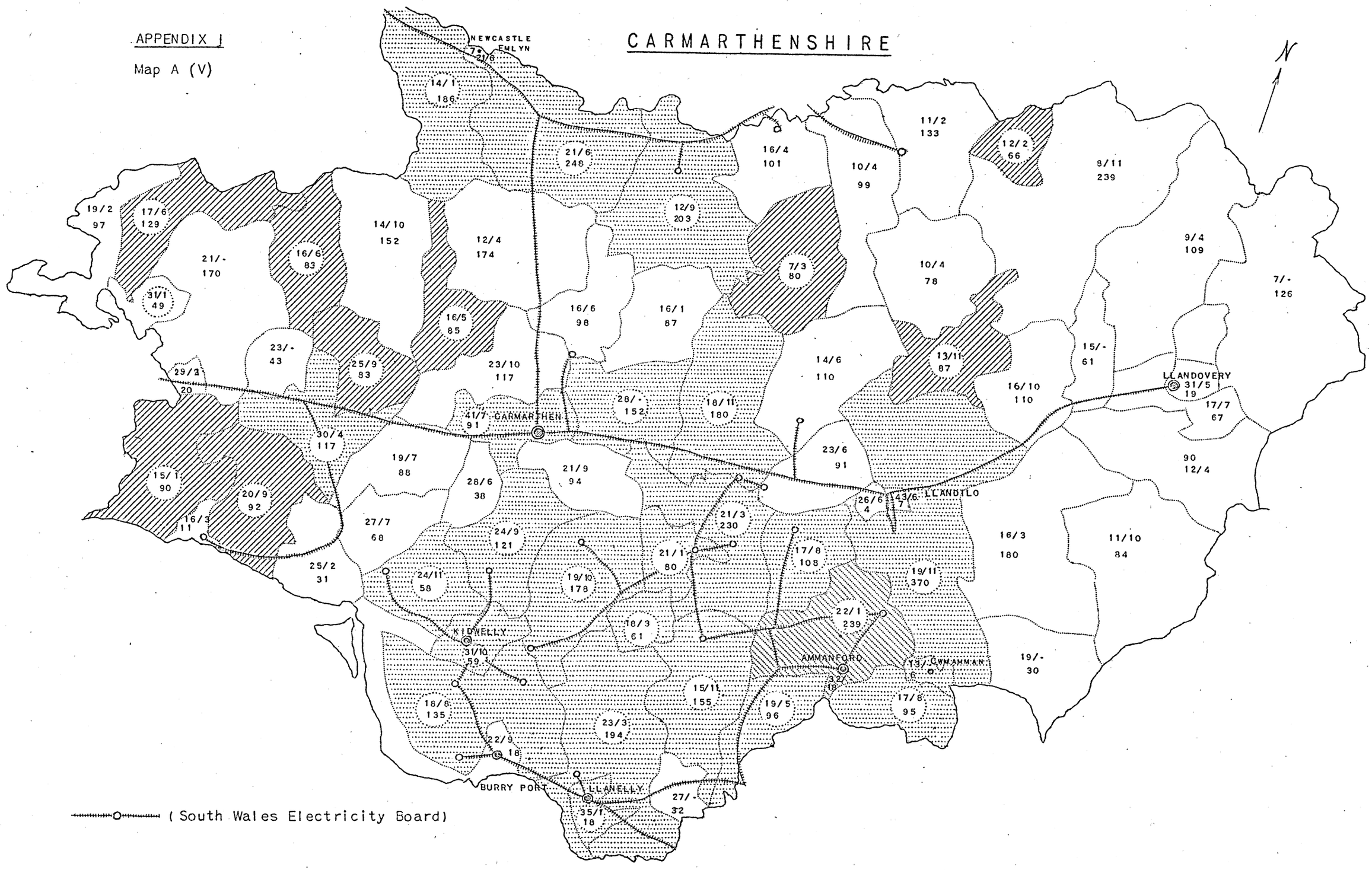


South Cardiganshire under S. Wales Electricity Board
North " " Merseyside and North Wales Electricity Board

APPENDIX I

Map A (V)

CARMARTHENSHIRE

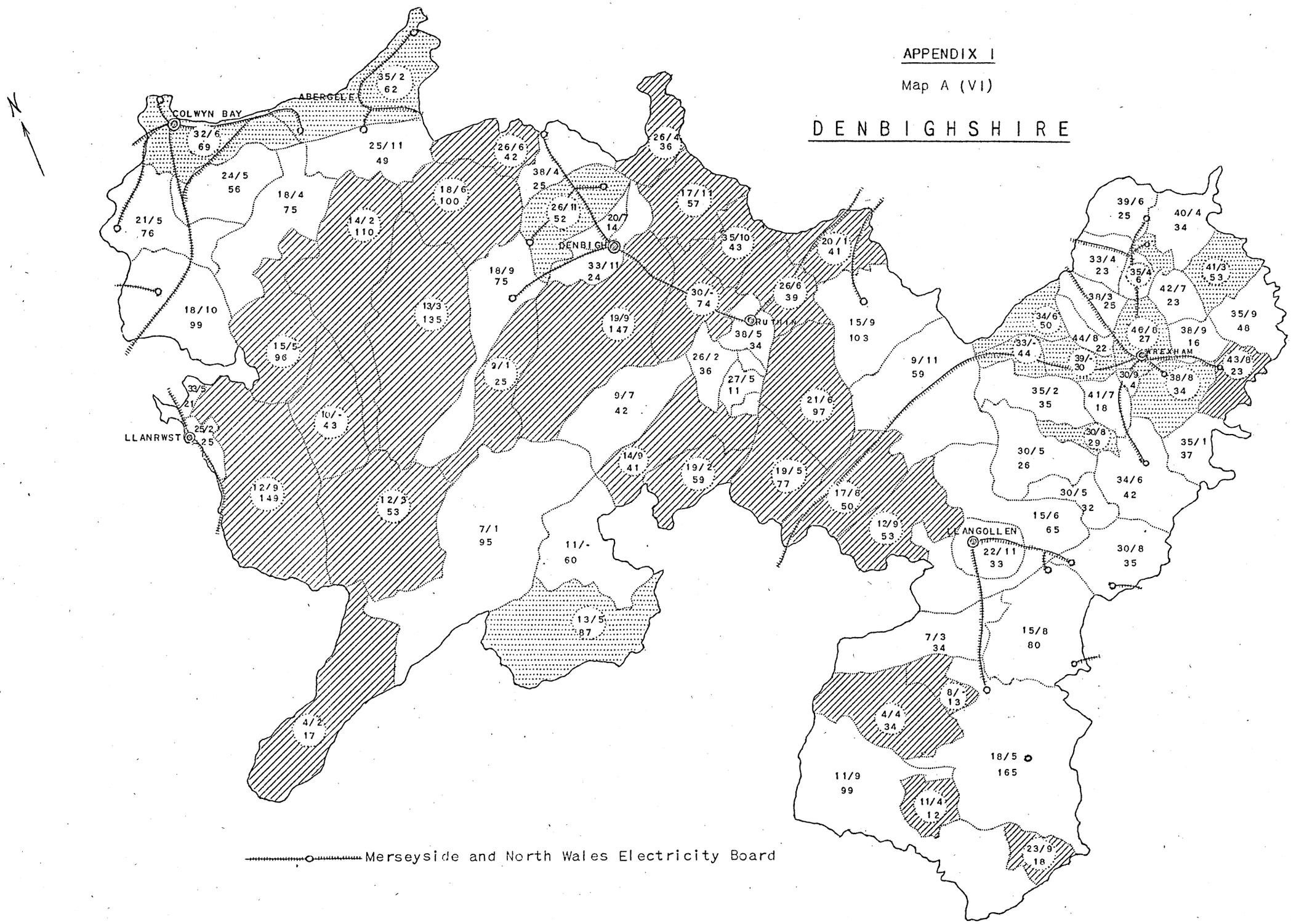


(South Wales Electricity Board)

APPENDIX I

Map A (VI)

DENBIGHSHIRE

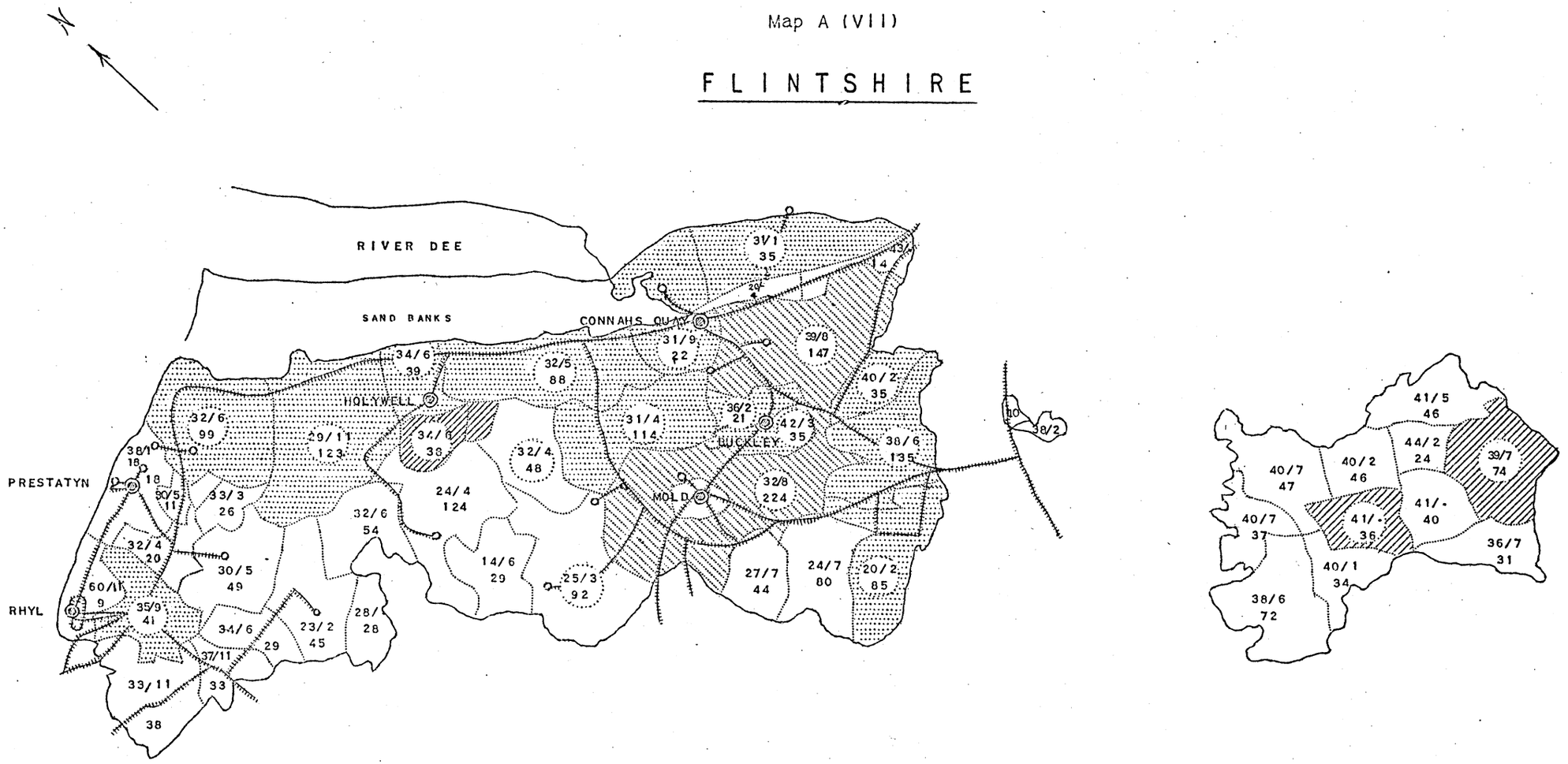


Merseyside and North Wales Electricity Board

APPENDIX I

Map A (VII)

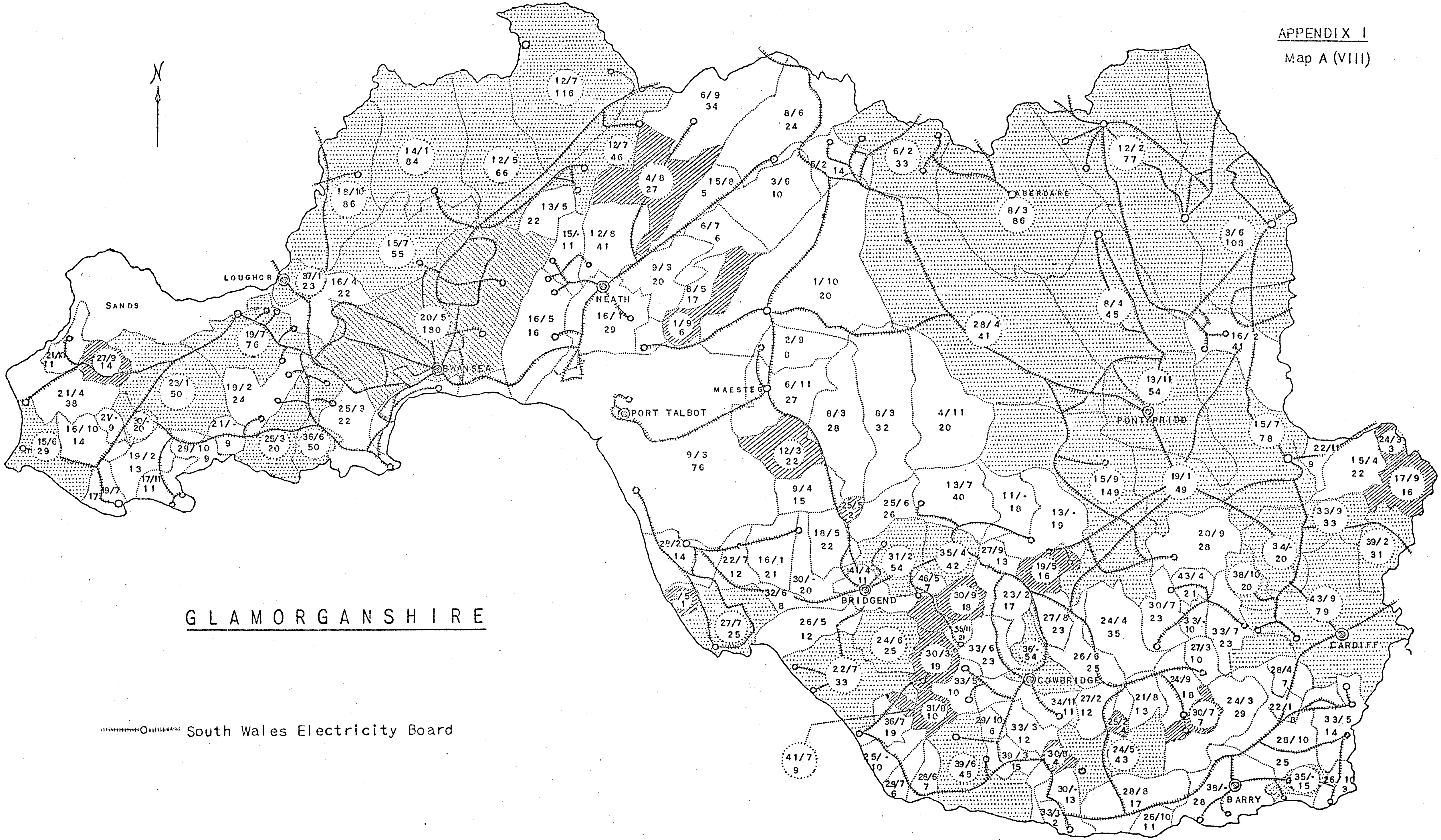
FLINTSHIRE



Merseyside & North Wales Electricity Board

APPENDIX I

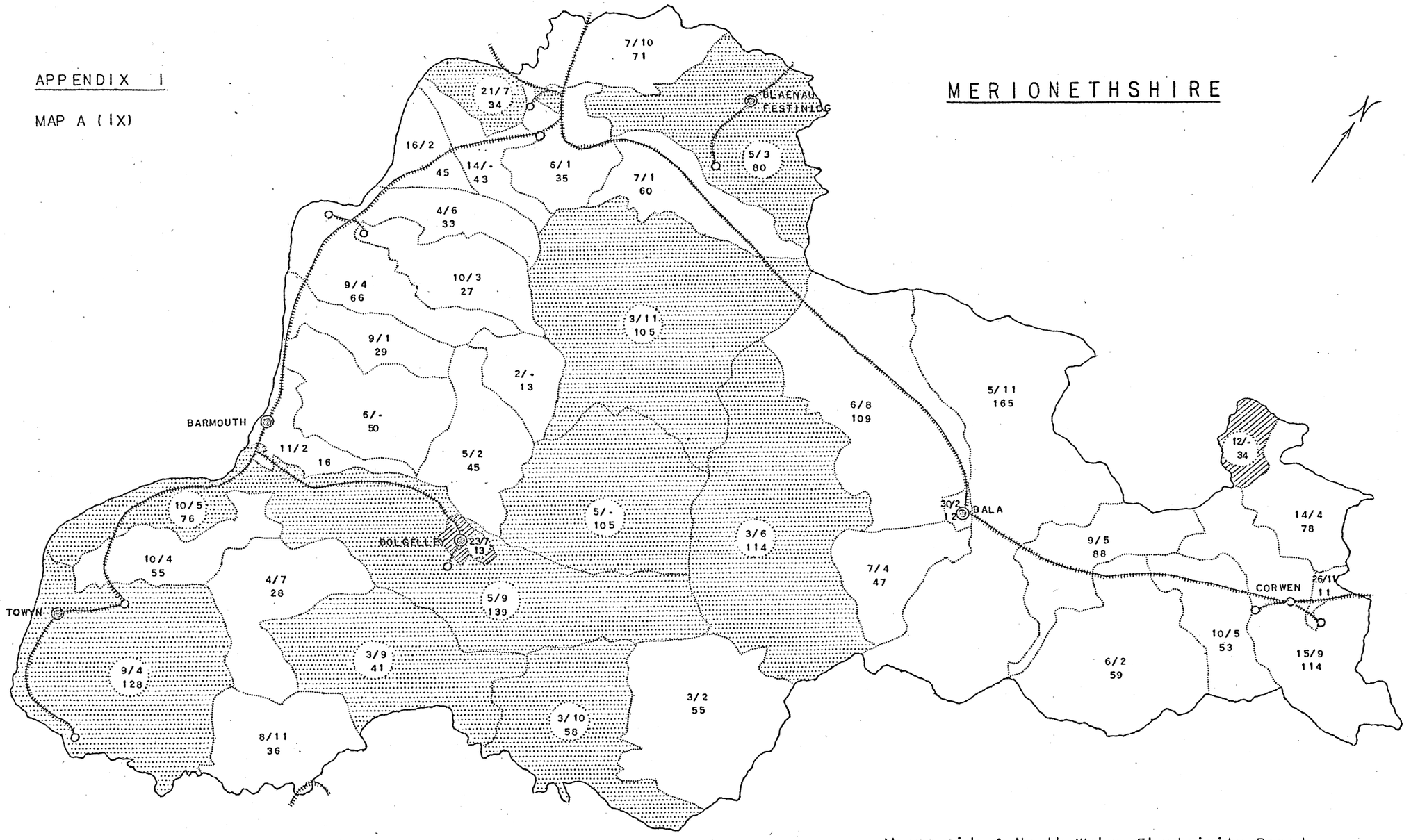
Map A (VIII)



APPENDIX I

MAP A (IX)

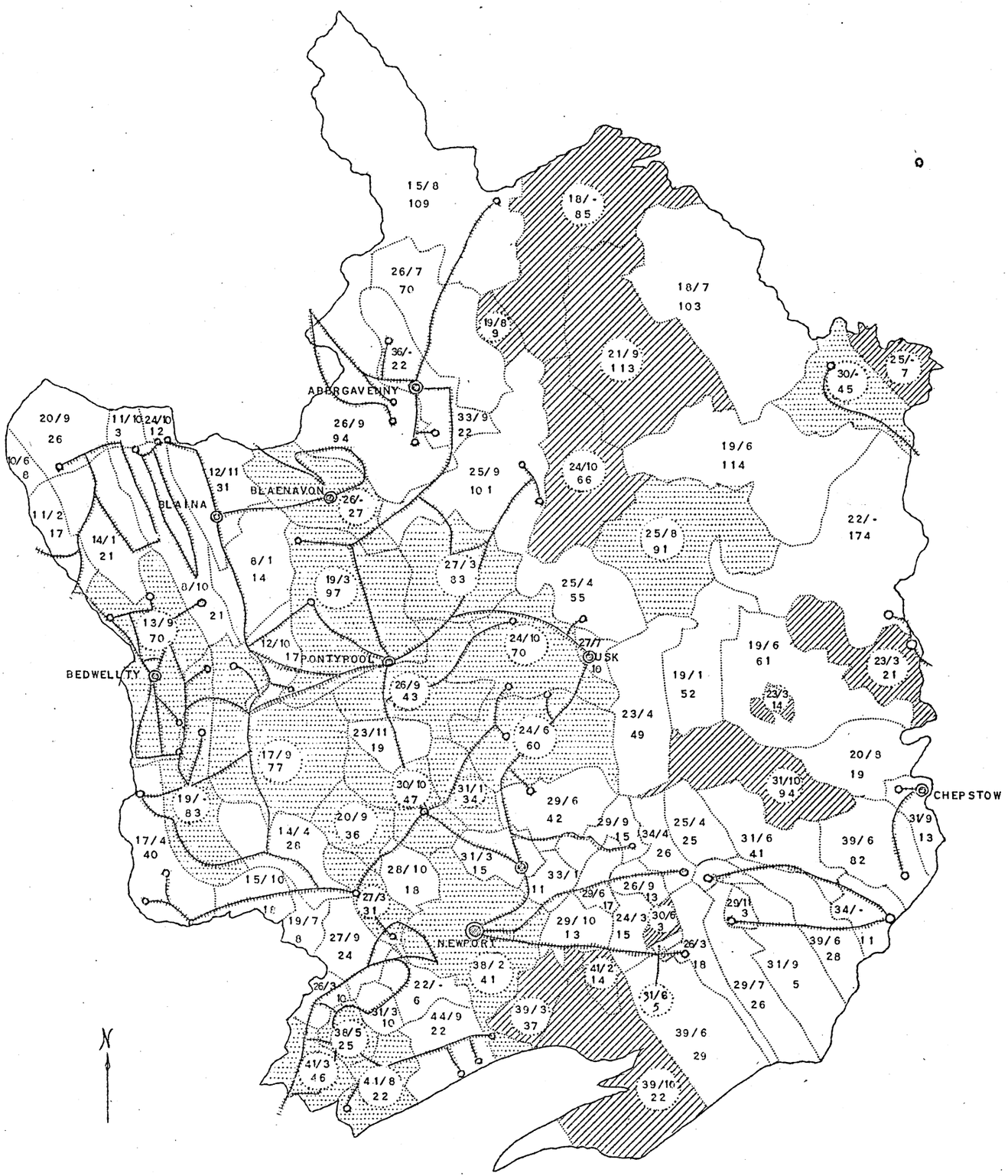
MERIONETHSHIRE



APPENDIX I

Map A(X)

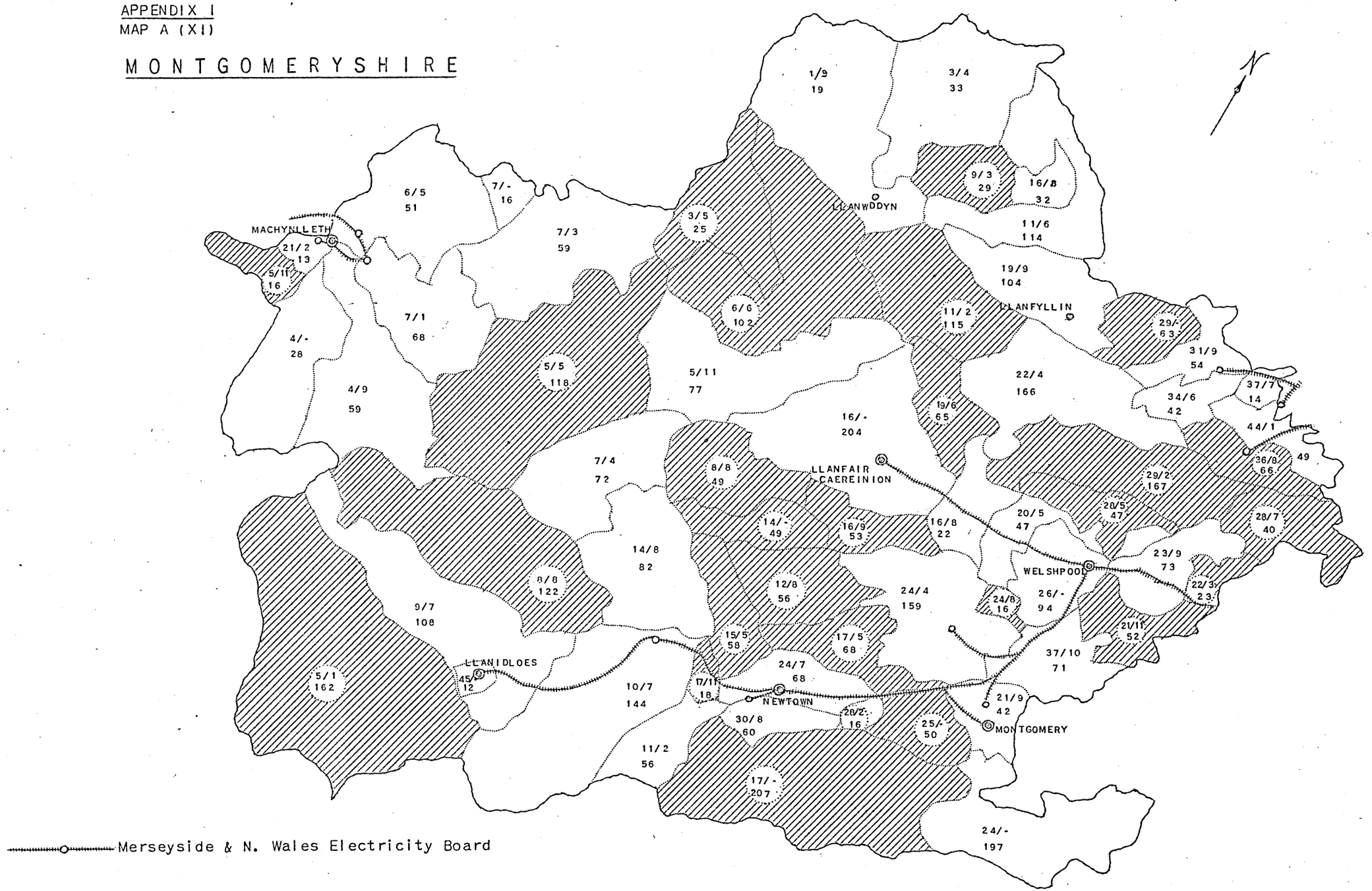
MONMOUTHSHIRE



South Wales Electricity Board

APPENDIX I
MAP A (XI)

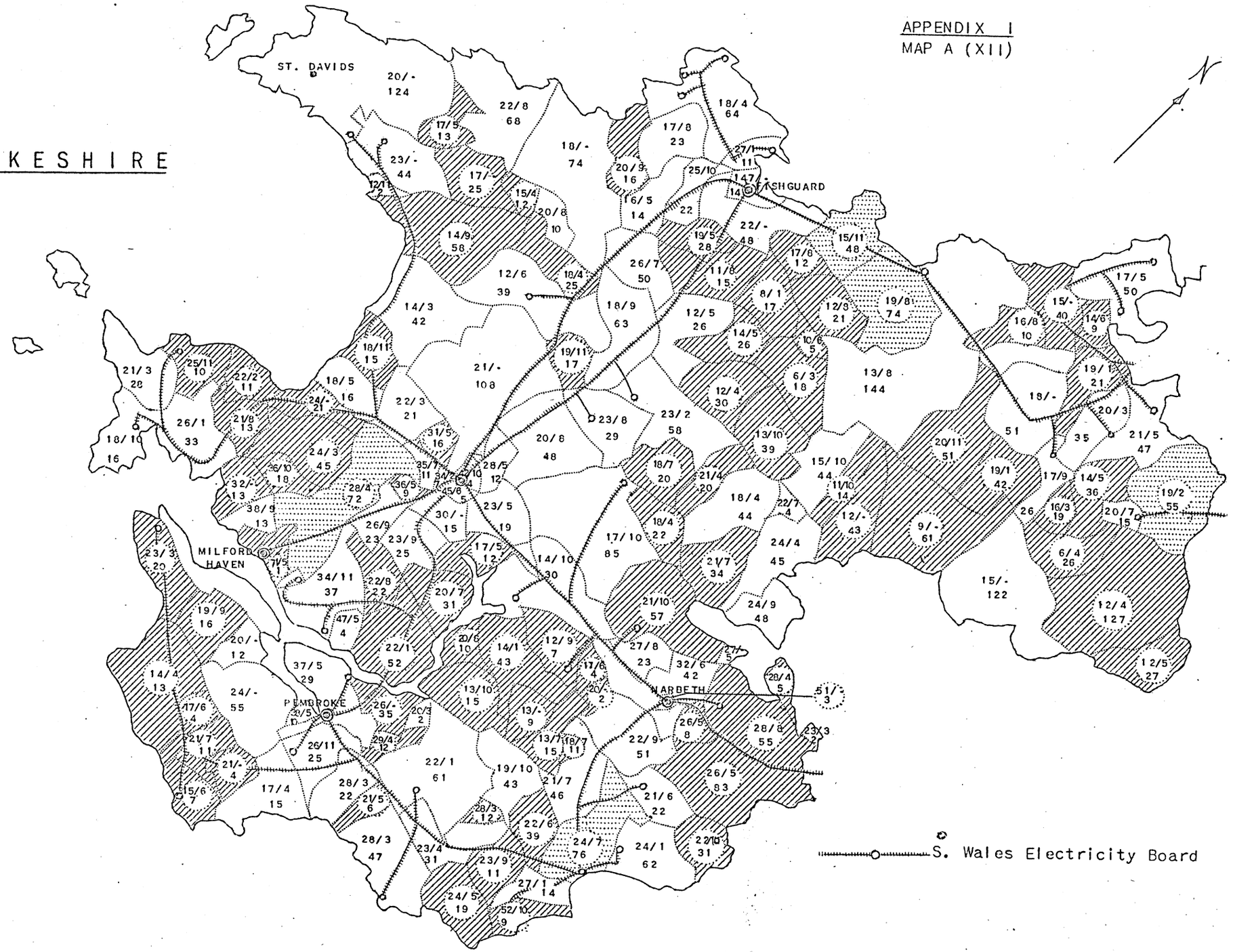
MONTGOMERYSHIRE



Merseyside & N. Wales Electricity Board

APPENDIX I
MAP A (XII)

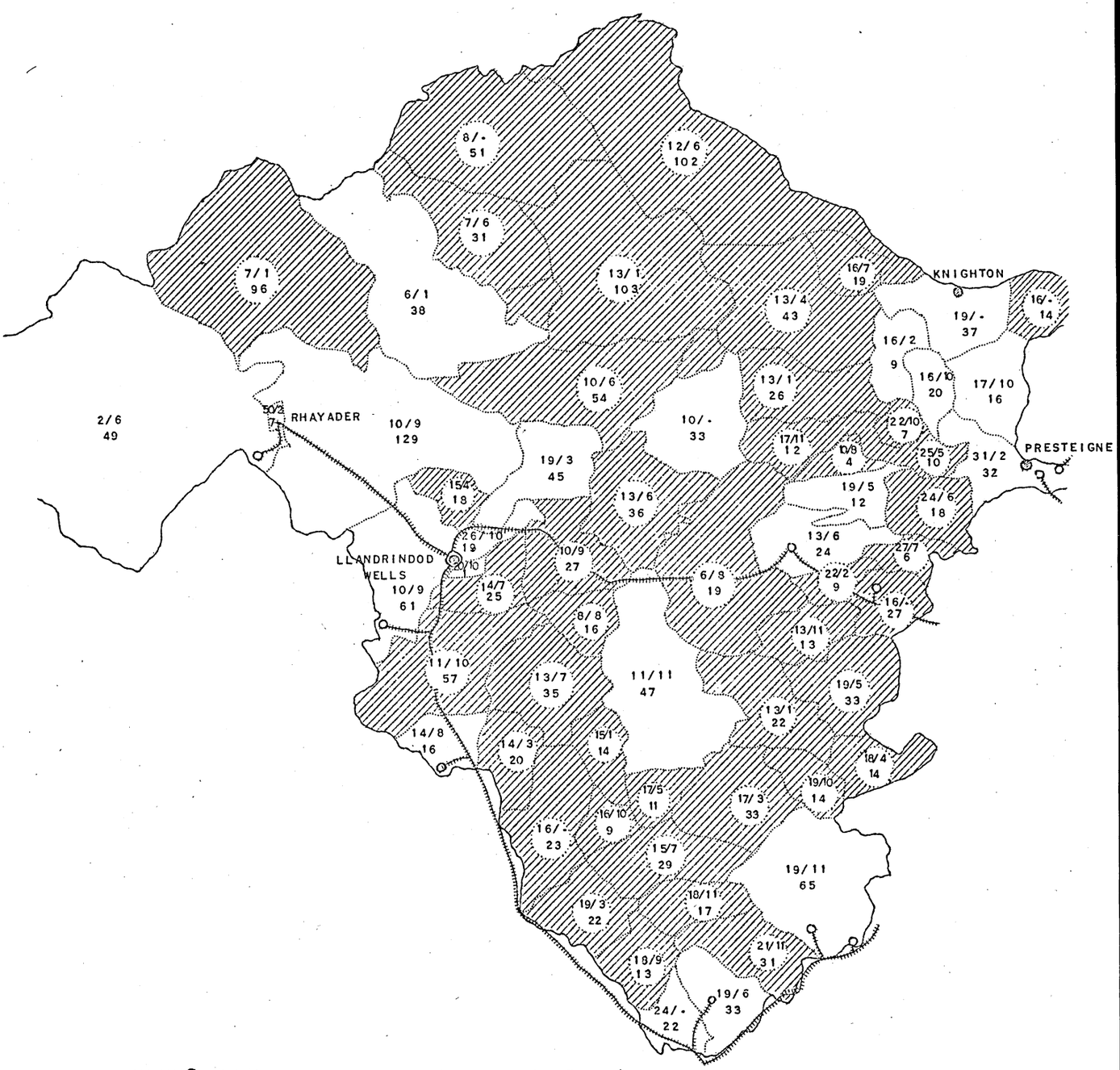
PEMBROKESHIRE



APPENDIX I

MAP A (XIII)

RADNORSHIRE



South Wales Electricity Board

TYPES OF FARMING

in

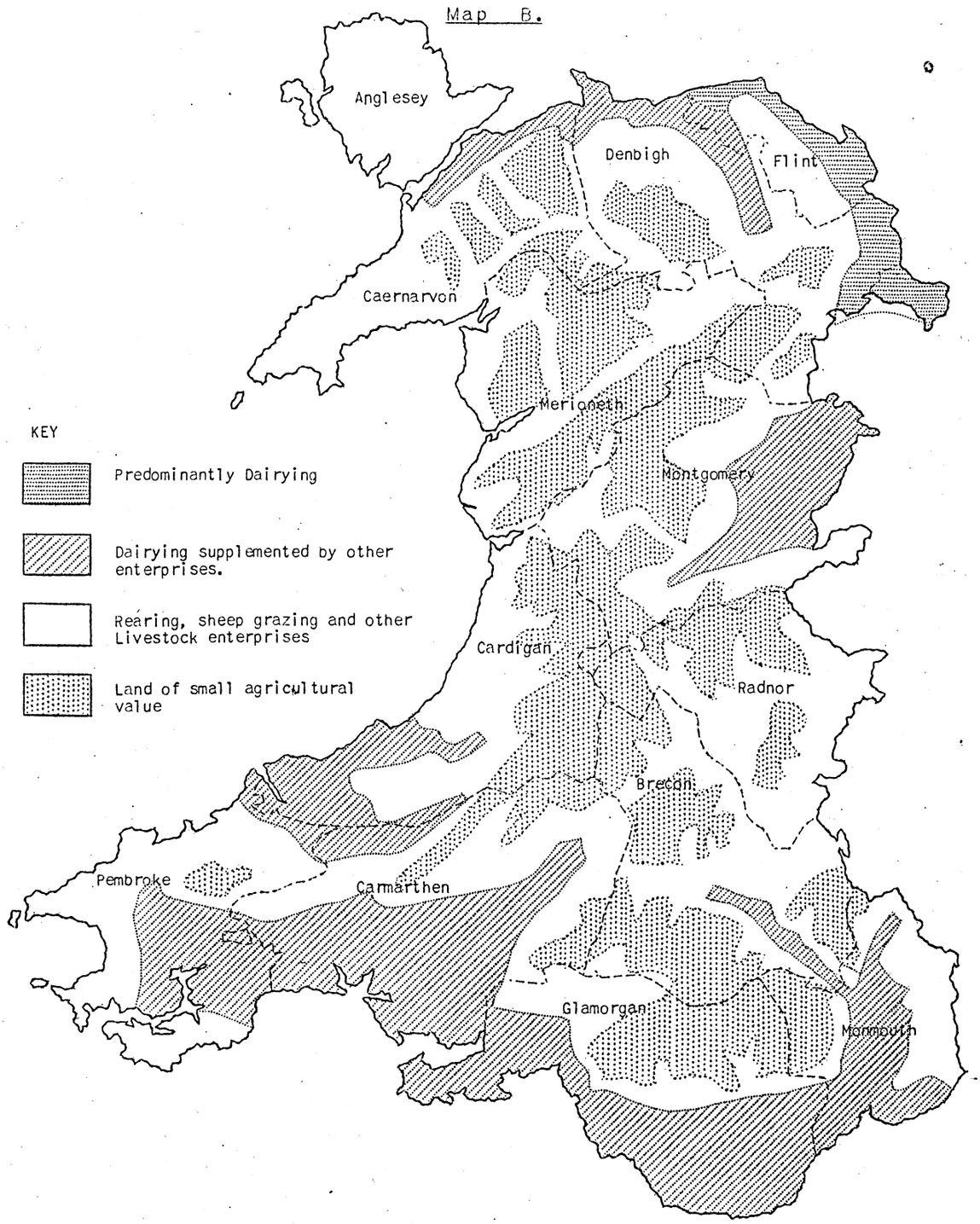
WALES AND MONMOUTH

(Ministry of Agriculture and Fisheries)

June 1939

APPENDIX II.

Map B.



APPENDIX III.

Table (a).

Electricity Supply & Size of Farm.

District.	Under 25 acres.		26-100 acres T.C.A.		Over 100 acres T.C.A.	
	Public.	Private	Public.	Private	Public.	Private
Denbigh:	%	%	%	%	%	%
Ruthin 1	10	9	60	41	30	50
Ruthin 2	-	12	50	29	50	59
Wrexham 1	30	31	49	23	21	46
Wrexham 2	52	19	36	56	12	25
Llangollen	33	16	47	25	20	59
Llanrhaidr	67	26	-	32	33	42
Llanrwst	-	25	67	-	33	75
Llansilin	12	46	38	27	50	27
Abergele	43	29	25	43	32	28
Cerrig-y-druidion	28	15	50	46	22	39
Colwyn Bay	55	20	42	60	3	20
Denbigh	42	9	23	18	35	73
All Districts	42	21	39	33	19	46
Montgomery:						
Welshpool	33	42	52	21	15	37
Machynlleth	47	24	47	36	6	40
Llanidloes	44	19	28	43	28	38
Newtown	50	33	40	45	10	22
Llanfyllin	45	15	45	45	10	40
Llanfair Caereinion	67	21	11	32	22	47
All Districts	44	26	43	36	13	38

Table (b).

Electricity Supplies and Full-time Farmers.

District.	Full-time Farmers.		Others.		All Farmers.	
	Public.	Private	Public.	Private	Public.	Private
Denbigh:	%	%	%	%	%	%
Ruthin 1	100	91	-	9	100	100
Ruthin 2	50	47	50	53	100	100
Wrexham 1	60	46	40	54	100	100
Wrexham 2	58	81	42	19	100	100
Llangollen	69	67	31	33	100	100
Llanrhaiadr	33	74	67	26	100	100
Llanrwst	17	100	83	-	100	100
Llansilin	88	55	12	45	100	100
Abergele	75	29	25	71	100	100
Cerrig-y-druidion	83	69	17	31	100	100
Colwyn Bay	76	60	24	40	100	100
Denbigh	46	73	54	27	100	100
All Districts	64	67	36	33	100	100
Montgomery:						
Welshpool	58	63	42	37	100	100
Machynlleth	59	68	41	32	100	100
Llanidloes	57	71	43	29	100	100
Newtown	80	61	20	39	100	100
Llanfyllin	75	75	25	25	100	100
Llanfair Caereinion	78	74	22	26	100	100
All Districts	66	68	34	32	100	100

Table (c).

Supply of Electricity and Tenure.

District.	Tenants.		Owners.		Part-Tenants, Part-Owners.		All Farms.
	Public.	Private.	Public.	Private.	Public.	Private.	
Denbigh:	%	%	%	%	%	%	%
Ruthin 1	10	25	30	58	60	17	100
Ruthin 2	-	6	100	71	-	33	100
Wrexham 1	47	46	25	23	28	31	100
Wrexham 2	43	44	26	31	31	25	100
Llangollen	39	42	44	58	17	-	100
Llanrhaiadr	-	37	100	53	-	10	100
Llanrwst	50	38	-	62	50	-	100
Llansilin	24	46	38	27	38	27	100
Abergele	50	-	36	71	14	29	100
Cerrig-y-druidion	55	39	28	38	17	23	100
Colwyn Bay	46	36	35	64	19	-	100
All Districts	42	33	33	50	25	17	100
Montgomery:							
Welshpool	52	46	39	46	9	8	100
Machynlleth	41	16	47	76	12	8	100
Llanidloes	43	33	43	62	14	5	100
Newtown	30	44	60	50	10	6	100
Llanfyllin	30	50	45	50	25	-	100
Llanfair Caereinion	11	32	78	58	11	10	100
All Districts	38	36	48	58	14	6	100

Table (d).

Nature of Electricity Supply to Farms.

District.	Light & Power.		Light only.		Power only.		All Supplies.
	Public.	Private.	Public.	Private.	Public.	Private.	
Denbigh:	%	%	%	%	%	%	%
Ruthin 1	30	42	70	58	-	-	100
Ruthin 2	50	23	50	77	-	-	100
Wrexham 1	32	8	68	92	-	-	100
Wrexham 2	33	37	66	63	1	-	100
Llangollen	14	84	86	16	-	-	100
Llanrhaiadr	-	26	-	74	100	-	100
Llanrwst	50	38	33	52	17	10	100
Llansilin	12	36	76	55	12	9	100
Abergele	64	-	36	100	-	-	100
Cerrig-y-druidion	28	15	72	85	-	-	100
Colwyn Bay	95	40	5	40	-	20	100
Denbigh	42	55	54	45	4	-	100
All Districts	40	33	59	65	1	2	100
Montgomery:							
Welshpool	73	50	27	46	-	4	100
Machynlleth	88	96	12	4	-	-	100
Llanidloes	58	95	28	-	14	5	100
Newtown	50	39	40	61	10	-	100
Llanfyllin	80	70	20	30	-	-	100
Llanfair Caereinion	34	47	44	47	22	6	100
All Districts	71	68	26	30	3	2	100

Table (e).

Use of Electricity Supplies to Farms.

District.	House & Farm.		House only.		Farm only.		All Uses.
	Public.	Private	Public.	Private	Public.	Private	
Denbigh:	%	%	%	%	%	%	%
Ruthin 1	10	33	40	42	50	25	100
Ruthin 2	50	53	50	47	-	-	100
Wrexham 1	60	92	38	8	2	-	100
Wrexham 2	41	50	57	31	2	19	100
Llangollen	33	33	64	58	3	9	100
Llanrhaiadr	-	47	100	53	-	-	100
Llanrwst	50	50	33	50	17	-	100
Llansilin	38	55	62	36	-	9	100
Abergele	28	43	68	57	4	-	100
Cerrig-y-druidion	33	54	67	46	-	-	100
Colwyn Bay	42	100	47	-	11	-	100
Denbigh	38	73	58	27	4	-	100
All Districts	40	55	55	39	5	6	100
Montgomery:							
Welshpool	52	50	48	50	-	-	100
Machynlleth	41	68	59	32	-	-	100
Llanidloes	57	90	43	10	-	-	100
Newtown	70	61	30	33	-	6	100
Llanfyllin	50	55	45	35	5	10	100
Llanfair Caereinion	44	58	56	37	-	5	100
All Districts	51	64	48	33	1	3	100