

Inter-War Land Drainage and Policy in England and Wales¹

By JOHN BOWERS

Abstract

Economic conditions in the inter-war period made field drainage uneconomic to the farmer and, in consequence, there was no social return on arterial investment designed to facilitate it. Despite this, the Ministry of Agriculture carried through a substantial programme of arterial drainage. To achieve this it was necessary to reform the archaic and chaotic system of drainage administration and to overcome opposition from the farming community to paying for its programme. Administrative reform was consolidated in the Land Drainage Act of 1930. Opposition was overcome in three ways: by promoting land drainage for other purposes such as the relief of unemployment and thus tapping other sources of funding; by widening the definition of beneficiary so as to broaden the fiscal base; and, via loans and grants to drainage authorities, by shifting the burden from rates to general taxation. The programme was complemented by propaganda to promote field drainage. The motivation for the programme appears to have been technical, stemming from the recognition that land drainage would increase agricultural output. This foregone output was presented as a loss to the nation despite the fact that it was not economic to produce it. Parallels are drawn with the post-Second World War Ministry view that the economic incentives facing the farmer should be manipulated so as to achieve production that was technically possible.

THE middle years of the nineteenth century were a period of great activity in agricultural drainage. Between 1847 and 1899 Phillips estimated that £5.5m of public money was lent to landowners in England for the underdrainage of agricultural land.² This public money was supplemented by private. On the great estates public loans provided about 20 per cent of the total capital suggesting total expenditure for England over the period of £27.5m in the draining of 4.6 million acres of agricultural land.³ The expenditure peaked in the 1850s and declined rapidly thereafter. With the onset of agricultural depression land drainage expenditure dwindled to almost nothing. According to MacGregor's analysis⁴ expenditure on drainage was only £531,000 in the decade

1883-92 and totalled only £90,000 in the next two decades, despite additional legislation encouraging drainage.⁵ The reasons for this decline were principally that, at lower agricultural prices, land drainage was unprofitable. Landlords could not recoup their expenditure in higher rents and

on most of the heavy arable land the expense of cereal production was unprofitable and much land was laid down or permitted to tumble down to grass. Land too wet for arable might do well enough for pasture.⁶

By the onset of the First World War it is clear that drainage had deteriorated considerably from its position thirty years previously. Nor, apart from the war and its immediate aftermath, were agricultural conditions such as to see any improvement from initiatives by landlords or their tenants. Throughout the 1920s and 1930s agricultural land drainage was simply unprofitable. Adkins' judgement is again worth quoting.⁷

¹ I am grateful to my colleague Katrina Honeyman for her helpful comments on this paper. Responsibility for what remains rests of course with me.

² A D M Phillips *The Underdrainage of Farmland in England during the Nineteenth Century*, 1989, chapter 3.

³ *Ibid.*, p 120.

⁴ Unpublished figures by J J MacGregor quoted in C S Orwin and E H Whetham, *History of British Agriculture 1846-1914*, 2nd ed, Newton Abbott, 1971, p 196; see also Phillips, *Underdrainage*, pp 122-6.

⁵ Thus agricultural tenants were encouraged to drain their land at the expense of their landlords by the Agricultural Holdings Act 1883.

⁶ B W Adkins *Land Drainage in Britain*, 1933, pp 228-9.

⁷ *Ibid.*, p 229.

Since the War the improvement of agricultural land by land drainage or otherwise has become a difficult problem; the cost of labour has increased, probably it has doubled in most cases, the cost of materials has also doubled. Times have become very bad for agriculturists and agricultural land is almost a drug on the market. Agricultural land drainage on the old lines has become practically a dead letter for the cost of draining an acre by those methods is in many cases more than the value of the freehold of the land. The skilled drainers have died out and draining by unskilled labour is a slow and expensive process.

Technical progress had not rendered the traditional methods obsolete. Thus Adkins again:

Mole drainage has been much talked of recently and the coming of the tractor and other appliances has made cheap work possible. A considerable amount of mole draining has been done where the soil and circumstances were suitable but this method of draining land has its limitations and it can be regarded only as a poor substitute for pipe drainage.⁸

Agricultural land drainage embraces two inter-related processes: field drainage, the drainage of individual fields with the objective of lowering the water table and improving the growth conditions for the crops grown; and arterial drainage, improvements in the capacity of the river system to shift water from the land. Arterial improvements facilitate field drainage by providing the system capacity to accommodate field drainage and, by reducing the incidence of flooding, increasing the economic returns on it. Arterial drainage is a collective benefit to the owners and occupiers of the affected lands and as such, from the time of Henry VIII at least, there has been statutory provision for collecting its cost from the benefiting landowners or occupiers. But the benefit from arterial drainage and hence the incentive to contribute to its cost depends on its relationship with field drainage. If economic conditions mean that the investment in field drainage yields insufficient return to the farmer such that he will not invest in it, then arterial

drainage — providing the conditions for field drainage — has itself no economic return.

This statement is of course an oversimplification. Improvements to the arterial system reduce flood frequency and hence reduce flood damage. But with livestock systems this damage is typically small and areas prone to frequent flooding are perceived correctly by farmers as unsuitable for arable. Some improvements to the arterial system yield automatic benefits by lowering the water table without the intercession of field drains and by permitting an extension of the grazing season. But even with the prices prevailing in the 1970s automatic benefits from arterial schemes were very small and insufficient to cover the costs of the works.⁹

The land drainage expenditure of the mid-nineteenth century involved both field and arterial drainage with the driving force lying in the profits to be derived from field drainage. In the inter-war period economic conditions were not favourable to field drainage and little was carried out. Indeed the evidence points to substantial disinvestment through the failure to maintain the system. The area of tillage in England and Wales fell by over 3 million acres between the end of the First World War and 1932 and showed no serious signs of recovery until 1940. This loss was not a switch to grass leys since the area under grass less than seven years old remained almost constant. Rather it reflected the abandonment of land maintenance. The area classified as Rough Grazing in Sole Right, land in poor state receiving effectively no maintenance, increased over the period by 600,000 acres; the rest comprised ageing permanent grass with some, presumably declining, agricultural value.¹⁰

⁹ J K Bowers, 'Cost benefit analysis of wetland drainage', *Environment and Planning A*, 15, 1983, pp 227-35.

¹⁰ Data from Ministry of Agriculture, Fisheries and Food, *A Century of Agricultural Statistics. Great Britain 1866-1966*, 1968.

⁸ *Ibid.*

Agricultural observers noted and deplored the state of the land. Thus:

The deplorable state of a large acreage of farming Britain today is enough to make one weep – land under-stocked, weeds flourishing, fences and hedges in dis-repair, ditches and drains neglected, and everywhere a woeful lack of fertility, production and employment.¹¹

Despite the lack of activity on the farm which alone would have given a return on it, the Ministry of Agriculture nonetheless was able to sustain a considerable volume of investment in arterial drainage. This paper shows how it was achieved and why. The drive for the programme was technical. Higher crop yields and livestock outputs were available if the land was drained and indeed substantial investment in both arterial and field drainage was necessary if technological possibilities were to be realized. The economic factors that were inhibiting this investment were seen as obstacles to be overcome rather than as signals that the market didn't want the produce.

To achieve its programme the Ministry overturned the traditional views on financing land drainage and established it instead as a public responsibility financed ultimately by the urban taxpayer. Its successes with arterial drainage were not matched at the level of the farm despite an extended campaign.

Agricultural policy directed at realizing the technical possibilities of agricultural production regardless of the economic circumstances characterizes the period following the Second World War¹² and suggests a continuity of policy objectives. The difference between the periods is that in the inter-war period the Ministry could not manipulate prices to realize its vision and therefore could not ultimately deliver the output that was technically possible. In the 1950s this constraint had gone. This

picture of a continuity of agricultural policy conflicts with the views of Whetham¹³ of passive *laissez-faire* in the inter-war period modified slowly in consequence of the results of the 1930s depression. That view derived from a concentration on the effects of policy on farmers' prosperity rather than what the Ministry was up to.

I

There are no available direct data on arterial land drainage investment in the inter-war period and work was carried out by a large number of drainage bodies. The work was however partially funded with a variety of loans and grants from the Ministry of Agriculture and data on these allow estimates to be made of the work done. The details of these estimates are presented in Table 1 and the resulting series are in Table 2. The expenditure can be interpreted as gross domestic fixed capital formation at, in the terms of Feinstein,¹⁴ original cost. While depreciation cannot be estimated much of this drainage work in the major wetland areas such as the Ouse catchment was new. Figure 1 graphs the results in both current and constant (1930) prices. Constant prices reduce the estimates of expenditure in the early 1920s but otherwise scarcely affect the results. The peaks in 1926 and 1930 result from the pattern of legislation that facilitated funding. From 1935 expenditure was on a sharply rising trend. Uncertainty attaches to the exact timing of the expenditure that was financed; loans and grants were typically provided in advance of the work; and the expenditure was probably smoother than is shown. Over the period 1919–1940 £8.5 m investment at 1930 prices is identified. The scale of the works may be gauged by comparing them with Feinstein's esti-

¹¹ A G Street, *Farming England*, 1937.

¹² J Bowers, 'British agricultural policy since the Second World War', *AHR*, 33, 1983, pp 60–67.

¹³ Edith H Whetham *The Agrarian History of England and Wales. Volume VIII, 1914–39*, 1978.

¹⁴ C H Feinstein *Domestic Capital Formation in the United Kingdom 1920–1938*, 1965.

TABLE I
Government finance to land drainage

Year	Grants (£'000)				Loans (£'000)					Net identified repayment ⁷	Net loans	
	Grants under land drainage acts ¹	Unemployment relief schemes ²	Sub total	Wash reclamation ³	Total grants	Land Drainage Act 1918 ⁴	Unemployment relief ⁵	Sub total	Expenses of inquiries ⁶			Total loans
1919				100.0	100.0	150.0		150.0	10.0	160.0	260.0	160.0
1920				11.2	11.2	79.0		79.0	7.0	86.0	90.2	76.0
1921		222.1	222.1	2.5	224.6	12.0	96.4	108.4	5.0	113.4	338.0	103.4
1922		241.9	241.9	1.0	242.9		91.5	91.5	4.0	95.5	338.4	85.6
1923		189.8	189.8	0.4	190.2		73.7	73.7	4.0	77.7	267.9	70.6
1924		164.5	164.5	0.4	164.9		63.2	63.2	3.0	66.2	231.1	56.3
1925		37.6	37.6	0.4	38.0		63.0	63.0	2.5	65.5	103.5	57.6
1926	170.0			0.2	170.2				1.0	1.0	171.2	-7.9
1927	80.0			0.2	80.2				4.0	4.0	84.2	-0.9
1928	95.0			0.5	95.5				0.6	0.6	96.1	-4.1
1929	115.0				115.0				0.5	0.5	115.5	-0.6
1930	120.0	40.0			160.0				1.3	1.3	161.3	-0.2
1931	190.0	60.0			250.0				2.0	2.0	252.0	0.2
1932	66.0	6.5			72.5				1.0	1.0	73.5	-2.0
1933	62.0				62.0				0.9	0.9	62.9	-1.5
1934	68.0				68.0				0.9	0.9	68.9	-1.2
1935	59.4				59.4				2.1	2.1	61.5	-1.0
1936	120.0				120.0				2.0	2.0	122.0	-1.3
1937	200.0				200.0				1.3	1.3	201.3	-2.4
1938	304.0				304.0				1.2	1.2	305.2	-1.7
1939	379.0				379.0				0.7	0.7	379.7	-1.5
1940	505.0				505.0				0.6	0.4	505.4	-0.9

¹ Grants to drainage authorities, catchment boards and county councils under the Land Drainage Acts 1918, 1926, 1930 and Agriculture Act 1937.

² A) Winter schemes for the relief of unemployment 1921-6, land drainage and coastal defence schemes, grants paid to drainage authorities and county agricultural committees.
B) Grants to landowners towards the cost of approved schemes of field drainage, water supply and fen claying for the improvement of agricultural land initially; schemes designed to facilitate the transfer of labour from distressed areas.

³ Reclamation scheme for northeast corner of the Wash. Funded from the Development Fund. Some revenues in the form of land sales and rentals resulted from the scheme.

⁴ Various schemes under Land Drainage Act 1918 including emergency schemes. Some of the work was performed by POWs whose labour is not priced in the scheme cost.

⁵ Element of relief of winter unemployment expenditure recoverable from the parties benefiting. Much of its expenditure was never recovered.

⁶ Recoverable expenditure related to the administration of the land drainage acts, expenses of inquiries and (under the Land Drainage Act 1930) costs of surveys.

⁷ The recoverable expenditure identified from the estimates falls far short of expenditure. Some was identified as written off. Much has simply disappeared from the accounts.

TABLE 2
Estimated expenditure on arterial land
drainage and sea defence schemes, 1919-1940

Year	£'000 at current prices	£'000 at 1930 prices ¹	Percentage government funds
1919	510 ²	373	100
1920	259	155	100
1921	333	228	100
1922	334	294	100
1923	277 ³	261	95
1924	281 ³	261	81
1925	154 ³	144	66
1926	486 ⁴	462	35
1927	229 ⁴	218	35
1928	271 ⁴	263	35
1929	329 ⁴	322	35
1930	464 ^{4,5}	464	34
1931	725 ^{4,5}	732	34
1932	208 ^{4,5}	221	35
1933	177 ⁴	191	35
1934	194 ⁴	210	35
1935	170 ⁴	182	35
1936	300 ⁶	311	40
1937	500 ⁶	487	40
1938	760 ⁶	702	40
1939	946 ⁶	923	40
1940	1263 ⁶	1150	40

¹ Other construction work; table 63 in C H Feinstein *Statistical Tables of National Income, Expenditure and Output of the UK, 1855-1965, 1972*.

² Includes an estimated £300K for the value of prisoner-of-war labour.

³ Includes non-grant-aided expenditure by the Ouse D B and Middle Level D C.

⁴ Average grant rate of 35 per cent assumed.

⁵ 33½ per cent grant on Unemployment Relief Schemes.

⁶ 40 per cent average grant rate assumed.

mates of gross fixed capital formation in agriculture (Table 3). Arterial drainage investment was over 7 per cent of gross domestic capital formation in agriculture 1920-1938 and amounted to 13 per cent in the depth of the depression in the early 1930s.

II

The problem faced by the Ministry of Agriculture in upgrading the arterial drainage system of the country was two-fold. First the system of land drainage administration was complex, archaic and chaotic.

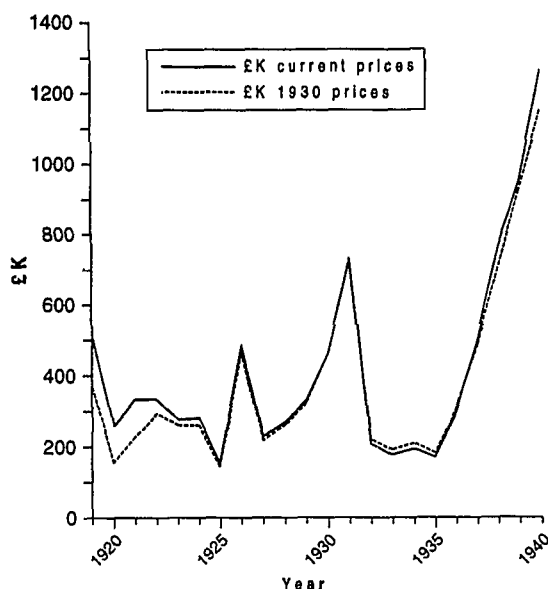


FIGURE 1
Expenditure on land drainage.

Conflicting responsibilities, lack of effective powers and limited ability to raise revenue was perceived as an obstacle to improvement. Second, because of the lack of perceived benefits by those on whom the costs would fall it faced considerable resistance among the agricultural community to any expenditure on land drainage. We discuss these in turn.

III

At the end of the First World War there remained a bewildering number of bodies with arterial drainage powers and responsibilities. Some attempt at reform had been made under the Land Drainage Act 1861. This had created two kinds of areas and authorities: drainage areas under commissions of sewers and drainage districts under elective drainage boards. The former were crown appointees on recommendation of the Inclosure Commissioners, the latter were constituted by parliamentary order on petition of the owners of at least a tenth of the affected land. The act's intention was that these new bodies would

TABLE 3
Gross domestic fixed capital formation in arterial land drainage and agriculture

Period	GDFCF/pa Agriculture ¹ (£m 1930 prices)	GDFCF/pa Arterial Drainage (£m 1930 prices)	Drainage as a percentage of agriculture
1920-24	5.7	0.2	4.2
1925-29	3.2	0.3	8.8
1930-34	2.8	0.4	13.0
1935-38	5.2	0.4	8.1
1920-38 (Total)	81.6	6.1	7.4

¹ C H Feinstein, *Statistical Tables of National Income, Expenditure and Output of the UK, 1855-1965*, 1972, table 5.10.

replace existing ones but progress required the consent of the bodies to be discontinued which clearly proved difficult to obtain. Without such consent the powers of both types of bodies to carry out works was severely limited. Furthermore the confirmation of the order setting up a drainage district required the consent of owners of two-thirds of the land. By 1918 there were 51 commissions of sewers and 49 elective drainage boards under the 1861 Act but there remained 219 other drainage bodies under various previous special acts.¹⁵ An Act of 1918 was intended to facilitate the formation of drainage districts by altering the conditions of consent. The provisional order setting up the drainage board would be confirmed unless within a prescribed period owners of one-third of the land objected. This had some effect. In 1927 the elective drainage boards had increased to 114 with 49 commissions of sewers but the number of other drainage bodies had fallen only slightly to 198.¹⁶ In the Great Ouse catchment alone there were 81 separate drainage bodies.

The solution of the Royal Commission on Land Drainage set up in March 1927 with the terms of reference 'to inquire into the present law relating to Land Drainage in England and Wales and its administration to consider and report whether any amendment is needed to secure an efficient system of arterial drainage ...' and reporting nine

months later was the creation of a central drainage authority for each major river catchment area with sole authority for the main channel of the river and with supervisory powers over elected internal drainage authorities where these were required, who would be responsible for subsidiary drainage channels. 'Commissions of sewers and obsolete or moribund Drainage Authorities should be abolished'.¹⁷ This reform should be implemented by a consolidating Land Drainage Act and all previous legislation should be abolished or so amended as to conform with the objectives of that act. Overall control of the new catchment boards would be vested with the Minister of Agriculture and Fisheries and the catchment areas should be listed as a schedule to the act. The commission supplied a suggested list of 89 catchment areas together with their areas of administrations and suggestions for priorities in creating catchment boards.

These recommendations were carried through in the Land Drainage Act 1930 and some 46 catchment boards, constituting, with some consolidation, the royal commission's priority areas, were created. Where catchment boards did not exist the act, as recommended by the royal commission, vested drainage powers with county councils.

This system, which survived until further consolidation under the 1972 Water Act,

¹⁵ Adkins, *Land Drainage*, p 194.

¹⁶ Cmd 2993, *Royal Commission on Land Drainage*, 1927, para 7.

¹⁷ *Ibid*, para 143.

provided the conditions for comprehensive catchment drainage plans and it was the implementation of these which gave the rising volume of arterial drainage investment in the 1930s (Table 1). Some illustrations of the work are in order.

The Ouse Drainage Board constituted by ministerial order in 1920 and confirmed after opposition in both Houses of Parliament was *de facto* a catchment board. A commission appointed by the Minister of Agriculture¹⁸ recommended works totalling £2.5m for the main river and its outfall plus £216,000 for the South Level Drainage Internal Drainage District. Much of this work was carried through over the following decade and in addition substantial works by the Middle Level Drainage and Navigation Commissioners totalling £650,000 were completed by 1934.¹⁹

The Kent Rivers Catchment Board was created by ministerial order in 1937 and involved the amalgamation of four out of five of the Kent catchment boards created under the 1930 Act. It inherited a three-phase plan for the Medway Catchment totalling £900,000 on which work had started in 1934. By 1938 phases 1 and 2 totalling £450,000 had been largely completed.²⁰

The Rother and Jury's Gut Catchment Board was faced with a substantial programme of sea defence works at and around Rye Harbour where works carried out in 1924 had been unsuccessful. Work commenced in 1934 and £180,000 had been spent by 1938 with further smaller works still to be done. In addition land drainage

works totalling £164,000 had begun in 1935.²¹

IV

If the administrative structure was an impediment to the development of arterial drainage in the inter-war period, the agricultural depression was a greater one since it led to consumer resistance to expenditure. The basic principle of finance for land drainage, and a hallowed one, was that the cost of works should be borne by the owners of the land which benefited. Since the owners saw little or no benefit from arterial drainage they resisted the expenditure.

The best documented example of rate-payers resistance is found in the saga of the Great Ouse Catchment. Under powers conferred by the Land Drainage Act 1918 the Board of Agriculture made a draft order for a single catchment drainage board in 1919. The board's responsibility involved 140 miles of main river and 480,000 acres of rateable land in ten counties, 'nearly a quarter of which has hitherto made no contribution to the cost of keeping the main channel and its banks in order!'²² Objection was made to the order and a public inquiry called. This by no means silenced the opposition and the Ministry was forced to clarify its motives:

Certain statements recently published in the press disclose considerable misunderstandings with regard to the object and effect of the Order ...

It has been alleged that if the Order becomes effective the Ouse Drainage Board will embark forthwith on a scheme for putting the river into order at a cost of not less than £3,000,000. Such a statement is, of course, entirely misleading and incorrect. In the first place, the highest estimate yet put forward was not £3,000,000 but £2,000,000. In the second place, even assuming that such a figure represented the probable cost of putting the rivers into order, it is obvious that the work would

¹⁸ Cmd 2572, *Report to the Minister of Agriculture and Fisheries of the Commission appointed by him in connection with the Ouse Drainage District*, 1926.

¹⁹ A T A Dobson, 'State-aided land drainage works in the Middle Level District of the Great Ouse Catchment Basin', *Journal of the Ministry of Agriculture (JMA)*, 36, 1929, pp 620-3; Anon, 'Land drainage works in the Middle Level District of the Great Ouse Catchment Basin', *JMA*, 38, 1931, pp 893-4; Anon, 'New sluice and pumping station at St Germans', *JMA*, 41, 1934, pp 729-32.

²⁰ Anon, 'Land drainage: an account of works of improvement in the Medway Area of the Kent Rivers Catchment Board', *JMA*, 45, 1938, pp 132-9.

²¹ Anon, 'Land drainage improvement works carried out by the Rother and Jury's Gut Catchment Board', *JMA*, 45, 1938, pp 1147-54.

²² *JMA*, 26, 1919, pp 729-31.

necessarily be extended over a great number of years, and that nothing approaching such a sum would ever be raised at once. The Ouse Drainage Board will be a body elected by the ratepayers of the district, and it is inconceivable that a body of that nature would embark upon any such fantastic career of extravagance as is suggested by the persons who have made the statements referred to above.

Calculations have been published in letters to the Press, of the amount of the rate per acre which may be expected to be imposed on agricultural land in the upper valley of the Ouse by the Ouse Drainage Board. Those calculations were not only made on the false assumptions that the Drainage Board will raise a sum of £3,000,000 by a single loan, but they appear to have been based on the original draft of the Ouse Drainage Order. The rating schedule contained in that draft was revised drastically in favour of the upper parts of the valley before the Order was sealed.²³

The provisional order was confirmed after debates in both Houses of Parliament. In announcing this, the first positive result of the 1918 Act, the Ministry again felt the need to defend itself:

It is sometimes thought that in endeavouring to establish a drainage board the Ministry is conspiring to force the carrying out of one or other elaborate engineering scheme and that on the establishment of such a board the district will suddenly be burdened with intolerable expense. It must be stated with greatest emphasis that this is not the case.²⁴

The protesters were right in their belief that the Ministry was convinced of a need for a comprehensive scheme even if it had no commitment to any particular one. The denials in any case had little effect. The Ouse Drainage Board found itself simply unable to collect its rates and in 1925 the Ministry was forced to suspend the rating of the upland areas of the Ouse Drainage District and to set up a commission to investigate the problem of Ouse drainage and its finance.²⁵

The problem of the Ouse catchment was by no means unique. The royal commission noted that problems of rate collection were fairly general and disputes on

liability commonplace. In 1918-19 some difficulties were experienced in getting landowners to accept work carried out by prisoners of war apparently because of the element of cost that they would have to meet²⁶ and opposition equally was met to the schemes for the winter relief of unemployment. Thus, the report of the second season's work noted:

As in the previous period there was a tendency on the part of owners of the land at first to assume that under the conditions of working with unskilled labour, and in spite of the Ministry's grant the work would prove expensive.²⁷

The rational basis for such opposition, that arterial improvements would yield no economic benefits to the ratepayers, has been explained.

The Ministry's strategy to overcome this problem had three components: i) land drainage works were promoted instrumentally for other purposes, and as such they could be subsidized; ii) the notion of benefiting area was extended, increasing the rateable value of the drainage authorities and thereby reducing the burden on existing ratepayers; and iii) state support for arterial drainage was shifted from loans to grants so that an increasing part of the cost was borne directly by the taxpayer.

With the first component, the first expedient was the use of the free labour of prisoners of war for drainage works. This commenced under the Defence of the Realm regulations and continued under the Land Drainage Act 1918. Free labour of prisoners of war was provided

to obviate the injustice of compelling a ... occupier or owner to pay for work which benefited other land besides his own.²⁸

According to a review in 1920 some 405,500 acres in England and Wales benefited from these schemes. Some 30,000 of these acres were in Norfolk where some

²³ *JMA*, 26, 1920, pp 1172-3.

²⁴ *JMA*, 27, 1920, pp 767-8.

²⁵ *JMA*, 33, 1925, pp 102-3.

²⁶ *JMA*, 26, 1919, pp 729-31.

²⁷ *JMA*, 30, 1923, p 523.

²⁸ *JMA*, 26, 1920, p 1089.

1.17 m man-hours of POW labour was committed.²⁹ If we assume that man-hours per benefiting acre was the same for other schemes³⁰ and, that an hour of POW labour is equivalent to an hour of a free unskilled agricultural labourer then the total labour cost of the schemes amounted to approximately £726,000. To this must be added expenditure on tools and supervision. Some £90,000 was advanced to county agricultural executive committees for this purpose, giving a total expenditure incurred in 1918 and 1919 of £826,000. This can be treated as a measure of the value of the investment in land drainage and in that spirit a portion of it has been included for 1919 in Table 1. Exchequer cost would, of course, be less than this and opportunity cost of POW labour could reasonably be treated as zero. This was the Ministry's view: the ultimate cost of the work to the state, they argued, amounted only to £70,000 of advances written off as irrecoverable – an average of 2s per acre.

The other major instrumental justification for land drainage schemes was the relief of unemployment. A programme of winter works for the relief of unemployment operated from 1921–2 to 1925–6.³¹ Funds were made available to drainage authorities, or where none existed, to county agricultural committees (CAC) for approved schemes of land drainage. The Ministry advanced the entire of the money but drainage authorities were expected to repay 25 per cent and CACs 33.3 per cent, the latter under guarantee of the benefiting owners. In exceptional cases repayments of up to 50 per cent of the money were required. At 75 per cent of cost the grants to drainage authorities were the highest

rates paid for land drainage in the inter-war period. The justification for these rates lay in the restrictions imposed. Work was to be done by hand labour as far as possible and expenditure for tools and materials was restricted to 20 per cent of the wage bill; where possible 75 per cent of the employed should be ex-servicemen and of the remaining 25 per cent the majority should be married civilians. Skilled men were restricted to one for every ten unskilled. Wage rates were not to exceed the local rates for unskilled agricultural workers.

The intention of the programme was to provide relief for the rural unemployed and it had its counterparts in other public works schemes for the urban unemployed. Nonetheless by 1924–5:

the altered conditions of agricultural employment have depleted the rural districts of casual labour causing more recruitment from adjacent towns.

Other conditions of the scheme were altered as it progressed. In 1924–5 the restriction on tools and materials was relaxed so as to encourage larger-scale drainage schemes. In the final season, 1925–6, applications were confined to CACs and the volume of expenditure capped at a lower level.

The drainage schemes were of two types, land drainage and sea defence, the latter including some urban coastal protection. There was additionally a small amount of expenditure by CACs for water supply to remote farms. Winter was hardly the proper season for land drainage works and opposition from landowners was experienced for that reason as well as reasons of cost. Furthermore, the winters of 1922–26 were exceptionally wet and a number of schemes were abandoned with the work incomplete. As measured by labour input the scale of the scheme was considerably smaller than the Defence of the Realm operations using POWs, and while figures are incomplete, the maximum number engaged in any week was probably less

²⁹ Estimated from Anon, 'Drainage operations in Norfolk', *JMA*, 26, 1919, pp 381–7.

³⁰ A questionable assumption since topography is the main determinant of the area of benefit per unit length of water course. It perhaps suffices for a ball-park figure.

³¹ Annual reports of the programme are published in the *JMA* as follows: 29, 1922, pp 488–9; 30, 1923, pp 519–25; 31, 1924, pp 610–7; 32, 1925, pp 588–94; 33, 1926, pp 201–11.

TABLE 4
Employment under relief works (including water supply)

Year	Total (Mondays) (<i>'000</i>)	Max in 1 week
1921-2	900	8165
1922-3	1019	9879
1923-4	711	na
1924-5	644	na
1925-6	219	na

than 10,000 (Table 4). As a contribution to the unemployment problem, even the problem of agricultural unemployment, it was of little consequence. Maximum expenditure in 1922-3 was less than £300,000. Most of the take-up was by drainage authorities where schemes averaged almost nine times the size of CAC schemes (Table 5). This implies that the project was concentrated in the major wetland areas where most of the drainage authorities were located. The published data include a regional breakdown but since the regional boundaries were changed in each of the first four years of the programme and were drawn in a variety of bizarre ways little information about the geographic spread of drainage under the programme can be gleaned.

Whether measured by number of schemes, total cost or area benefiting, the overwhelming majority of the programme was directed at land drainage rather than sea defence. Sea defence projects were, however, larger than land drainage ones on

average and more expensive also in terms of cost per acre (Table 6).

While the notion of area of benefit was a matter of dispute in the 1920s, as discussed below, it is clear from internal evidence that in this case it refers to estimates by those responsible for the works of the area directly benefiting in that the land would experience less frequent flooding or lowered water tables as a direct consequence of the work done. For drainage authority schemes this would not necessarily coincide with rating liability. Excluding sea defence schemes, where some proportion of the benefiting land – probably a small proportion – could be in non-agricultural use, the total area of benefit amounted to just under 2.4 m acres.

From 1926-32 grants towards the costs of field drainage schemes were available to landowners as part of the programmes to facilitate the transfer of labour from distressed areas. The sums involved were small, the maximum identified being £60,000 in 1931 which includes an unknown amount for water supply and fen claying as well as field drainage.

The creation of catchment-wide drainage authorities consolidated in the 1930s Land Drainage Act broke the direct link between benefit and payment for arterial drainage. Henceforth drainage works were financed from rates levied on all ratepayers of the catchment including householders with no connection with agriculture. The change could be expected to reduce

TABLE 5
Land drainage and sea defence

Year	Drainage Authorities			County Agricultural Committees		
	No of schemes	Total cost (£K)	Cost per scheme (£K)	No of schemes	Total cost (£K)	Cost per scheme (£K)
1921-2	149	239.2	1.605	176	28.8	0.164
1922-3	182	248.7	1.366	350	38.0	0.109
1923-4	174	179.0	1.029	216	41.6	0.193
1924-5	152	152.7	1.005	234	38.8	0.166
1925-6	—	—	—	194	38.0	0.196

TABLE 6
Land drainage works for the relief of unemployment

Year	No of projects		Area benefiting (^{000 acres})		Miles of waterways/ coastline covered		Total cost (£K)		Cost per project (£K)		Cost per acre benefiting (£)	
	Land drainage	Sea defence	Land drainage	Sea defence	Land drainage	Sea defence	Land drainage	Sea defence	Land drainage	Sea defence	Land drainage	Sea defence
1921-2	281	44	325	42.1	341.6	na	na	na	318.4	na	na	na
1922-3	358	47	405	166.1	912.7	2105	88	93.7	322.1	0.64	1.99	0.80
1923-4	353	37	390	658.2	727.3	na	na	223.8	256.2	0.63	0.87	0.66
1924-5	352	34	386	597.1	71.5	1667	55	174.2	233.3	0.49	1.74	0.60
1925-6	188	6	194	95.2	8.5	na	na	53.6	62.6	0.29	1.50	0.56
Total	1532	168	1700	2396.7	357.3	2753.8	na	na	1192.6	(0.54)	(1.20)	(0.32)

opposition from potential beneficiaries who calculated that their benefits fell short of the costs but at the possible risk of further opposition from those with no possibility of benefit. The likelihood of this, however, was low following the Local Government Act 1929 which abolished general rates on agricultural properties. Thereafter the only rates payable on agricultural land were for drainage. Opposition from upland ratepayers was central to the troubles in the Ouse catchment and led to their exclusion from its boundaries. In accordance with the recommendation of the royal commission, rating for drainage purposes was henceforth based on annual value of property rather than acreage, thus shifting the incidence from agriculture to urban properties. This was to be accomplished by a precept on the counties and county boroughs to be collected as part of the general rates. This revenue was for three purposes: main river works; administration; and contributions to internal drainage authorities. These latter bodies were to collect revenue for internal drainage, defined as all arterial drainage works within the catchment area other than works on the main channel and its outfall, from rates levied on their respective internal drainage districts. These rates had to be by value except for agricultural land where they could be acreage based (1930 Act clause 23). Catchment boards were empowered to exact contribution from internal drainage bodies for works done on their behalf or for their specific benefit.

The royal commission recommended that a distinction should be drawn between upland and lowland parts of catchment with a lower rate precepted for the former. The division was subject to confirmation by the Minister with a right of appeal by aggrieved parties.

They argued at length that the traditional narrow definition of benefit deriving from s. 5. 3 of the Bill of Sewers 1531 was the main hindrance to progress in land drainage

and was no longer unacceptable. In discharging water to a river the landowner bore some responsibility for its passage to the sea. If he altered discharges by field drainage then he should bear some of the costs incurred in the lower reaches of the water course affected.

Originally the Lowlands were in many cases swamps, receptacles for the upland waters. The ingenuity of the Lowlander has reclaimed them, and from being vast unhealthy washes they have ... been converted into some of the ... most valuable lands in the kingdom ... Modern methods of agriculture have been adopted by both the Uplander and the Lowlander. Field drainage ... has become common to both. The result is that the waters from the Uplands reach the outfall more rapidly than formerly ... This has driven the Lowlander to expend vast additional sums on protective measures ...³²

These reforms undoubtedly served to relieve the financial constraints under which arterial drainage had hitherto operated. By spreading the burden much more widely, and removing the direct link between drainage and payment, opposition to land drainage was effectively removed. The net effect of the rating reforms of the 1929 Local Government Act and the 1930 Land Drainage Act was probably that the rates burden was reduced for all farm-land even with the higher levels of expenditure on arterial drainage.

A switch from loans to grants was in many ways a logical complement to the rating reforms. With the transference of the burden to the taxpayer all links between direct benefit and liability for payment for land drainage are severed. The winter schemes for the relief on unemployment were partly grant financed. When phased out they were replaced by powers under the 1926 Land Drainage Act with grant aid for approved schemes by a drainage authority 'conferring a wide benefit on agricultural land.'³³ This scheme had no links with unemployment and hence there were

³² Cmd 2993, paras 38 and 39.

³³ *JMA*, 33, 1926, p 496.

no restrictions on the use of machinery. The only constraint was that all new plant and material must be of British manufacture.

The scheme was originally for five years. It was continued under powers of the 1930 Land Drainage Act and subsequently extended and up-rated by the Agricultural Act 1937. Rates of grant varied between drainage authority but were higher under the 1937 Act than before it. Calculation of average grant rate is rendered difficult not only because of the variations between authorities but also because rates were effectively scheme-specific and were higher for large scale long-term programmes (although they varied between parts of the programmes). An additional complication is that they were typically coupled with a wide variety of soft loans. The calculations in Table 1 assume an average rate of 35 per cent 1926-35 and 40 per cent 1936-40. The rating reforms meant that the drainage authorities had little need for state loans after the introduction of this scheme and gross expenditure on loans was virtually zero, with expenditure net of repayments slightly negative after 1926. As a rough approximation then land drainage investment was financed 60-65 per cent by the ratepayer and 35-40 per cent by the taxpayer. Loan finance was important for land drainage only in the early 1920s. It is clear from the annual appropriation accounts that many of the loans given in the early years were never repaid and were subsequently written off, so that the distinction is more a matter of form than substance.

V

The incentive to the farmer to undertake field drainage depends on a comparison between the costs of installation and the benefits in terms of increased crop yields and the opportunity to shift to more profitable enterprises. Given the state of agricultural markets the costs of field drain-

age were prohibitive throughout most of the inter-war period. Thus in 1921:

Manual labour in digging and laying drains on stiff land last winter probably cost about £15 per acre. Expenditure on this scale, coupled with the long period required to complete the work, and the increasing difficulty of obtaining skilled men to carry it out, is doubtless preventing much tile drainage work from being undertaken.³⁴

The Ministry's attention therefore focused on the possibility of the use of machinery. A review of available machinery was published in the *Journal of the Ministry of Agriculture* for 1921.³⁵ This suggested that a petrol engine wheel excavator as used in Canada was suitable for tile drainage and a trial of such a machine was conducted in Cambridgeshire in July 1921.³⁶ The results were disappointing. The machine was expensive to operate and unreliable:

As an example of a typical day, August 25th may be quoted. There was a stoppage of 1½ hours for a blacksmith's repair; 1¾ hours in minor adjustments in the field; and a period of 6 hours was actually spent in digging 21½ chains of 2 ft 6 in minors in stiff wet clay, 11½ gallons of benzol, 2¼ gallons of cylinder oil and about ½ lb of grease being consumed.

The cost of digging mains by the machine under controlled conditions was within the range 'estimated by practical farmers who saw the work' of doing the same work by hand. The machine offered some small cost advantage for dry soils.

Machinery in fact made no significant impact on the cost of field drainage throughout the inter-war period. Nicholson's view as late as 1940 is worth quoting:

The land most in need of draining today is, unfortunately, least able to bear costs of any kind. ... Tile draining is laborious and costly - £10-20 per acre

³⁴ H V Garner, 'The "Buckeye" Ditcher for land drainage: trial in Cambridgeshire', *JMA*, 28, 1921, pp 306-20.

³⁵ Major J G Merrison, 'Farm drainage machinery', *JMA*, 45, 1920, pp 1080-88.

³⁶ Garner, 'The "Buckeye" Ditcher'.

before the beginning of the war. For most heavy land, the costs of such work are prohibitive.³⁷

Faced with this difficulty the Ministry devoted considerable effort to the promotion of the cheaper alternative of mole draining.³⁸ Mole drainage is a technique for pasture improvement, not, in normal circumstances, suitable for arable. Successful moleing requires clay subsoil and some 'fall' to the land since the mole will be a constant distance below the surface.³⁹ It does not work with crumbly soils nor on flat lands. The opinion of the Ministry's expert was that 'since most of the land needing under-draining is land with a clay soil there are few cases where this method is not effective.'⁴⁰ Much of the land in the major wetlands which the Ministry was draining with arterial schemes was however likely to be flat. Mole draining with horse and by double steam traction was deemed to be too expensive, but drawing moleing machines by tractor or single steam traction was feasible with a cost far lower than tile draining.⁴¹ The Ministry undertook a programme of mole ploughing demonstrations to publicize the technique to the farming community. In the period 1924-1932 53 demonstrations in 34 counties were carried out. An analysis of the results suggested a less than rosy picture. Some were judged to have been failures and many more only partially effective. While in some cases an effective life of ten years was possible, from the data given, the norm would seem to have been less than five.⁴² The programme

was successful in revealing the limitations and problems with mole drainage⁴³ and in stimulating the market in equipment.⁴⁴ There are no data on the spread of mole ploughing from which the broader success of the programme in disseminating technique can be judged. Indirect evidence however suggests that it was not widely adopted. Thus in 1940 Nicholson could say that:

There is reliable evidence that 25 per cent of the heavy land of the country is in need of field drainage, and in many parts of the eastern counties considerable areas are derelict for this reason. This condition can be largely rectified by means of the mole plough.⁴⁵

VI

During the early 1920s the Ministry undertook an extensive inquiry into the need for land drainage. For the 1925 survey of agricultural output⁴⁶ the crop reporters were asked to estimate the area which might be improved by small scale drainage schemes. They identified some 650,000 acres although over 50 per cent was in the northern counties,

accounted for in the main by rough grazings where open 'sheep drains' are required or old drains of this type require cleaning out.

To this 650,000 acres had to be added the areas which could only be dealt with by large drainage schemes 'and the aggregate of these areas is very considerable'. In total the Ministry estimated that

over a million acres of agricultural land in England and Wales are urgently in need of drainage and another half-million acres are capable of improve-

³⁷ H H Nicholson, 'The importance of mole draining in present circumstances', *JMA*, 46, 1940, pp 671-6.

³⁸ Anon, 'Mole drainage demonstrations', *JMA*, 33, 1926, pp 587-91.

³⁹ 'With some types of mole plough it is, at least theoretically, possible to vary the depth of the cartridge as the mole plough travels along ... but the operation requires considerable skill, and ... has not proved satisfactory': Thompson Close 'Mole draining by direct haulage', *JMA*, 32, 1925, pp 303-6.

⁴⁰ *Ibid.*

⁴¹ Mole draining of 87 acres in 1925 with a single steam engine took four days at a total cost of £1 6s 8d per acre: A D Imper, T Lewis and V Liversage, 'A note on the cost of mole draining' *JRASE*, 86, 1925, pp 43-8; Adkins suggests £3-£5 per acre as being more typical: *Land Drainage*, p 289.

⁴² J H Blackaby, 'Mole drainage demonstrations, 1924-32', *JMA*, 42, 1935, pp 1244-55.

⁴³ Including the problems created by (real) moles. The little gentlemen in black velvet seem to have taken the name of the process literally and assumed that the demonstrations were for their benefit.

⁴⁴ 'At the first demonstrations in 1924, direct haulage was represented by one tractor and one make of mole plough, whereas in 1932, it was demonstrated by no fewer than 8 tractors ... and 9 mole ploughs': Blackaby, 'Mole drainage', pp 1244-55.

⁴⁵ Nicholson, 'Mole draining', p 671.

⁴⁶ Cmd 2815, Ministry of Agriculture and Fisheries, *The Agricultural Output of England and Wales 1925, 1927*, p 7.

ment by drainage, and these estimates are exclusive of land where field drainage alone is required.⁴⁷

These figures were subsequently refined by evidence gathered from other sources including returns from drainage authorities and the works undertaken for the relief of unemployment. A paper in 1927 gave surprisingly precise figures of 1,279,350 acres in urgent need of drainage and 475,850 acres capable of improvement through drainage, a grand total of 1,755,200 acres.⁴⁸ This estimate of need was repeated on several occasions including by the Royal Commission on Land Drainage⁴⁹ and clearly provided a driving force and justification for Ministry policy. But what was the nature of this need?

In the opinion of the royal commission the need was a strategic one for self sufficiency in food production to which the state of land drainage was an impediment.

As the period of the War lengthened and the necessity became apparent of raising from the land of this country as much as possible of the food required for the population, the problem of land drainage emerged as one of great urgency (para 53).

However,

the desirability of providing for the proper drainage of the agricultural land of this country was fully appreciated long before 1914; the emergency measures necessitated by the War merely focused attention upon it.

The commission was quite clear that this strategic need necessitated public subsidy. The situation was worsening:

... the depression in agriculture which existed during the last 20 years of the Nineteenth Century made it increasingly difficult for owners of agricultural land to maintain at their own cost an efficient system of land drainage over large tracts of the country. These difficulties have been aggravated in some parts of the country by the scarcity during the War, and its increased cost since. With the splitting up of estates during the last few years, the serious waterlogging of land may be expected to

become even more prevalent, unless adequate steps are taken to ensure that drainage operations, in many cases of an extensive character, are carried out efficiently and economically (para 55).

These were the views of the landed interest from which the royal commission membership was drawn. The Ministry of Agriculture and Fisheries could scarcely openly endorse its protectionist stance. Instead it offered two justifications. First, the damage done from drainage was irreversible.

... a vast amount of work requires to be done if valuable land in large tracts is in many cases to be saved from sooner or later becoming derelict. That such is the case requires no expert eye, but merely the casual observation of any ordinary traveller from one end of England to the other.⁵⁰

The appeal to casual observation was necessary since the claim does not stand up to scrutiny. The land whose drainage had deteriorated had been drained before with private finance when the economic conditions made it profitable to do so and there was no reason why it should not be improved again if the market conditions were suitable. Furthermore the large arterial schemes that the Ministry was promoting was making it possible to bring into production land that had not previously been drained, because it was not economic to do so, during the high drainage period of the nineteenth century. This was the case in the major wetlands, for example of the Ouse catchment and the Kent Marshes. Thus the work conducted by the Rye-Rother catchment allowed a major switch from sheep to arable on Romney Marsh in the 1950s.⁵¹ Finally, to reiterate, the state of the land and the economic return on the arterial schemes depend on field drainage which will not take place unless it is profitable. The note concludes, lamely:

⁴⁷ Anon, 'The need for land drainage', p 1013.

⁴⁸ *Ibid*, p 8.

⁴⁹ Anon, 'The need for land drainage', *JMA*, 33, 1927, pp 1010-14.

⁵⁰ Cmd 2993, para 57.

⁵¹ John Sheail and J Owen Mountford 'Changes in the perception and impact of agricultural land-improvement: the post-war trends in the Romney Marsh', *JRASE*, 145, 1984, pp 43-55.

the Ministry is not unmindful of the difficult times through which agriculture is now passing, but ... there can be no question that the expenditure involved is not only essential, but will ultimately prove profitable.

The second argument concerned the economic loss from undrained land:

Out of 27 million acres under crops and grass, at least 1,200,000 are in areas which are waterlogged and another 500,000 acres are capable of being improved by drainage operations. These latter areas include some of the richest land in the Kingdom ... The loss to the nation in food alone has been estimated at £18 million annually, in addition to the loss to the country through the smaller employment of labour.⁵²

There are several obvious criticisms of this statement. First the lost gross output from the land is too high. The loss of gross output per acre implied by this figure is £10.59. From the 1925 Agricultural Census,⁵³ total gross output for England and Wales was £225,330,000 from an agricultural area (excluding rough grazings) of 25,755,000 acres implying a gross output of £8.75 per acre. This global figure includes elements such as glasshouses, soft fruit and orchards which should be excluded. Gross output of livestock products per acre of grass from the census is £8.77; gross output per acre of farm crops and vegetables is £7.29; gross output per acre of crops and livestock is £8.31. This latter would seem a more sensible figure to use. It would reduce the 'loss to the nation in food alone' to a little over £14 m.

But this assumes that all the 1,700,000 acres are currently producing nothing. It is clear that the 500,000 acres described as capable of improvement were not in that situation. If we assume that the land was yielding half of average gross output, the loss is further reduced to £12 m. The Ministry's figure of £18 m would require that the land if drained would produce a gross output 33 per cent above the national

average.⁵⁴ Over such a large area of land, even with field drainage, which was not forthcoming, this was an unrealistic expectation to say the least. The Ministry must have known that its estimate of output losses was a gross exaggeration.

But of course the production of food requires resources, and the 'loss to the nation' from poor drainage is not measured by gross output but by net output. The distinction would have been perfectly understood within the Ministry since the 1925 Agricultural Census was carried out in connection with the Census of Production Act 1906. That having been said, the measurement of net output is not straightforward because of the difficulty of measuring on farm consumption of crops. Using the conversion factors suggested by Ojala,⁵⁵ the ratio of net to gross output for 1924-9 is 0.563. Thus the Ministry's 'loss to the nation' gross output of £10.59 per acre equates to a net output loss of £5.96 or, in aggregate £10.13 m. Our corrected estimates of £12-14 m equate to losses of £6.76 m-£7.88 m.

The average gross outputs revealed in the 1925 census of £8.77 per acre for livestock products and £7.29 per acre for crops equate to net outputs of £4.47 per acre and £5.10 per acre respectively.⁵⁶ These figures reveal the dilemma faced by the Ministry in promoting field drainage. Deduction of labour costs from these figures would give gross margins of something like £1-£2 per acre. With a cost of tile drainage of £15 per acre the internal rate of return on the investment for land currently producing nothing will be 3-5 per cent against a cost of borrowing of 7-10 per cent.

⁵² Anon, 'Government assistance to land drainage', *JMA*, 33, 1926, pp 280-1.

⁵³ Cmd 2815.

⁵⁴ This calculation assumes that the 1,200,000 acres in need of drainage produced nothing but were included in the census acreage, an unlikely contingency since such land would in all probability either appear as rough grazing or escape enumeration.

⁵⁵ E M Ojala, *Agriculture and Economic Progress*, 1952.

⁵⁶ Using net/gross output ratios calculated from Ojala, *Agriculture and Economic Progress*, of 0.51 for livestock and 0.70 for crops.

VII

The return on arterial drainage of agricultural land depends on parallel investment in field drainage by the farming community. Throughout the inter-war period the economic condition of agriculture was not conducive to field drainage investment and little was carried out.⁵⁷ Despite this obstacle the Ministry of Agriculture promoted an extensive programme of arterial drainage works. It did this through a series of administrative returns which broke the traditional link between payment and benefit and transferred the cost of the programme to taxpayers and urban ratepayers. But relieving farmers of the cost of arterial drainage works was not sufficient to induce them to drain their land and expand output with the consequence that the tax- and ratepayers saw no return on their investment until the changed conditions of the Second World War or in some cases until the post-war period.

The motivation for the drainage programme lay in the Ministry's preoccupation with technical efficiency as defined by agricultural science which showed that it

was technically possible to increase the agricultural product, to improve crop yields, if the land were properly drained. From an economic viewpoint of course this missing output was not a waste since the opportunity cost of realizing it was too high.

The Ministry could only have achieved its ambition of having the land efficiently farmed had it been able to subsidize the investment in field drainage and, since at the agricultural prices then prevailing field drainage would not have been worthwhile at virtually any cost, also to raise the return received by the farmer from the resulting product. In the political conditions of the inter-war period it was able to do neither. In the different conditions after the Second World War it could and did do both. The result was that tile drainage became the norm in the English and Welsh lowlands with well documented consequences for landscape and wildlife.⁵⁸ The arterial drainage of the inter-war period facilitated this. But while subsidy and price support could alter the economics of field drainage from the viewpoint of the farmer, it could not alter the social return from arterial drainage since the real return on agricultural expansion is not changed by subsidy. Arterial drainage in the post-war period remained uneconomic.⁵⁹ But, as in the previous period, that did not prevent it from taking place.

⁵⁷ The absence of public loans or grants for field drainage in the inter-war period means that there is no hard evidence to support this contention. One possible source of evidence is the administration of field drainage grants after 1939 where MAFF drainage advisors were required to note the presence of old drains. These data were analysed by F W H Green, 'Field under-drainage before and after 1940', *AHR*, 28, 1980, pp 120-23, who treats them as evidence of nineteenth-century drainage since 'it is known that little was done between 1880 and 1939'. A later analysis by M Robinson, 'The extent of farm underdrainage in England and Wales, prior to 1939', *AHR*, 34, 1986, pp 79-85, concurs except that 'some short lived twentieth-century drainage schemes might have been counted in error'.

⁵⁸ For a summary see J Bowers and P Cheshire *Agriculture, the Countryside and Land Use: An Economic Critique*, 1983.

⁵⁹ J Bowers 'Cost-benefit analysis in theory and practice: the case of land drainage', in R K Turner, ed, *Sustainable Environmental Management Principles and Practice*, 1988, pp 265-89.