Land drainage in England and Wales : report.

MINISTRY OF AGRICULTURE AND FISHERIES

Land Drainage in England and Wales

REPORT OF THE
LAND DRAINAGE LEGISLATION SUB-COMMITTEE
OF THE
CENTRAL ADVISORY WATER COMMITTEE

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1951
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NOTE

This report has been prepared by the Land Drainage Legislation Sub-Committee of the Central Advisory Water Committee appointed by the Minister of Health under Section 2 of the Water Act, 1945. The Report was adopted unanimously by the Main Committee on Friday, 24th November, 1950.

CENTRAL ADVISORY WATER COMMITTEE

LAND DRAINAGE LEGISLATION SUB-COMMITTEE

Terms of Reference

To consider proposals and make recommendations for the amendment and modernization of the law relating to Land Drainage in England and Wales.

Original Members

Lt.-Col. Sir Arthur Heneage, D.S.O., D.L., J.P. (Chairman).
Capt. Sir Jocelyn Bray, D.L., J.P., F.R.I.C.S., F.L.A.S.
Sir Wynne Cemlyn-Jones.
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Sir Cecil Newman, Bt., J.P.
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Mr. G. A. Worth, M.B.E., J.P.

Co-opted Members

*Mr. J. Hirst, A.F.C.
†Mr. W. C. Jackson, C.B.E., J.P.
Mr. D. B. Toye, C.B., O.B.E.

Assessors

Mr. A. Titherley, Ministry of Health.
Mr. W. J. Shea, M.B.E., Ministry of Transport.
Mr. Hugh Gardner, Ministry of Agriculture and Fisheries.
Mr. A. Hodgson, M.C., Ministry of Agriculture and Fisheries.
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Mr. J. V. Spalding, B.A., M.I.C.E., A.M.I.W.E., Ministry of Agriculture and Fisheries.

Secretaries

Mr. G. F. Dean (from February, 1947, to February, 1948).
Miss E. C. Sutcliffe (from February, 1948, to April, 1950).
Mrs. D. Hussey (from May, 1950).

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*Mr. Hirst was co-opted on 29th December, 1948.
†Mr. Jackson died on 27th October, 1948.

1A

EXPRESSIONS USED IN THE REPORT

Award is a scheme, made many years ago under an old general Inclosure Act or local Act, conferring powers and duties, in relation to small local drainage problems, on persons, bodies of persons or parishes. Hence Parish Award, Inclosure Award.

Award Authority is an authority appointed to administer the award—sometimes private persons, the parish council, etc.

Drainage Authority is a wide term applying to any authority or body of persons exercising statutory land drainage powers. It includes drainage boards, q.v., and also county councils, award authorities and other authorities exercising powers under private local enactments.

Drainage Board is a particular type of drainage authority set up specifically for land drainage purposes. It is a general term limited in its application to catchment boards, river boards, internal drainage boards and external drainage boards.

(i) *Catchment boards* are statutory authorities set up under the Land Drainage Act, 1930, each exercising jurisdiction over an area whose drainage is directed to a particular river or group of rivers (catchment area). Fifty-three catchment boards have been established in England and Wales (see Appendix III). They have no power to levy rates, but they may issue precepts to the councils of counties and county boroughs and to the internal drainage boards within their areas. Catchment boards are now being superseded by river boards.

(ii) *River boards* are statutory authorities constituted under the River Boards Act, 1948, each exercising jurisdiction over the whole watershed area of a river system or group of river systems together with certain adjoining areas (river board area). River boards are now being set up for the whole of England and Wales ; as they are established, they assume the powers and functions of the catchment boards which they supersede, as well as the functions of fishery boards and the functions of local authorities in regard to the prevention of pollution. The process of their establishment will soon be completed.

(iii) *Internal drainage boards* exercise jurisdiction over internal drainage districts : that is, defined areas of land such as " will derive benefit or avoid danger as a result of drainage operations " and *lying within the catchment or river board area.* Internal drainage boards have power to levy drainage rates on owners and occupiers of property within their districts.

(iv) *External drainage boards* exercise jurisdiction over external drainage districts : that is, areas of land defined on the same principle as internal drainage districts (see above) *but lying outside a catchment area or river board area.* These drainage boards also have the power to levy drainage rates within their districts. When river boards have been set up for the whole of England and Wales there will be no drainage boards and drainage districts in this category ; they will have become drainage boards and districts under category (iii) above. The proposals in the report are intended to apply when this stage is reached.

Drainage District is a general term meaning the area of jurisdiction of a drainage board, and thus includes catchment area, river board area, internal and external drainage districts.

Main River is any channel for which a catchment board or river board has assumed responsibility. Main river is clearly marked on the statutory maps prepared by the Minister of Agriculture and Fisheries in relation to each catchment area and river board area when it is established or altered.

Notes : (i) The terms " watercourse ", " drain ", " channel " and " ditch " are assigned special meanings in paragraph 38 of the report, and those meanings are intended to apply throughout the remainder of the report.

(ii) The term " banks " is discussed in paragraph 143 of the report.

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PREFACE

To the Central Advisory Water Committee

Gentlemen,

We were appointed by the Central Advisory Water Committee on 21st February, 1947, at the request of the Minister of Agriculture and Fisheries, to consider proposals and make recommendations for the amendment and modernization of the law relating to land drainage. We have the honour to submit a report of the conclusions we have reached as a result of our investigation, which, if accepted, will involve a substantial re-casting of the Land Drainage Act, 1930, and related legislation.

Constitution.—The original nine members of the Sub-Committee were all members of the main Committee. Power was exercised, however, to co-opt Mr. W. C. Jackson, who brought to our deliberations the benefit of his wide experience as Chairman of the River Great Ouse Catchment Board ; and Mr. D. B. Toye, a former head of the Land Drainage Division of the Ministry of Agriculture and Fisheries, whose connection with land drainage dates back to the time when he was secretary to the Royal Commission on Land Drainage in England and Wales, whose report was presented to Parliament in December, 1927. The death of Mr. Jackson on 27th October, 1948, deprived us of a much-valued colleague. In his place we co-opted, on 29th December, 1948, Mr. John Hirst, Clerk of the River Trent Catchment Board. Mr. Ellen was unfortunately prevented by illness from attending our concluding meetings. He played a full and valuable part in our deliberations over a period of three years and it is a matter of great regret to us that his illness has prevented him from completing his work as a member of the Committee.

Proceedings.—We met on 53 days. At our initial meetings we restricted our deliberations to main issues of principle, leaving points of detail, however important, to be considered later. We received written evidence from the organizations listed in A of Appendix I, and we subsequently took oral evidence on major issues of policy from the organizations listed in B of that Appendix. From consideration of suggestions received in the Ministry of Agriculture and Fisheries from a number of sources, for the amendment of the individual sections of the Land Drainage Act, there emerged a number of subsidiary points on which we sought further written information from the interests concerned. We had informal discussions with the representatives of the organizations which are listed in C of Appendix I on one or more of these points. In addition, we spent 10 days in visits to Lincolnshire and the area round the Humber, Essex, North Wales, Somerset and parts of the Thames Catchment Area. It may be asked why we did not visit the Fen country where land drainage is more vital to the interests of the community than in any other part of England and Wales. The Royal Commission of 1927 had visited the Fens and had given much consideration to the drainage problems there ; and, thanks largely to the provisions of the Land Drainage Act, 1930, which was based on their report, an efficient organization is in being in the area. We had before us much information about the drainage system and administration in the area ; and, moreover, during the earlier and more important stages of our work we had the assistance of the late Mr. Jackson, whose first-hand knowledge and long experience of drainage in the Fens were invaluable to us. Our reasons for selecting the particular areas we visited were partly because we required more information about their special drainage characteristics, but mainly because they seemed to us the most useful areas from the point of view of the chief problems we had to consider.

REPORT OF THE LAND DRAINAGE LEGISLATION SUB-COMMITTEE

NOTE.—It is our intention that all the recommendations in the following report which apply to river boards should apply also to the Thames Conservancy and the Lee Conservancy Catchment Board, which exercise the same range of functions as river boards.

Chapter 1.—Introduction

HISTORICAL BACKGROUND

1. In our survey of land drainage legislation in England and Wales we are very conscious of the debt we owe to the Royal Commission on Land Drainage of 1927, on whose findings the Land Drainage Act, 1930, was based. In view of the detailed survey of former land drainage legislation made by the Commission in the first part of their report, we do not feel it necessary to set out the earlier historical background. But it has been constantly in our minds throughout our deliberations that we were playing our part in a process of evolution which, so far as drainage legislation is concerned, began well back in the Middle Ages. The process of evolution has accelerated in the 23 years since the Royal Commission reported. There have been substantial changes in the relationship between central and local government and between the major and minor local authorities. Certain large industries and undertakings have experienced fundamental changes in organization and control and these affect land drainage administration in various ways. The impact of a world war, moreover, and the new place achieved by domestic agriculture in the national economy, have brought to the forefront the importance of land drainage works, particularly on lesser watercourses. The principle established in the Land Drainage Act, 1930—that works of land drainage, in the wide sense in which that term is used in the Act, are of something more than purely local concern—has acquired a new and broader meaning. That is the cardinal fact underlying all our recommendations.

THE LAND DRAINAGE ACT, 1930

2. In paragraph 58 of their report, the Royal Commission stressed—

"(*a*) the necessity of having a supreme Authority in each Catchment Area which should be in charge of the main channel and banks of the river and work in closest collaboration with the Drainage Authorities concerned with the internal drainage of the catchment area ; and

(*b*) the prime importance of the extension of the area of and alteration in the basis of rating for drainage purposes, in order to include a much wider area and basis of contribution than can be brought in under the old interpretation of the principle of ' benefit '."

The Land Drainage Act, 1930, provided for the establishment of catchment boards for the whole watershed areas of individual rivers or groups of rivers ; and the precepting for land drainage expenses on all councils of counties and

county boroughs within the watershed area. The River Boards Act, 1948, by providing for the establishment of river boards for the whole of England and Wales has carried this process one stage further. A guide to the powers and functions of river boards, which has been prepared by the Ministry of Agriculture and Fisheries and the Ministry of Health, includes a summary of the provisions of these Acts.* We have not, therefore, included a summary as an Appendix to this report as we had originally intended.

DE-RATING OF AGRICULTURAL LAND

3. It is a point of importance that, between the date of the Royal Commission's report and the passage of the Land Drainage Act in 1930, agricultural land was de-rated by the Local Government Act, 1929, and hence has not, except when it lies within an internal drainage district, contributed to the cost of drainage works on the main rivers of the country.

IMPLEMENTATION OF THE LAND DRAINAGE ACT, 1930

4. Following the passage of the Land Drainage Act, 1930, catchment boards were set up for the areas named in Part I of the First Schedule to the Act. Subsequently certain new areas were defined and some existing areas amalgamated and the position reached on 31st March, 1949, was that there were 53 statutory catchment areas and boards in England and Wales covering the greater part of the country and including, with one or two exceptions, all areas in which drainage problems of any magnitude existed. Within these catchment areas there were some 360 internal drainage districts. The process of constituting new internal drainage districts or extending or amalgamating existing districts has gone forward continuously since the Land Drainage Act was passed in 1930. Outside statutory catchment areas there were 28 external drainage districts set up or reconstituted under Section 17 of the 1930 Act or earlier enactments, some of which deal with problems of considerable weight. Detailed statistics for the year 1948-49, relating to the catchment areas, are set out in Appendix II to this report, and Appendix III is a map showing the boundaries of the statutory catchment areas at 31st March, 1949.

THE RIVER BOARDS ACT, 1948

5. The River Boards Act, 1948, required the Minister of Agriculture and Fisheries and the Minister of Health to set up river boards whose areas should between them cover the whole of England and Wales, with the exception of the Thames and Lee Catchment Areas and the administrative County of London and those of its environs which were not included in a statutory catchment area at the date of the passing of the Act. The process of setting up river boards is now in progress and, as established, the boards are taking over the powers under existing legislation of catchment boards, fishery boards and pollution prevention authorities. The legislation in relation to the prevention of pollution has already been reviewed by the Central Advisory Water Committee and a report has been published.† It is our task to make proposals for

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* " River Boards—A Guide to their Powers and Functions," published by His Majesty's Stationery Office. Copies may be obtained from any branch of that office or through any bookseller, price 2s. 0d. net. (S.O. Code No. 24—175).

† " Prevention of River Pollution—Report of the Rivers Pollution Prevention Sub-Committee of the Central Advisory Water Committee," published by H.M. Stationery Office. Copies may be obtained from any branch of that office or through any bookseller, price 1s. 6d. net. (S.O. Code No. 32—397.)

the modernization of the land drainage powers that will be exercised by river boards in succession to catchment boards. The passage of the River Boards Act has not greatly altered the scope of our task or the considerations that have guided us, except that we have necessarily taken into account the greater resources which will be available to river boards in view of the fact that the whole country is to be included in their jurisdiction. This fact has also simplified our search for authorities to exercise control over all watercourses in every part of England and Wales.

FINANCIAL POSITION OF CATCHMENT BOARDS

6. The statistics in Appendix II, relating to individual catchment boards, have supplied us with much of our basic information ; and an examination of them makes clear the nature of the problems facing us. They bring out the striking variation in circumstances between one catchment area and another. In size, there are, at one extreme, five boards each covering an area of over 2,000,000 acres and, at the other extreme, nine boards each covering an area of less than 100,000 acres. Amalgamations of catchment areas under the River Boards Act will reduce these variations and this is most desirable because, in general, very small authorities cannot afford to employ the skilled technical staff that is necessary if the drainage problems of the area are to be dealt with effectively. More important than variations in area are variations in rateable value. Of the five catchment areas covering more than 2 million acres, three —the Trent, the Yorkshire Ouse and the Thames—have each a rateable value in excess of £20 millions. The Severn has a rateable value of just over £10 millions and the Great Ouse a rateable value of just less than £4 millions. Amongst the medium sized catchment areas, the Lee and the Mersey and Irwell, each covering some 350,000 acres, or one-sixth of the Great Ouse Catchment Area, have some £14 millions and £17 millions of rateable value respectively. The Welland, with a similar area, has a rateable value which just exceeds £500,000. Of the nine boards whose area is less than 100,000 acres, five have a rateable value exceeding £1 million, and two have a rateable value of less than £100,000. In drawing attention to rateable values, we have not lost sight of the fact that, in the Fen areas, the disparity is to some extent offset by substantial contributions from internal drainage boards, whose districts are vitally affected by the works of the catchment board on its " main river ". Indeed, these contributions often equal or exceed the amount raised by precept on county councils and county borough councils in the catchment areas concerned. Whilst the definition of river board areas may, to a limited degree, help to even out the resources of boards from one area to another, it is clear that substantial discrepancies will inevitably remain, owing to the uneven distribution of rateable values in England and Wales as a whole, and that these variations in rateable value bear little relationship to the need for drainage works in the different river board areas.

7. A further general point illustrating the variation in circumstances between catchment areas is that in 11 catchment areas, county borough councils contribute more by way of precept to the funds of the catchment board than county councils ; and, at the other extreme, 22 catchment areas, including that of the Great Ouse, contain no county boroughs whatsoever. The variation in the extent to which catchment boards require contributions to their expenses from internal drainage boards is also striking. In eight catchment areas the contribution from internal drainage boards represents some 50 per cent. or more of the revenue from local sources. In contrast, 18 catchment boards require no contribution from internal drainage boards, and in eight further

catchment areas the contributions are quite negligible. The precept on local authorities varies from an amount equivalent to a rate of 1½d. or less in the £ of rateable value in eight areas to a sum of 4d. or more in the £ in 15 other areas. The range would be wider were it not for the fact that Government grants in respect of capital works are at a varying rate in accordance with the needs of each area.

8. We would emphasize the disparity that so often exists between the cost of necessary works and local resources in the catchment area. The Coast Protection Act, 1949, makes provision for coast protection work to be done, where necessary, on any part of the coast, but these provisions do not affect the present powers and responsibilities of drainage authorities in this respect and some boards have very extensive and costly responsibilities for sea defence and tidal river works. An extreme case is the River Ancholme Catchment Board, administering an area of 152,000 acres with a rateable value of only £137,000, which has to maintain a costly line of difficult defences to protect 20,000 acres of low-lying land against tidal inundation from the Humber. Other catchment boards have to deal with specialized fenland drainage problems. The Great Ouse Catchment Board, for example, has to carry out a scheme, estimated to cost £6½ millions, for the protection of its South Level, covering 190,000 acres, where serious drainage problems arise from the shrinkage of the fen, and can no longer be remedied by the annual raising and strengthening of the main river embankments. We saw many areas of valley land in North and West Wales whose productivity could be greatly increased and which could play an important part in providing summer grazing and winter keep for hill farms, but the resources of the boards do not permit drainage works on the scale required. No doubt there are a number of other catchment boards in the country who have found it impossible because of inadequate resources to do all the works which they consider desirable.

9. As mentioned in paragraph 7, differing circumstances between one catchment area and another are reflected in varying rates of Exchequer grant towards the cost of new works or the improvement of existing works. These grants rise to a maximum of 80 per cent. for inland works and 85 per cent. in respect of sea defence works ; and in respect of the new responsibility to install gauges, imposed on river boards by Section 9 of the River Boards Act, 1948, grants rising to 85 per cent. will be available. Catchment boards with limited financial resources have hitherto been able to meet their share of the cost of important works by loans, the repayment of which is spread over a number of years ; but the existence of these long term commitments may make it difficult for any further substantial programme of capital works to be contemplated in these areas. In addition to the burden of loan repayments and the cost of capital works, a catchment board must meet heavy expenditure on annual maintenance of land drainage works, to which, for river boards, there is now added responsibility for the installation and maintenance of gauges. Expenditure on maintenance and general administration has increased greatly in recent years as a result of the increased cost of materials and substantially higher wages ; and although mechanization has to some degree reduced costs, maintenance of arterial drains and watercourses can often still only be done by hand labour. These higher costs are, of course, affecting expenditure on all services for which the local authorities, who provide funds for the catchment board's work, are responsible. There is an increasing danger that river boards, as successors to catchment boards, faced with substantial rises in costs without a comparable rise in their revenues, would be forced either to economize on their maintenance expenditure, or to defer capital schemes of new works and improvement.

MAINTENANCE OF IMPROVEMENT WORKS ON WATERCOURSES OUTSIDE THE JURISDICTION OF DRAINAGE BOARDS

10. The problem we have had to consider does not end with the watercourses for which drainage authorities are directly responsible. Since the passing of the Agriculture Act, 1937, and especially during the war, numerous works of improvement have been carried out on lesser watercourses which are not " main river " of a catchment board and are outside internal drainage districts. The work done on these improved watercourses ought to be maintained. Whilst county councils have certain limited general powers under the 1930 Act in relation to lesser watercourses and some of them have taken special powers, both to sponsor improvement works and to require maintenance, the extent to which these powers have been exercised has varied ; and they are necessarily less effective in practice than the direct powers of drainage boards. On certain watercourses district councils may be exercising drainage powers originating from Inclosure Awards ; but the provisions of these Awards are often obsolete and little effective work is done. Improvement schemes on many of these lesser watercourses were carried out during the war under the compulsory powers made available by Section 14 of the Agriculture (Miscellaneous War Provisions) Act, 1940, or by means of voluntary schemes on behalf of riparian owners sponsored by drainage authorities, other than catchment boards, for grant under Section 15 of the Agriculture Act of 1937. We have had evidence that on many of these watercourses the improvement secured is being dissipated for lack of maintenance. The Thames is a noteworthy exception. In that area, all the many watercourses which were the subject of wartime improvement schemes and numerous additional watercourses have since been taken over as " main river ". But without detracting in any way from the value of the action taken by the Thames Conservancy it is necessary to bear in mind the considerable rateable value of that catchment area and the fact that it has no problems of embanked fenland rivers such as are met with in East Anglia nor, since its jurisdiction ends at Teddington Weir, any responsibility for tidal river and sea defence problems. In most other catchment areas the boards have generally felt unable to add to their existing heavy commitments by assuming responsibility for these lesser watercourses. In only a few areas has it been possible to provide for regular maintenance by extending the catchment board's main river, by setting up new drainage districts, or by extending the boundaries of existing ones.

THE GENERAL POSITION TO-DAY

11. The foregoing paragraphs would convey a completely false impression if they led the reader to suppose that the reforms made by the Land Drainage Act of 1930 have been generally ineffective. Our task is, however, to suggest modifications and improvements in the Act ; to point to defects which have become apparent since its enactment and suggest their remedy. But to put matters in their proper perspective we must stress that, in all the long history of drainage legislation, no more important step forward has been taken than the definition of catchment areas covering complete river systems, the constitution of catchment boards, and the levying of precepts recoverable from the general rate over the whole catchment area to meet the costs of arterial drainage in the area. For the first time, over the country as a whole, unified control of river systems by substantial bodies, armed with effective powers, became possible as a result of the 1930 Act. We have been impressed, moreover, with the flexibility and common sense with which the provisions of the Act have been administered, and the extent to which the course of action has varied

according to the distinctive needs of each individual catchment area. Catchment boards have in general adequately discharged their responsibilities and, in the past 20 years, many drainage works of major importance have been carried out, and further important works are in progress or are projected : we mention some of these in paragraph 14. The achievement is all the more striking when it is remembered that for the first four years of their existence, owing to measures of national economy, few grants were available to catchment boards for drainage works ; that, during the war years, major capital works necessarily had to be suspended ; and that since then shortages of labour, materials and equipment have impeded the execution of many large land drainage schemes. Nevertheless, since the passage of the Act to date, catchment board schemes estimated to cost over £23 million have been approved for grant under Section 55 of the Land Drainage Act, 1930 ; and schemes of other drainage boards and county councils estimated to cost £8¾ million have been approved for grant under Section 15 of the Agriculture Act, 1937. Our report, in fact, deals with an organization which is, in every sense of the word, a going concern ; and its very effectiveness enables us to contemplate added powers and responsibilities.

THE MAIN PROBLEMS FOR CONSIDERATION

12. It may well be that the greater part of the country's drainage problems is being dealt with effectively under existing statutory powers. None the less, the time has undoubtedly come to take stock and, in the light of experience over the past 20 years and the developments mentioned in our opening paragraph, to propose measures that will enable a further advance to be made in works of land drainage and flood control and prevention in both urban and rural areas ; and to provide adequate means for solving those drainage problems that cannot be dealt with effectively under current legislation. We first discuss, in Chapters II to V of our report, questions which involve major issues of general policy ; and in Chapter VI we deal with problems which, though important, particularly where they concern the relationship between land drainage and other interests, can be considered independently of the main questions before us. The final chapter contains a summary of our main recommendations. The principal problems for which in our main recommendations we have attempted to find solutions are :—

(*a*) Provision for capital works and maintenance on lesser watercourses which are not " main river " of a river board and which are not included in an internal drainage district.

(*b*) Provision for widening the basis of local contribution to include those hereditaments outside internal drainage districts which do not at present contribute to the costs of drainage through the precept on councils of counties and county boroughs.

(*c*) Provision for strengthening the financial position of those river boards and other drainage authorities whose resources are not commensurate with the need for drainage works in their areas.

Chapter II.—Existing and Proposed Re-allocation of Responsibilities for Drainage Works and Administration

(1) GENERAL CONSIDERATIONS

The problem of the lesser watercourses

13. Some of our chief recommendations arise from the need to make better provision for those lesser watercourses for which neither a river board nor an internal drainage board have assumed responsibility. We may distinguish two classes of these lesser watercourses. There are those in the uplands, lying outside internal drainage districts, which link farm ditches and field drainage systems with the statutory " main river " of a river board ; and there are others in the lowlands linking farm drainage systems and ditches with the watercourses for which an internal drainage board have assumed responsibility. In the aggregate the mileage of these lesser watercourses is very great and the need for keeping them in good order is directly related to the need for increased production from the farm lands through which they flow ; though we do not overlook the fact that where these lesser watercourses flow through towns and villages they may cause localized flooding problems. Catchment boards have, in most cases, had to concentrate their resources on the principal rivers and their outfalls, and this will, no doubt, always remain the most important part of the land drainage side of the work of their successors, the river boards. At the other extreme, individual farmers and landowners, with guidance and help from County Agricultural Executive Committees, have concentrated on the development of underdrainage systems and the clearing and maintenance of farm ditches taking water from their own farms or estates. The war-time emphasis on the importance of field drainage has now become an established part of the agricultural policy as set forth in the Agriculture Act, 1947. But there is no clear provision for assigning direct responsibility for the intermediate watercourses though individual ones may be dealt with by bodies deriving their powers under local Acts. The responsibility of individuals over such watercourses is often not clearly defined ; difficulties arise in securing common action on lengths of watercourses where works by individuals are likely to be ineffective ; and powers of enforcement are weak and, such as they are, have been used only sporadically.

Technical approach of the catchment boards

14. From the long-term engineering standpoint, catchment boards have undoubtedly been justified in their technical approach to the drainage of their areas. The matter is discussed in paragraphs 61 and 62 of the report of the Royal Commission which open with the sentence : " In our opinion, if drainage is to be effective the first requirement is to clear the main stream of the river beginning with the outfall and working up towards the source." In the 20 years of their existence, in spite of the checks imposed on the execution of major works and of the war-time necessity to carry out works in the upper reaches in advance of improvements to the outfall, many catchment boards have in fact put their main rivers and outfall channels into a condition fit to receive without detriment an increased flow of water from the uplands. Further works are in progress or are contemplated. In the early days of the Act, the River Nene Catchment Board executed substantial improvement works to give a clear and controlled passage into the Wash for the waters of their area.

To give two current examples, the Great Ouse Catchment Board are embarking on a major flood protection scheme involving the construction of entirely new channels to secure the safe passage of upland waters through or around the fen area of the South Level to the sea ; and the Welland Catchment Board have already made substantial progress with a less extensive scheme of a similar character.

Effect of drainage in the uplands

15. We are aware that in some quarters it is strongly held that improved drainage in the uplands has greatly increased the threat of flooding to the lowlands. There is an opposing body of opinion that maintains that the execution of drainage works creates storage capacity in the land, thereby reducing rather than increasing the flood discharge. This conflict of opinion and the apparent lack of concrete evidence on the subject led us to seek the technical advice of the Ministry of Agriculture and Fisheries, and we asked them to call together a panel of technical experts to consider the problem. As we had also received suggestions that land drainage operations adversely affected water resources, we asked them to investigate that subject also, and we gave them the following terms of reference :—

" To examine broadly the information available as to the effect of land drainage operations on the flow in rivers and upon water resources ; to consider what practical steps might be taken, if necessary, by drainage authorities to conserve water without impinging on the functions and interests of water undertakers and other river users ; and to report upon the methods at present adopted by drainage authorities to enable riparian users to obtain a supply of water."

16. The Panel's report is contained in Appendix IV. They state that the factors involved in the problems before them are many and variable, and that in their investigations they have been seriously handicapped by the lack of observational data. As the investigation of possible repercussions of land drainage operations on both flood risk and water supply is a matter of considerable importance, we support their recommendation that it be further examined. They have concluded that it is impossible to say whether underdrainage or moorland gripping have any significant effect on flood risk. They point out, however, that since 1940 the land which has received Government grant in respect of underdrainage represents only 2 per cent. of the agricultural land of England and Wales, and it seems likely, therefore, that the effects of this type of drainage, if existent at all, will not be serious. Pending conclusive evidence to the contrary, the Panel are of the opinion that local channel improvement works or the improvement of control structures may result in increased flood peaks downstream ; and, as the cumulative effects of many improvements to ditches, streams and rivers may be substantial in the lower reaches, they recommend that before such works are undertaken the possible effects downstream should be balanced against the benefits likely to accrue. They advise that throughout a catchment area there should be a clear conception of the objectives of the improvement works. We consider that those responsible for the planning of drainage works would do well to bear these suggestions in mind.

17. As regards the remaining matters on which the Panel were asked to report, it will be noted that they consider that drainage authorities in general are alive to the need for providing a supply of water for agricultural and other purposes. Further recommendations on these important and intricate problems will be found in the Technical Panel's report.

We wish to call attention to the initiative and skill with which the Chairman, Mr. Johnson, has conducted the investigation. This is particularly noteworthy in view of the complexity of a subject which is still comparatively unknown. In addition we should like to thank the distinguished members of his Technical Panel for their expert and valued assistance.

(2) PRESENT RESPONSIBILITIES FOR DRAINAGE WORKS

Catchment and river boards

18. Catchment boards, and their successors the river boards, alone exercise the drainage powers of the 1930 Act on watercourses defined as " main river ". The cost is met from the general funds of the board, including, in some cases, contributions from internal drainage boards which benefit from works carried out by the catchment or river board. The variation in mileage of main river in catchment areas of similar size can be seen from Appendix II. Geographical reasons alone do not account for the more extreme variations, which are largely due to administrative and other causes. For example, while the average acreage to the mile of main river in catchment areas over the whole country is about 2,300, in the Thames Catchment Area it is 1,070 only, the length of main river in this area being almost as great as the aggregate length of main river in the four other largest catchment areas—the Severn, the Trent, the Yorkshire Ouse and the Great Ouse—each of which is much the same size as the Thames Catchment Area. The Lee Catchment Area is another striking example of a catchment area where the length of main river in proportion to area is high, the acreage to the mile of main river in this area being only 800. It should be mentioned that in both the Lee and the Thames Catchment Areas all internal drainage districts have been abolished and main river embraces not only the major watercourses but also a great number of small tributaries, whereas in certain other catchment areas only major watercourses were " mained ". It will be noted that, as a general rule, the smaller catchment boards have a greater length of main river in proportion to their areas than the larger boards. Apart from technical considerations—reluctance to assume responsibility for a tributary until the main watercourse into which it discharges has been cleared—the unwillingness of catchment boards to take on additional watercourses as main river has often undoubtedly been influenced by financial considerations. The extent to which works have been done on comparable watercourses classified as main river has, we believe, also varied from one catchment area to another.

Internal drainage boards*

19. An internal drainage district covers an area which, in the terms of Section 1 (5) of the Land Drainage Act, 1930, " will derive benefit or avoid danger as a result of drainage operations." Owners and occupiers of land in the district pay drainage rates, calculated on the assessments of gross annual value of their hereditaments for the purposes of income tax under Schedule A of the Income Tax Acts. Rates are payable to a board which is responsible for drainage works in the district, and is under the general supervision of the catchment board. In certain circumstances the functions of the drainage board may be transferred to the catchment board. Reference to Appendix II will show that nearly 60 per cent. of the number of internal drainage districts, covering over 60 per cent. of the area included in such districts, are contained

* NOTE.—We have not given separate consideration to external drainage boards since, when all river boards are set up, these will be included in river board areas and will become internal drainage boards.

in the six principal catchment areas whose waters discharge into the Humber or the Wash—the Yorkshire Ouse, Trent, Witham and Steeping, Welland, Nene, and Great Ouse. Most of the remaining drainage districts are to be found in the low-lying parts of East Norfolk, Essex, Kent and Somerset. The internal drainage district and board has, in general, proved to be a suitable organization for dealing with the problems of a compact, low-lying area in which owners and occupiers have a common interest in maintaining or improving a network of artificial drains and other drainage works, such as pumping stations or flood embankments. Where these conditions are not present difficulties have often arisen. The lowland drainage board, in areas where the productivity of the land depends on adequate drainage and the maintenance of embankments, is the oldest form of drainage organization and, indeed, perhaps the earliest form of democratic organization in the country. Many boards can trace their origins well back into the Middle Ages. It is natural that successful drainage boards should be found principally in the Fens and comparable areas, where the land is flat and there is a broad area of benefit to rate in relation to the lengths of drains to be maintained. Sizable districts, which can carry the necessary administrative costs and employ adequate staffs, can be formed in such areas. It is true that there are some successful drainage boards in flat areas of high land ; but, in general, the concept of the internal drainage board, levying rates for capital works and maintenance on the basis of an area of benefit, was not devised to deal with the problems of upland watercourses and their tributaries winding their way through many miles of narrow valleys from the source of the river to its main channel. Attempts to set up drainage districts and boards in such areas have often met with difficulties and local opposition.

County and county borough councils

20. Councils of counties and county boroughs have certain general powers under Part VI of Land Drainage Act, 1930, to promote drainage works on watercourses not falling within the jurisdiction of other statutory drainage authorities. Some county councils, e.g., Essex and Cumberland, have additional powers in relation to drainage under local Acts. Certain county councils have done valuable work by sponsoring voluntary drainage schemes prepared on behalf of groups of frontagers for which grant-aid has been available under the Agriculture Act, 1937, and the contribution made by their activities to better drainage and food production in their areas deserves commendation. As regards their powers under the Land Drainage Act, 1930, only sporadic use has been made of the powers to require co-operation in a joint scheme of works conferred by Section 52 ; nor have they enforced the obligation imposed by Section 35 to remove obstructions in watercourses which cause damage to neighbouring land, largely because the statutory procedure makes the provision difficult to operate. In our view, however, these councils with their wide and growing range of work in other directions, should no longer be called upon to exercise land drainage functions. The County Councils' Association, in their evidence before us, expressed the view that county councils would in general be not unwilling to be relieved of their responsibilities under the Land Drainage Act. We consider that their land drainage functions should be exercised by a body whose primary activities include the execution of drainage works, or by one which is specifically set up for that purpose, or else by a body directly concerned with promoting the better standards of husbandry and estate management which drainage works are designed to secure. The wider problems with which river boards deal extend beyond local authority boundaries ; but council members serving on the boards which handle those problems bring to their deliberations the benefit of their local knowledge and

experience. Responsibility for the smaller drainage problems, raising localized issues of food production, may well have seemed appropriate to county councils after the 1914/18 war, when many other powers affecting food production were conferred on them. During the second world war, however, local responsibility for food production rested with War Agricultural Executive Committees as the direct agents of the Minister of Agriculture and Fisheries. Subsequently, under the Agriculture Act, 1947, the Agricultural Committees of county councils were disbanded and the local responsibility now rests with County Agricultural Executive Committees, appointed by and directly responsible to the Minister.

Award authorities

21. In certain parts of the country many of the smaller watercourses are the subject of Awards made in the 19th century, or earlier, under local enactments. These Awards vary widely in character : some affect individual estates, some are private Awards under the jurisdiction of bodies which are quite independent of any local authority ; but the great majority of them are Parish Awards made under the Inclosure Acts. These Awards served a useful purpose for a considerable time after they were made but latterly, owing to changes in drainage requirements and practice and, in particular, to the effect of changes in local government legislation, most of them have ceased to be effective. Indeed, it would probably be true to say that the great majority of them are no longer being operated at all. Changes in local government legislation have meant, *inter alia*, that responsibility under many of the Awards has devolved on Rural District Councils. When, under the Local Government Act, 1929, agricultural land ceased to be subject to the general rate, the whole cost of works under such Awards fell to be borne by non-agricultural property, although it was the agricultural property that mainly benefited. The position thus became inequitable and most local authorities have in consequence ceased to operate the Awards for which they are responsible. The Rural District Councils' Association, in their evidence before us, have asked that local authorities should be relieved of these drainage obligations. These old Awards have certain other defects ; for example, the terms of many of them are rigid and lay down maximum dimensions of drains which may be quite inappropriate in present circumstances ; again, the Award powers may relate to only one of several parishes through which the watercourse concerned flows. In all the circumstances we consider that these watercourses should be brought within the general administration recommended in our report and that the Award authorities, in so far as their powers relate to land drainage, should be abolished, and in paragraph 54 we suggest how this might best be effected.

Commissioners of Sewers

22. There are still in existence a number of Commissioners of Sewers whose offices it was the intention of Section 4 of the Land Drainage Act, 1930, to abolish. Many schemes for setting up internal drainage districts and boards have embraced parts of Commissioners' districts, whose powers have to that extent been rendered of no effect, but some Commissioners, sometimes administering truncated districts, remain. Their existence is often an impediment to efficient land drainage administration and we consider that these antiquated authorities should be abolished, as was intended in the 1930 Act. We refer again to this matter in paragraph 55.

Owners and occupiers

23. Under the Agriculture Act, 1947, the farm ditch is regarded as part of the fixed equipment of a holding. Sections 10 and 11 of the Act define

respectively the rules of good estate management and the rules of good husbandry. Under Section 10 (1), " an owner of agricultural land shall be deemed to fulfil his responsibilities . . . in so far as his management of the land . . . is such as to be reasonably adequate . . . to enable an occupier of the land . . . to maintain efficient production." Under Section 10 (2), " regard shall be had . . . to the extent to which the owner is providing, improving, maintaining and repairing fixed equipment on the land in so far as is necessary to enable an occupier of the land . . . to maintain efficient production." Under Section 11 (1), " the occupier of an agricultural unit shall be deemed to fulfil his responsibilities . . . in so far as the extent to which and the manner in which the unit is being farmed . . . is such that . . . the occupier is maintaining a reasonable standard of efficient production . . . while keeping the unit in a condition to enable such a standard to be maintained in the future." Section 12 of the Act provides for the making of supervision orders where the Minister of Agriculture and Fisheries is satisfied that the owner of a farm is not managing it in accordance with the rules of good estate management or that the occupier is not farming it in accordance with the rules of good husbandry. Section 14 (1) of the Act provides for the giving of directions to secure good estate management and good husbandry to owners and occupiers of holdings in respect of which a supervision order is in force. Under Section 14 (3), however, a direction requiring the provision, improvement, maintenance or repair of fixed equipment—which includes farm ditches—may be given notwithstanding that no such order is in force. We have quoted these provisions to bring out the essential difference between the range of problems covered by Part II of the Agriculture Act, 1947, and that covered by the Land Drainage Acts. Part II of the Agriculture Act deals with the responsibility of an owner of land to an occupier of that land, and the responsibility of an occupier in relation to the land that he is farming himself. The Land Drainage Acts, in contrast, deal with the responsibilities of owners or occupiers of land to their neighbours in relation to drainage problems of common concern. The distinction is brought out clearly by the following extract from Section 35 (1) of the Land Drainage Act, 1930 :—

> " Where any watercourse is in such a condition that the proper flow of water is impeded, it shall . . . be the duty of the person having control of the watercourse . . . to put the watercourse . . . in proper order if by reason of such impediment agricultural land belonging to or in the occupation of some other person is injured by water or in danger of being so injured."

24. Summarizing the position under Part II of the Agriculture Act, 1947, a County Agricultural Executive Committee can give directions for the clearance of a ditch when the works are necessary for the proper cultivation of the holding to which the ditch is attached. Where the works are necessary for the protection of some other person's land, no direction can be given under the Act nor could a direction reasonably be given in relation to common ditches or watercourses, where the benefits from the work would be communal rather than individual. A ditch serving one estate, which can properly be made the subject of a direction under Part II of the Act, may, without any alteration in its intrinsic character, pass outside the ambit of the Act through the break-up of the estate into different ownerships and tenancies. Whilst some problems relating to ditches can be dealt with under the Act, others cannot. For example, if an owner or occupier installs a dam in his ditch for irrigation or other purposes, and damage is threatened to a neighbour's land, the provisions of the Land Drainage Act, 1930, and the Agriculture (Miscellaneous War Provisions) Act, 1940, and not those of the Agriculture Act, 1947, will apply. Again, a ditch passing through woodland may be neglected and, while causing no particular

harm to the woodland, may be causing damage to adjoining agricultural land ; directions under the Agriculture Act cannot be made in respect of it since woodland (except woodland used for purposes ancillary to agriculture) is not included within the definition of " agriculture " for the purposes of the Agriculture Act, 1947. Finally, the Agriculture Act does not enable directions to be given to any person to protect his neighbour's ditch, or a watercourse flowing through or past his land, by the erection of fencing or the construction of drinking places for cattle. These are important matters, since a ditch often forms the boundary to a holding, the spoil from the excavation of the ditch being thrown inwards to form a bank on which the hedge is planted. It is necessary that the ditch should be protected against treading-in by stock after it has been cleared, and this often calls for the erection of fencing on neighbouring land on the far side of the ditch.

25. The obligations of owners and occupiers in relation to ditches and common watercourses are, of course, a good deal wider than are laid down in the rules of good estate management or the rules of good husbandry or are enforceable by directions under Section 14 of the Agriculture Act, 1947. These obligations arise by tenure, custom or prescription or by direct statutory requirement and vary widely in character. The express statutory obligation imposed by Section 35 (1) of the Land Drainage Act, 1930, has been quoted in paragraph 23 above. Customary obligations are many and varied. Owners and occupiers have contractual obligations towards each other by virtue of tenancy agreements ; and Section 37 of the Agriculture Act, 1947, enables the Minister of Agriculture and Fisheries to " make regulations prescribing terms as to the maintenance, repair and insurance of fixed equipment which shall be deemed to be incorporated in every contract of tenancy of a holding . . . except in so far as they would impose on one of the parties to an agreement in writing a liability which under the agreement is imposed on the other." Regulations have been made under this Section and provide *inter alia*, for an obligation on the tenant in relation to the landowner, where the tenancy agreement does not otherwise provide :—

> " 10. To dig out, scour and cleanse all ponds, watercourses, ditches and grips, as may be necessary to maintain them at sufficient width and depth, and to keep clear from obstruction all field drains and their outlets."

26. Historically, it appears to us that the problem of how to deal with common ditches cut in past centuries has often been created by the break-up of large landed estates. When all the land on a large estate was in one ownership, one person was responsible for the efficient working of the drainage system throughout the estate from the minor and tributary ditches to the main estate ditch or watercourse. Now, no single person is responsible for the main ditch, and often numerous owners and occupiers are responsible for the tributary ditches. What is clearly needed is some body to fill the place of the original owner, with power to require that necessary works are done on these common ditches.

27. Certain farm ditches are covered by the provisions of the Agriculture Act, 1947, quoted in paragraph 23 above. We regard it as our duty, however, to make recommendations covering all drainage channels in so far as they are not capable of being dealt with under the provisions of that Act relating to good husbandry and good estate management. The difficulty has been to define where the farm ditch ends and the common ditch or watercourse begins and this difficulty is aggravated by the fact, indicated in paragraph 24, that, under existing legislation, a particular ditch may be covered by the provisions of the Agriculture Act, 1947, for one purpose but not for another, and may

cease to be covered at all as a result of changes in tenure. We asked witnesses who appeared before us for guidance as to the definition of a farm ditch. The answer most frequently given was " It is difficult to define in words, but you know a farm ditch when you see one." This seems to us to over-simplify the matter ; but it offers the most practical approach to a definition, i.e., to decide the matter on the spot. It is the intrinsic character of a channel that makes it a farm ditch rather than a watercourse and that character does not alter with changes in the ownership or occupation of the land draining into it. In general, we consider that a watercourse would be fairly regarded as a ditch if it would be reasonable to expect it to be maintained by ordinary agricultural labour using the usual hand tools. The difficulty we have experienced in trying to define a farm ditch has, however, led us to approach the problem from the opposite standpoint and to suggest factors to be taken into account by river boards in defining the watercourses, other than farm ditches, for which they are to become responsible. In paragraph 42 we have set out some of the general factors which we consider should be taken into account in the task of differentiating between watercourses and farm ditches.

Powers under Emergency Legislation and Defence Regulations

28. Section 14 of the Agriculture (Miscellaneous War Provisions) Act, 1940, enabled catchment boards, at the request of County War Agricultural Executive Committees, to prepare and, with the approval of the Minister of Agriculture and Fisheries, to carry out compulsory schemes for the drainage of agricultural land. In respect of each scheme an area of benefit was defined, and the capital cost of the works (less Government grant) was recoverable from owners of land falling within that area. This provision, which was designed to give a more expeditious procedure to supplement the powers available to county councils under Section 52 of the Land Drainage Act, 1930, lapsed at the end of 1947. Under it, 451 schemes were carried out in different parts of England and Wales at a total cost exceeding £1 million. In paragraph 10 we have discussed the subsequent care of these watercourses and called attention to the fact that for a number of them there is no provision for permanent maintenance ; and the difficulty of making such provision is linked with the fact that we stressed in paragraph 19—that the drainage district procedure is unsuitable for upland watercourses, where the area of benefit is narrow and drainage works are valuable, but not of vital importance. There are powers under Section 5 (4) of the Agriculture (Miscellaneous Provisions) Act, 1941, for catchment boards to carry out works of maintenance on watercourses cleared under Section 14 of the 1940 Act, not as an annual charge, but as and when required. These powers, which lapsed at the end of 1950, provided for recovering the cost of such works of maintenance from the occupiers of land in the area of benefit as defined in the original scheme. For practical reasons, mainly the great number of occupiers concerned in the area of a scheme, the difficulty in tracing some of them, and problems arising from changes in occupation, little use was made of these temporary powers. In retrospect, it may have been a mistake to apply to many of these watercourses the principle of area of benefit which should, in our view, be generally limited in its application to fen and similar areas. The obligations of the riparian owners and occupiers as indicated in paragraph 25 are in general based on their length of frontage to the watercourse rather than to the depth of land which benefits from work on it.

29. There are various other provisions in war-time legislation, both permanent and temporary, to which we have not thought it necessary to refer in detail in this chapter. Mention, however, may be made of the use made in relation to drainage works of the powers given by Defence Regulation 62 (1) which

enabled the Minister to " give such directions with respect to the cultivation, management or use of land for agricultural purposes as he thinks necessary or expedient for the purpose of promoting, increasing or maintaining the production in the United Kingdom of articles necessary for the efficient prosecution of the war or for maintaining supplies and services essential to the life of the community." The exercise of these powers for drainage purposes was discontinued with the coming into force, in the early part of 1948, of Part II of the Agriculture Act, 1947. It is clear that the Defence Regulation powers went further than those contained in the Agriculture Act, 1947, since they enabled directions to be served for the execution of work on ditches in the interest of food production in general, and not solely in the interest of production on the farm or estate responsible for the ditch. Mention may also be made of Defence Regulation 50, under which a few drainage improvement schemes, most of them schemes of restoration, were carried out.

(3) THE PROBLEM OF THE LESSER WATERCOURSES OUTSIDE INTERNAL DRAINAGE DISTRICTS

A review of proposals for the solution of the problem

30. In paragraph 13 we have stated the problem of the lesser watercourses. We have given a good deal of thought to the question of the type of organization that would be best fitted for dealing with such of those lesser watercourses as are outside internal drainage districts. In their evidence before us (which, however, was taken before we had formulated our recommendations concerning the additional funds necessary to meet the cost entailed) some Associations suggested that provision for these watercourses might best be made by an extension of the powers of river boards ; others, among them the Catchment Boards' Association, the Association of Drainage Authorities and the National Farmers' Union, sought a solution by the extension of existing internal drainage districts, by the formation of new internal drainage districts where appropriate, and where neither of these ways was suitable, by the " maining " of further streams. The Association of Drainage Authorities and the National Farmers' Union stated in their written evidence that it should be possible to include within a drainage district any land which contributes run-off into the watercourses of the drainage district. Arising out of these suggestions, we gave serious consideration to the possibility of dividing the catchment area of each main watercourse into a number of sub-catchment areas. Each sub-catchment area would extend from a lowland district, usually adjoining the river board's " main river " to the local watershed ; the board for each sub-catchment area would, subject to general supervision by the river board, have jurisdiction over the whole area whose drainage discharged through that lowland district to the " main river " of the river board. Power to carry out works and to levy rates would be exercisable throughout the district with provision for differential rating between uplands and lowlands.

Examination of the proposal to establish sub-catchment areas

31. The attraction of the " sub-catchment areas " arrangement is that it would put the responsibility for works in the hands of local people, and would enable funds to be secured from owners and occupiers in the uplands to meet the cost both of works necessary on upland watercourses and also of lowlands drainage works necessitated by the discharge of water from those uplands through the lowland area. The complaint of lowland farmers regarding the expense to which they are put by reason of water discharging through their area from adjoining uplands is as old as drainage itself, and this proposition would go some way to meet it. The arrangement, however, if adopted, would

affect fundamentally the structure of land drainage organization in this country and we have therefore given it close consideration. We have come to the conclusion that it would be unworkable for the reasons set out in paragraphs 32 to 35 below.

32. Section 1 (5) of the Land Drainage Act, 1930, provides that " the districts (other than catchment areas) to be constituted as drainage districts under this Act shall be such areas as will derive benefit or avoid danger as a result of drainage operations ". The Ministry of Agriculture and Fisheries set out its interpretation of the position for administrative purposes in a letter of 25th June, 1933, which has come to be known as the " Medway letter ". (This is reproduced in " River Boards—A Guide to their Powers and Functions" referred to in paragraph 2.) Land within this limited area generally receives special benefit from drainage works, and the owners and occupiers within the area are in consequence called upon, through the drainage rate, to make special contributions towards the cost of such works. Such contributions are often very substantial and it follows that the boundaries of the benefit area (or drainage district) must be drawn with great care. Suggestions have been made from time to time that the " Medway letter " is too strict an interpretation of the principle of benefit, and the interpretation contained in that letter has been reviewed from time to time, but it has not been possible to devise a more satisfactory one.

33. In theory, the problem of the upland watercourses could be dealt with under the " Medway letter " and the delineation of the drainage district continued up rivers and their tributaries to their sources, but we have indicated in paragraph 19 that attempts to set up drainage districts and boards in other than wide compact areas of reasonable size have often given rise to difficulties. The suggestion we are now considering, however, is that not only the whole of the area of benefit but the whole of the land in the sub-catchment area should be brought within the drainage district. This would mean that drainage rating would in future be governed by two principles instead of one—the principle of benefit ; and the principle of contribution from areas which do not necessarily receive benefit but contribute run-off to the lowland areas. It seems to us, in view of the widely conflicting interests involved, that it would be extremely difficult to constitute a drainage board for such a district which would work harmoniously.

34. We consider it proper to retain internal drainage boards for districts drawn as at present and limited to the type of area referred to in paragraph 19, to deal with specific local problems which are vital and general to the people in the whole of the locality and to require special contributions from owners and occupiers in the locality who directly derive benefit or avoid danger. We have given a good deal of thought to the question of what contributions might fairly be made by lands outside internal drainage districts to the funds of the river board. Taking the river board area as a whole, the precept on councils of counties and county boroughs varies according to the needs of the whole area for drainage works ; and to this extent, therefore, the uplander's contribution to drainage through local rates bears some general relation to the problems created by the water discharged from his land. We should prefer to regard the local ratepayer's contribution to land drainage expenditure through the precept on councils of counties and county boroughs, not as payment for damage caused, but as due to the spreading of the cost of local services. This principle applies generally to local services such as highways, health, education, etc., and we consider it is appropriate to the service of land drainage. It justifies the inclusion in river board areas of those coastal

districts whose storm waters discharge direct into the sea, as well as of the inland towns, remote from the coastal plain where drainage works are principally carried out. It is right, in our view, that occupiers of all land in the river board area, including agricultural land, should make a general contribution towards the cost of drainage in the area as a whole ; and in Chapter IV we make proposals and further develop our arguments for the payment of such contributions to the river board. It would, we think, be a retrograde step to require a special contribution, additional to their general contribution through the precept, from those uplanders whose lands happen to discharge water into or through a drainage district, towards works in that district from which the uplanders will not derive any tangible benefit. It would localize matters which ought to be dealt with on a broader basis. We consider that the upland farmer outside the internal drainage district should have a right—indeed, an obligation—to drain his land in the most efficient way in accordance with the needs of food production on his land. He should contribute towards the cost of drainage in the river board area because he occupies land in that area, and not because the drainage from his land happens to discharge into any particular watercourse. On the same principle, we see no equity in levying a special charge over and above the precept against a town on a hill whose waters discharge by gravity through an area which has complex drainage problems, whereas another town in the same catchment area whose waters discharge without giving rise to problems lower down, pays only the precept.

35. It was suggested that authorities for sub-catchment areas, having local knowledge and resources, would be more efficient in determining and executing necessary local works than the river board which might tend to be over-centralized. We felt, however, that the river board, if called upon to assume responsibility for upland watercourses, would be obliged to develop their local organization by delegating some of their powers to district committees on to which local persons might be co-opted, as they are empowered to do under the Second Schedule of the River Boards Act, 1948 ; and that often they would, no doubt, find it convenient to employ on an agency basis the works organization of a local internal drainage board. There might seem in theory to be an advantage in leaving with a local board the decision as to what works should be carried out on particular watercourses. In lowland areas, where efficient drainage is of vital concern, the local board can be relied upon to deal actively with the problems of their area. But we do not think sufficient local interest would be engendered in a board responsible for carrying out works on upland watercourses with a long, straggling area of benefit, which might be of advantage, but not of vital concern, to the riparian owners and occupiers. It would mean an extension of power to levy drainage rates ; and the tendency might be to resist increases in the local rate rather than carry out desirable works.

General observations on the extension of internal drainage districts

36. An important motive force behind the various suggestions made over the past 20 years for extending the jurisdiction of internal drainage boards to upland areas whose waters discharge through their districts seems to us to be financial. An extension of boundaries would, however, carry with it an extension of responsibility for drainage works ; and the net increase in revenue accruing to the drainage board for works in the lowland area might well be disappointing. Differential rating would be necessary ; and the uplanders brought within the district would inevitably resist the levying of charges on them for the benefit of the lowland part of the area. The uplanders would, of course, be represented on a reconstituted drainage board ; and their influence

might well be exerted to slow down the execution of works in the lowland part of the area, from which they could expect to derive no direct benefit. We recognize the genuine financial difficulties that many internal drainage boards have to face; and the problems they encounter in providing safe passage for upland waters through their areas. But we consider that these problems are far better met by the financial arrangements we propose in Chapter IV.

37. After full consideration, therefore, of all the matters discussed in the foregoing paragraphs, we decided to reject any solution to the problem of upland watercourses or to the financial and works problems of internal drainage boards that would involve an extension of the area of jurisdiction of those boards or the establishment of a new type of drainage authority. We reaffirm the principle of the Land Drainage Act, 1930, that the power to levy drainage rates should not extend beyond drainage districts delineated on the basis of benefit or avoidance of danger; and that, moreover, such districts are best limited to homogeneous areas.

(4) CONCLUSIONS AND RECOMMENDATIONS ON FUTURE ALLOCATION OF RESPONSIBILITY FOR DRAINAGE WORKS

Division of watercourses into three categories

38. While, in respect of certain watercourses or lengths of watercourse, the present obligations and powers of authorities and persons to do drainage works appear to be adequate, we regard it as necessary that in respect of every watercourse or length of watercourse some person or authority should be made clearly responsible by statute for such works of maintenance and improvements as must be done, so that if, at any time, work or control is found to be necessary, there is some authority empowered to do the work or to direct that it shall be done. To secure this, we recommend that all watercourses or lengths of watercourse in England and Wales without exception should be divided into three categories and defined according to the authority or person responsible for drainage works on them, as follows :—

(i) " Watercourses ", for which river boards will be responsible.

(ii) " Drains ", for which internal drainage boards will be responsible.

(iii) " Ditches ", for which riparian owners and occupiers will be responsible.

All subsequent references which we make in our report to watercourses, drains and ditches will have these meanings. Where none of these is appropriate to the context, the term " channel " will be used for convenience.

General responsibilities of river boards and internal drainage boards

39. As we have mentioned in paragraph 4, river board areas will, with certain exceptions, cover the whole of England and Wales. We recommend that internal drainage districts, for which internal drainage boards are responsible, should be limited to the areas described in paragraph 34. Both river boards and internal drainage boards will be generally responsible for the drainage of their areas; and their jurisdiction will extend to all such channels within their areas as will, under our recommendation in the preceding paragraph, be defined as watercourses or drains as the case may be.

Demarcation between watercourses and ditches

40. Apart from the drains for which internal drainage boards are responsible, the determination of which is discussed in paragraph 44 below, all other channels in river board areas, and drainage works connected therewith, should

be divided into two categories. The first category would consist of arterial channels and their tributaries, which would generally include parish award channels, and the second category would consist of farm ditches in the sense in which that term is used in paragraph 27 above. All matters relating to the first category would be the responsibility of river boards; and we make financial recommendations in Chapter IV with a view to making it possible for river boards to undertake the full responsibilities we envisage. Riparian owners and occupiers would be directly responsible for the second category, County Agricultural Executive Committees having general powers of control and supervision. County and county borough councils would cease to exercise drainage powers; and channels for which Award authorities and Commissioners of Sewers are at present responsible would be taken over by the river board, apart from possible exceptions which it might be appropriate to regard as ditches. The liabilities and obligations of riparian owners and occupiers in relation to watercourses on the one hand, and in relation to ditches on the other, will differ materially on the lines indicated in paragraphs 111 and 121. For this reason it is essential that the distinction between the two categories should be drawn on the same broad principles in each river board area. We recommend, and discuss in detail in paragraph 47, that the river board should be initially responsible for drawing up a scheme and preparing a map showing the watercourses for which they will assume responsibility, the remainder being the responsibility of the riparian owner and occupier under the supervision of the County Agricultural Executive Committee. This will entail marking the point of demarcation between a watercourse and a ditch. It was found necessary in the interpretation of Section 1 (5) of the Land Drainage Act, 1930, for the Ministry to give very clear, though by no means rigid, guidance for the determination of the boundaries of internal drainage districts. This was done in the "Medway letter" referred to in paragraph 32. We find it impossible to give such a clear definition of what should be a "watercourse" or a "ditch" so that the river board could decide the point of demarcation as a clear-cut issue. The river board must have much greater discretion in arriving at their decision than is allowed them in the "Medway letter". The point of demarcation depends on many factors, mostly of a physical nature, and ultimately can be decided only by actual inspection. The relative importance of each factor may vary in different localities. The greatest possible measure of uniformity, as between one river board and another will, however, have to be attained. We, therefore, feel it incumbent on us to indicate certain factors which should all be taken into account and certain suggestions which should be considered by all river boards before they determine the point of demarcation.

41. The approach should, in our view, be for the river boards to determine what lengths of channels can properly be classed as watercourses. All remaining channels, apart from the drains of internal drainage boards, will be automatically classed as ditches and will come under the supervision of the County Agricultural Executive Committees whose powers in respect of these we recommend in paragraph 121 should be strengthened. It should not be forgotten that channels through woodlands or on the boundaries of woodlands must be similarly dealt with and classified into the two categories. There has, perhaps, hitherto been some implication that, because a channel has been delineated as "main river" of a river board, work is necessary on it. This may generally be true as regards existing "main river" but if, as we recommend, there is going to be a large addition to the watercourses coming under the jurisdiction of a river board, it will not follow in the least that it will be necessary for the river board to do work on all these watercourses. Some of them may be self-cleansing and never require any work at all. In some cases it may not be

an economic proposition to do any work ; the cost may be prohibitive or the nature of the land may be such that it is not worth doing.

42. We recommend that the following factors and suggestions should be taken into account by river boards in defining the watercourses for which they are to be responsible :—

(i) Watercourses should include all those channels which it would clearly be unreasonable to expect to be maintained by ordinary agricultural labour using the usual hand tools, bearing in mind the powers of County Agricultural Executive Committees under the Agriculture Act, 1947, to serve directions on owners and occupiers. (It is not implied that work on ditches should invariably be done by hand labour ; it may often be more convenient or economical for the riparian owner or occupier to have the work on his ditches done by mechanical means under contract.)

(ii) Watercourses will normally include those channels which take the surface water from towns and villages as well as those whose upkeep cannot reasonably be secured except by bringing them under the control of river boards.

(iii) The area drained by a watercourse at the suggested point of demarcation is some guide, but we have found by actual survey that the area varies greatly according to the nature of the soil, its pervious or impervious character, the contours of the land, and the presence or absence of springs. We have, therefore, found it impossible to suggest a universal standard on the basis of area alone. We do, however, consider that in impervious areas a channel is more likely to be a watercourse than a ditch at a point draining from 300/400 acres.

(iv) In considering whether a channel could be maintained by ordinary agricultural labour and the usual hand tools, its size and character are very important factors, but we hesitate to put forward any definite dimensions for depth, width of bottom and top. In the end, size and character are probably the chief factors taken into consideration when anyone states, " I know a farm ditch when I see one."

(v) Cost of maintenance may have some influence but it depends very largely on size, which is referred to in (iv) above. We do not feel able to lay down any limits of cost per chain or per mile.

(vi) Whether a channel contains running water all the year round in a year of normal rainfall is important. If it runs all the year round it is probably taking more than local farm water ; it may be taking spring water which may very well put it into the category of a watercourse.

(vii) We consider that some physical feature should constitute the point of demarcation between a watercourse and a ditch. This would normally be the junction of two or more ditches, below which the watercourse assumes a more important character. The temptation to fix the point at some easily recognizable structure, such as a bridge, should, however, be resisted if the structure has no relevance to the matter to be decided.

(viii) The fact that a particular channel has been the subject of a scheme under Section 14 of the Agriculture (Miscellaneous War Provisions) Act, 1940, or a scheme qualifying for grant-aid under the Agriculture Act, 1937, is some indication that it ought to be classified as a watercourse ; and a channel which has been the subject of a grant-aided

farm-ditching scheme will in most cases fall within the category of ditch. While these factors may serve as a general guide, they should not be regarded as a rule strictly applicable to all channels which have been the subject of grant-aided schemes, because the views of drainage authorities, county councils and County Agricultural Executive Committees on the types of channels which could be dealt with under the various categories of schemes varied considerably.

43. River boards must, in our view, take the initiative and indicate what, in their considered opinion, should be the point of demarcation and the upper limit of their watercourses. We believe that, working on the above lines, little difficulty should be experienced in achieving uniformity in determining whether particular channels should be regarded as watercourses or ditches. The issue will, in most cases, be beyond dispute, and where there are differences of opinion there will, in general, be only two or three possible points of demarcation. If differences cannot be settled it should be open to the landowning and farming interests to appeal to the Minister for decision.

Demarcation between drain and ditch

44. The drains for which an internal drainage board are to be responsible and their point of junction with ditches will be determined on just the same broad principles as have been described in relation to watercourses and ditches ; but within such districts, where gradients are small, the area drained by a ditch at the point of demarcation will normally be less than in upland areas. A somewhat greater degree of flexibility in fixing the point of demarcation might also be justified since owners and occupiers within an internal drainage district will manage their own affairs, and the cost of works on all ditches and drains in the district will be met by them either individually or collectively. It is important, however, that the drainage board should work on uniform principles throughout their district.

Carrier watercourses and drains

45. The division of responsibility between the river board and the internal drainage board should be determined according to whether the most important function of any particular channel is to provide a passage for upland water through the district on its way to the sea ; or whether it is to take water off low-lying land within the internal drainage district. Channels in the former category, which are known as carrier watercourses, will be the responsibility of river boards : those in the second category—the lowland drains—will be in the charge of internal drainage boards. In judging " the most important function " of a channel, we do not regard the proportion of upland to lowland water carried by it as the sole criterion. Some of the carrier watercourses will hitherto have been the responsibility of the internal drainage board through whose district they flow ; and the extension of the river boards' functions to include responsibility for all carrier watercourses should relieve many internal drainage boards of liabilities which have proved heavy in the past and have given rise to a sense of grievance. We think that it will, in certain cases, be of practical advantage and desirable for internal drainage boards to carry out works on the watercourses passing through their districts and we see no reason why this should not be done in agreement with the river board, with suitable financial adjustments between the two authorities, following broadly the principle embodied in Section 39 of the Land Drainage Act, 1930, which at the present time provides for such arrangements between internal drainage boards. Conversely, it may be of general advantage for an internal drainage board to make arrangements with a river board for the latter to carry out work

on their drains on a repayment basis. As a special case, we consider that river boards should be responsible for all sea defence works for land drainage purposes, as distinct from works of reclamation, even though this may necessitate defining as watercourses some channels that would otherwise be classified as drains.

Chapter III.—Procedure for Introducing New Administrative Arrangements for River Boards and Internal Drainage Boards

46. Assuming a division of responsibility for drainage works on the lines set out in Chapter II, it is necessary to consider how the new provisions should be brought into effect and what adjustments should be made in the powers of the various existing authorities. These matters are dealt with in this chapter. The financial issues involved are dealt with in Chapter IV.

(1) ASSUMPTION OF NEW RESPONSIBILITIES BY RIVER BOARDS AND INTERNAL DRAINAGE BOARDS

Definition by river boards of channels for which they will assume responsibility

47. Each river board should first survey their area on the lines set out in paragraphs 40 to 43 and prepare for the Minister's approval a scheme determining the watercourses for which they will be responsible. To save time where the river board area is large, the board should be empowered to prepare separate schemes for different parts of their area (or for different watercourses and their tributaries) and to seek separate approval for each scheme. All remaining channels, apart from internal drainage board drains, will be treated as ditches, for which the owners or occupiers concerned will be responsible. It follows that, in determining their own responsibilities, the river board will at the same time be determining the direct responsibilities of owners and occupiers. The survey should, therefore, be made in consultation with farming and landowning interests in the river board area, including County Agricultural Executive Committees. The river board should consult, and if possible reach agreement with, internal drainage boards about responsibility for channels through internal drainage districts. It must, however, be emphasized that it will be the river board's duty to prepare the scheme ; and these consultations, necessary as they are, should not be permitted to delay its presentation. To enable all concerned to know how they will be affected, we suggest that copies of the complete scheme, as submitted to the Minister for approval, should be deposited locally in several places ; and that, in addition, sectional maps should be made available at the county and district offices of County Agricultural Executive Committees. A period should be prescribed within which objections might be lodged with the Minister, who would then approve the scheme, with or without amendment. The Minister's decision should be final.

Definition by internal drainage boards of channels for which they will assume responsibility

48. Internal drainage boards similarly should survey their areas and define the drains for which they are to be responsible. All other channels in their districts will be watercourses or ditches. In carrying out their survey they should have regard to the river board's survey. The result of the survey should be recorded by the internal drainage board on a working map approved by

resolution of the board, indicating the drains for which the board are prepared to assume responsibility. A copy of this map should be deposited for inspection by owners and occupiers of land within the internal drainage district, and further copies should be deposited with the river board and with the County Agricultural Executive Committee. We do not contemplate formal approval by the Minister of the internal drainage board's working map. But there should be a right to individual owners and occupiers within the drainage district, during a prescribed period from the deposit of the working map, to appeal to the river board against failure by the internal drainage board to take responsibility for any particular channel, the ground of appeal being that responsibility has been assumed for similar channels in other parts of the drainage district. The river board, after consulting the parties, should have power to determine the issue and direct the internal drainage board to assume responsibility for any specified drain.

Interim arrangements

49. The foregoing procedure will inevitably take time. The additional responsibilities that will be assumed by river boards will have as their counterpart the additional sources of revenue we recommend in Chapter IV—shortly stated, a charge on agricultural and other land not at present subject to general or drainage rates—but it will also take time to establish the machinery to collect these additional revenues. We have accordingly considered whether it is necessary to defer the assumption by river boards of responsibility for lesser watercourses, and the placing on owners and occupiers of the new obligations we recommend in relation to ditches, to which we refer in paragraph 121, until the schemes of those authorities have passed through all their stages and have been formally approved, and until the new revenues are due for collection. It would be unfortunate if this were so, and we do not think it necessary. We suggest, therefore, that the new responsibilities of owners and occupiers should be assumed six months from the passage of the necessary legislation. It will be clear, in relation to most lengths of channels, where the responsibility lies. In relation to doubtful lengths not yet provided for by a scheme and on which works appear urgently necessary, it should be open to the river board to ask the Minister to determine the responsibility provisionally in advance of his approval of the scheme as a whole. Equally, if the County Agricultural Executive Committee should feel it necessary to serve a direction on an owner or occupier in relation to any particular channel which appears to them to be a ditch within the meaning of the Act, it should be open to the owner or occupier, pending the coming into force of a scheme, to appeal to the Minister, who should be required to consult the river board and obtain their view before deciding whether the channel falls within the jurisdiction of the Committee.

Preparation of schemes in default

50. We do not contemplate failure by river boards and internal drainage boards to carry out expeditiously the surveys indicated above ; but it is none the less necessary to provide for it. We recommend, therefore, a general provision enabling the Minister in relation to any river board area, or the river board in relation to any internal drainage district, in cases where it is clear that unnecessary delays have occurred or are occurring, to carry out the survey and prepare schemes or working maps, as the case may be, in default of the authority responsible, and to recover the cost from the latter.

Review of maps defining responsibility of drainage authorities

51. Some simple procedure will be necessary to modify as occasion arises the statutory map of the river board or the working map of the internal

drainage board. The river board's map should not normally require modification except to remedy mistakes that may have been made in the initial survey or to mark new artificial watercourses. The internal drainage board's working map may require more frequent amendment if new drains are cut or existing drains abandoned. We recommend that either authority, on their own initiative, or at the request of owners or occupiers affected, should have power by resolution to propose such alterations as seem to them appropriate. Before the resolution becomes effective the same procedure should apply as is described in paragraphs 47 and 48 for the original surveys. It should be the duty of the Minister in the case of a river board, or of the river board in the case of an internal drainage board, to consider representations made by individual owners or occupiers suggesting an alteration of the statutory or working map as the case may be and it should be open to the Minister or the river board to hear the parties concerned and to require such alterations in the map as may seem to them appropriate.

(2) CONSEQUENTIAL ABOLITION OF MISCELLANEOUS DRAINAGE AUTHORITIES AND THEIR POWERS

Review of authorities and powers concerned

52. The assumption of responsibility by river boards and internal drainage boards for all watercourses and drains throughout England and Wales, and the conferring of adequate powers to deal with them, will render obsolete the land drainage powers of various miscellaneous authorities at present responsible for certain watercourses or drains or having powers in relation to them. Special land drainage powers are possessed by some county councils and county borough councils in local Acts, by Award authorities operating under private or general Inclosure Acts, and by Commissioners of Sewers. We asked witnesses who appeared before us for their views on the best method of dealing with these authorities and the powers they exercise, and after considering their suggestions we make the recommendations contained in paragraphs 53 to 55 below.

General land drainage powers of county and county borough councils

53. We have already recommended in paragraph 20 that county and county borough councils should cease to function as land drainage authorities, and this will involve the repeal of Part VI of the Land Drainage Act, 1930. When river boards have been set up for the whole of England and Wales, many of the provisions of Part VI of the Act will, in any event, lapse. Some councils, however, e.g., Essex County Council, possess special land drainage powers of a general character over channels within a river board area but for which the river board or internal drainage board are not at present responsible. It should be provided in new legislation that they should cease to exercise such powers as and when the channels are brought directly under the jurisdiction of one or other of these authorities. There remain certain special land drainage powers exercised under local enactments by urban authorities for the control of watercourses in their districts which are largely used for the disposal of sewage and storm water. These channels will, of course, become the responsibility of the drainage authority, for the exercise thereon of their general powers, but there may be advantage in retaining the local act provisions so that the urban authority can, with the consent of the drainage authority, continue to do such special work as is necessary in their own area.

Land drainage powers of Award authorities

54. We consider that powers and obligations in relation to land drainage resting on authorities (other than drainage boards) or persons under old

Inclosure Acts and Awards should, under new legislation, cease from the date of the assumption by the river board or internal drainage board of their new responsibilities, and any property of the superseded authority, held for land drainage purposes, should on that date be regarded as having been transferred to the river board or internal drainage board, as the case may be. The fact that all hereditaments in a river board area will, under our recommendations, pay towards the expenses of the river board or internal drainage board leads us to suggest that financial and other obligations under the Award of private persons and authorities, including district councils, should be cancelled and not commuted, except such powers, duties, liabilities and obligations as have already been transferred to a river board, catchment board or internal drainage board, or are enforceable by any of these authorities. As practically all Awards have long since ceased to be operative we do not anticipate that such a general provision will give rise to difficulty, but it is conceivable that, in a few isolated instances, it may cause injury or give rise to hardship, and that other unforeseen difficulties may arise. We accordingly recommend that one of the first duties of the river board under the new legislation should be to advertise that, after the lapse of two years from the passing of the Act, all provisions relating to land drainage in any Inclosure Act or any Award in the river board area, subject to the exception mentioned above, will cease to have effect ; that all property held by the Award authority for land drainage purposes will be transferred to the river board from that date ; and that any person who considers that his interests are adversely affected by the provision, or who has any claim outstanding against the authority, should submit full particulars to the river board within a period to be specified. If representations are made and difficulties cannot be resolved locally the matter should be referable to the Minister who, after discussion with both parties, should make an order to give effect to his decision. The fact that a Commission of Sewers or an Award authority has jurisdiction over a particular watercourse should not deter the river board from taking action under the interim arrangements recommended in paragraph 49 above.

Powers of Commissioners of Sewers

55. The Act should provide for the abolition of the office of any Commissioners of Sewers who are still in office, and for the revocation of all their powers and duties, as from the date of the assumption of their new responsibilities by the river board or internal drainage board within the Commissioners' district. The procedure for dealing with these bodies should be on the same lines as the procedure outlined above for dealing with Award authorities.

Chapter IV.—Finance

(1) GENERAL AIMS OF FINANCIAL RECOMMENDATIONS

56. The financial recommendations in this chapter are designed to secure that no river board or internal drainage board shall with justification be able to plead that they are prevented, through lack of funds, from doing works which are locally or nationally worthwhile, or that they are unable to assume the full responsibilities involved by our recommendations ; and also to ensure that interests which benefit materially from works carried out by a drainage authority should make some special or general contribution towards the cost thereof. We have reviewed the principles on which the present sources of revenue for drainage work are based ; we have considered what further revenue is required to meet the re-allocation of responsibility for drainage works and administration proposed in the previous chapters ; and we have sought possible and equitable ways to provide that additional revenue.

(2) PRINCIPLES UNDERLYING THE PRESENT SOURCES OF REVENUE FOR DRAINAGE WORK

57. Under the Land Drainage Act, 1930, drainage work may be financed from one or more of the following main sources :—

(*a*) the owners and occupiers of land directly affected ;

(*b*) ratepayers within the catchment area ;

(*c*) the general taxpayer.

The principle of rating on the basis of benefit or avoidance of danger, on which the financing of all pre-1930 drainage work was based, is retained in the drainage rating by internal drainage boards. Such rates are levied to meet not only the cost of purely local work, but also contributions to the river board from the internal drainage district. The wider community contributes, by way of precepts on councils of counties and county boroughs, what is, in most areas outside the Fens, the major part of the revenue of river boards—a principle recommended by the Royal Commission on Land Drainage in 1927 and adopted in the Land Drainage Act, 1930. The State reinforces local resources in cases where drainage works of a capital nature are desirable in the national as well as the local interest, by contributing towards the cost of capital works carried out by drainage authorities. We have examined these three sources of revenue with a view to achieving the aims set out in paragraph 56 above and have considered the extent to which each party can reasonably be expected to contribute towards the cost of particular classes of drainage work. The position varies according to whether the benefit from drainage work is purely local in character, whether it extends directly or indirectly to the wider community, and whether it is in the national interest that the work should be carried out. Generally, we consider that it is important that the local interests should make their full contribution ; and that the Exchequer should only be called upon to contribute where a case is made out for financial assistance, and where there is also sufficient national interest.

58. Farm ditching work on a single holding is an extreme case of local benefit. This work may serve to discharge the water from the one holding only and may benefit no one but the owner or occupier. It is, therefore, equitable that the cost of the work should be borne by him. In order to encourage home food production, however, the Government has considered it expedient to continue to grant-aid ditching schemes until 1952, or if Parliament so resolves, until 1954, and has made this provision in the Agriculture Act, 1947.

(3) FINANCING OF RIVER BOARDS

(A) General Considerations

59. We have examined in Chapter I the variation in circumstances between one catchment area and another, and the chief fact that has emerged is that some catchment boards have found that the works needed in their areas are out of proportion to their local resources. Some catchment boards have been reluctant in the past to take over additional liabilities because, among other reasons, of heavy existing commitments or inadequate income from precepts on county councils and county borough councils. There has, we believe, in some instances been reluctance to incur expenditure for the benefit of outlying agricultural properties out of income derived from county and county borough rates, and unwillingness to take over responsibilities which the board may have felt should properly rest upon riparian owners and occupiers. If our

recommendations are accepted, river boards will be faced with additional liabilities. We have therefore attempted to assess the extent of those additional liabilities before examining what financial resources are available to meet them, and before considering how far the sources of revenue of some catchment boards have in the past fallen short of the requirements of their catchment areas. We have borne in mind that the setting up of river boards and the inclusion within their areas of coastal towns, may narrow the variations in resources that at present occur between existing catchment areas ; and in certain instances may result in an improvement in their financial position. We do not think, however, that the establishment of river boards will fundamentally alter the nature of the problem, which arises from the uneven distribution of rateable value over England and Wales. The amalgamation of neighbouring catchment areas in Lincolnshire and East Anglia, for example, where drainage is of paramount importance but where the rateable value is comparatively low, cannot result in any substantial overall improvement in the financial position of the catchment areas concerned. The amalgamation of adjoining catchment areas in South Lancashire, where, on the other hand, rateable values are high, will not result in any appreciable variation in the financial circumstances of the individual catchment areas. It would not be a practical proposition to bring the concentration of rateable value round Manchester and Merseyside to the aid of north-west Cumberland on the one hand, or north-west Wales on the other, by amalgamation in the same river board area. In some river board areas, therefore, rateable values will be high in relation to commitments and in others the position will be reversed. A contrast may usefully be drawn with the financial problems of local government. The degree to which local government services have to be provided is largely dictated by the population in a given area, and that in turn obviously bears some relationship to the rateable value in the area. None the less, Exchequer Block Grants are needed to equalize the position as between rich and poor areas. But in the case of land drainage, the need for services arises not so much from the demands of man as from the vagaries of nature and general physical conditions ; and the need for land drainage works, in the nature of things, bears little relationship to the population dwelling in a given area and hence to its rateable value.

(B) Assessment of liabilities of river boards

60. In our attempt to assess the extent of the additional liabilities which, under our recommendations, would be imposed on river boards, we sought the help of the Engineers of the Ministry of Agriculture and Fisheries. In their Report, which is attached as Appendix V, it is suggested that the average length of additional watercourse throughout that part of the country not covered by internal drainage boards is 1.1 miles per 1,000 acres, and this could reasonably be maintained at an average annual cost of £30 per mile. We accept this figure, and would stress the need, to which the report calls attention, for work on these lesser watercourses to be done to an " estate maintenance " standard only. Elaborate works on these watercourses, involving heavy expenditure and leading to greatly increased cost of maintenance in the future, cannot be justified. The river board should work to the practical standards which the good owner or occupier himself would adopt, if the work were to remain his own responsibility. The district engineer should develop his programme of works and maintenance in consultation with knowledgeable people in the area. We believe it will be found that much can be done economically by using local hand labour. It is essential to the financial structure of our report that river boards should approach their new responsibilities in the way we have indicated.

61. Over the total area of 34½ million acres to be covered by river boards, the total desirable expenditure on additional watercourses should amount, in round figures, to £1,140,000 a year. To make a comparison with existing catchment boards, the additional expenditure over the 26½ million acres covered by catchment areas, exclusive of the area covered by internal drainage boards, would amount to £875,000. This is just about two-sevenths of total catchment board expenditure in 1948–9 and one-half of the sums raised by precepts on councils of counties and county boroughs. It is clear that some river boards would, if they were dependent on their present financial resources, even supplemented by high Exchequer grants in respect of capital works, be unable to discharge these additional liabilities. In making recommendations in paragraphs 62 to 89 below, as to the sources of revenue of river boards, we have therefore had regard not only to the extent to which the present sources of revenue have fallen short of the drainage requirements of particular areas but also to the additional liabilities which are to be imposed upon them.

(C) Proposed Sources of Revenue

(i) LOCAL CONTRIBUTIONS TO RIVER BOARDS

62. Whilst not forgetting that river boards have duties and responsibilities in respect of the conservation and supply of water, we may here state that they are primarily concerned with seeing that the surplus water from their area is carried safely through and off the land to the sea. Their works serve directly or indirectly the needs of the whole of the river board area, and we think it fair in principle that the major part of the cost of the river boards' work, apart from contributions from internal drainage boards securing particular benefit, should be spread over the river board area as a whole, reinforced if necessary by Exchequer grants. Thus, capital works and works of maintenance on watercourses will ordinarily be paid for out of the general funds of the river board. We think, however, that it would be unreasonable to expect those funds to carry in full the capital cost of sizable works to remedy problems whose cause is largely local and whose importance is purely or mainly local ; and, indeed, in some cases it may be right that the whole cost should be borne by the persons or authorities concerned. We consider, therefore, that a river board can reasonably ask, when taking over responsibility for the maintenance of the additional watercourses in their area, either that such watercourses should be in reasonably good condition, or that the persons or authorities concerned in the locality should bear all or part of the cost of putting them into good condition. We accordingly recommend that the river board should have power to require contributions in respect of specific schemes of works in the three circumstances described in paragraphs 63 to 68 below.

Upland watercourses

63. Most of the minor watercourses which a river board would take over under our proposals and which are not self-cleansing will have been improved since the passing of the Agriculture Act, 1937 ; but where this has not happened, and clearance work of a substantial character is necessary and worth while, we consider that for a limited period of time the riparian owners should be placed under an obligation, where the river board so decide, to contribute to the cost of the river board's initial schemes for such watercourses, the owner's responsibility being confined to works of restoration only. We accordingly recommend that the river board should be empowered for a period of, say, five years following the passage of the Bill, either on their own initiative or at the request of a substantial number of the owners concerned, to prepare capital schemes for the improvement of lengths of watercourse (which would usually be fairly short) where the work throughout the length is fairly uniform in character. We recommend that such schemes should

qualify for grant-aid at the flat rate appropriate to Section 15 of the Agriculture Act, 1937. The net cost of the schemes, as far as the restoration part of the work is concerned, would be apportioned amongst the riparian owners in proportion to their length of frontage to that part of the watercourse which is subject to the scheme. The board should, however, be given discretion in the matter of the apportionment in the case of special works, e.g., the alteration of a weir. Before preparing the scheme, the river board would consult the County Agricultural Executive Committee. The special arrangements would be confined to watercourses whose condition was due to long-standing neglect, and would not include watercourses on which improvement works had been carried out since 1937, at the cost of riparian owners, including schemes carried out with the aid of Government grant under Section 15 of the Agriculture Act, 1937, or under Section 14 of the Agriculture (Miscellaneous War Provisions) Act, 1940 ; nor would they include channels of a type regarded as suitable for bringing within an internal drainage district. Notice of the scheme and particulars thereof would be served on riparian owners, who would have a right of appeal to the Minister of Agriculture and Fisheries on the ground that the cost was unreasonable or that the works were unnecessary, or that they were of a general rather than a local character and should properly be paid for out of the general funds of the river board. The owner should be allowed to recover his part of the cost from the occupier if his tenancy agreement or other provision enables him to do so. It seems proper that the charge should be recoverable from the owner since, if the condition of the watercourse is due to neglect of maintenance, for which the occupier is responsible, the owner will have his remedy against the occupier and will have been re-imbursed for any depreciation in the value of the holding in the dilapidations claim on a change of tenancy. The river board need not refrain from carrying out works under these arrangements in advance of the approval of the scheme for determining the watercourses for which it will be responsible in that particular area, as, under the procedure outlined in paragraph 49 above, we have suggested a means which would enable the Minister to determine provisionally, in advance of his approval of the general scheme, whether or not the river board should be responsible for a particular length of watercourse on which works are urgently necessary. Once a watercourse has been put in a satisfactory condition under this provision, full responsibility for its maintenance would rest on the river board.

Internal drainage districts solely for rating purposes

64. Our proposal that the jurisdiction of river boards should be extended to include many additional minor watercourses will mean that some internal drainage boards will to a large extent be relieved of responsibility for doing drainage works within their districts. In some circumstances it would be appropriate for the river board to abolish the internal drainage district ; in others, where the district receives appreciable benefit from the works of the river board, we consider that it would be of practical convenience for the river board to be empowered to take over the remaining works functions of the internal drainage board, defining all the channels in the district other than farm ditches as watercourses. The district would thus be retained solely for the purpose of securing a contribution larger than the agricultural charge from the area of benefit towards the cost of the river board's work on their watercourses. There may be other areas where there would be insufficient local drainage works to justify the establishment of an internal drainage board, but where the benefit derived from the works of the river board would be such that it would not be unreasonable to make the areas subject to drainage rating. We recommend that in such areas it should be open to a river board to establish an internal drainage district with no works responsibility of its

own and no elected board, and to levy a rate within that district to meet the cost of that work on the watercourses which is of particular benefit to the district. It should not be necessary, as is the case under present legislation, for a river board first to set up an internal drainage board and then petition to take over their powers and duties under the provisions of Section 11 of the Land Drainage Act, 1930. Where a river board decided either to retain an existing internal drainage district or establish a new one for rating purposes only, it would, however, be important to ensure that the drainage ratepayers were adequately safeguarded, and this would be secured if our recommendations in paragraph 109 were also accepted. We would add that, in view of our subsequent recommendations as to a contribution from land outside internal drainage districts, we do not contemplate any extensive use of this power to establish districts solely for the purpose of securing a contribution towards the works of the river board. We make further reference to these arrangements, and to the change in the incidence of maintenance costs from occupiers to owners, in paragraphs 98 and 92.

Channels in built-up areas

65. There are many channels, particularly in the industrial areas of Lancashire, the West Riding of Yorkshire and the Midlands, where development in the past century has so encroached on the channel that it has become incapable of discharging flood waters. Flooding of serious local concern occurs periodically in such areas. Indeed, wherever unplanned development has taken place on the natural flood-path of channels, flooding is bound to arise from time to time. Engineering works to mitigate flooding in the area affected, and designed so as not to transfer the flooding problem to points lower down the channel, are often very costly. Important considerations of planning and public health are often involved. The most economical procedure may be to demolish the buildings affected and reconstruct them elsewhere so as to provide an adequate floodpath for the channel ; but local authorities have in the past been generally unwilling to face the responsibility of accepting a drastic proposal of this character and the consequent loss of rateable value. If, however, engineering works are practicable, and the local authority desire that they should be carried out, the river board can reasonably ask them to bear the lion's share of the cost. We stress this point, because there might otherwise be an impression amongst local authorities that our proposals for the taking over of all arterial watercourses by river boards would absolve them from any further special financial responsibility in relation to flooding problems of purely local significance arising from causes that are mainly local. In the circumstances described, the local authority will have to decide whether they will meet the contribution required by the river board as a condition of the latter executing the works. If they decide that they are unable to do so, they alone suffer. It may be that a local authority will wish certain works to be elaborated in the interests of local amenities. While the river board should not, in our view, be required to meet the cost of such works out of their own funds, we consider that they should be empowered to do their drainage work in such a way as to meet the wishes of the local authority for any purpose of that authority on payment by the latter of an agreed contribution to the cost of the work ; and that similar provisions might also apply in relation to other statutory authorities.

66. Regulations made under Section 93 of the Town and Country Planning Act, 1947, provide for the payment of Exchequer grants to local authorities in respect of expenditure incurred by them in the acquisition and clearing of land for comprehensive re-development in areas of bad lay-out or obsolete development. This should encourage local authorities to co-operate with

river boards in carrying out drainage schemes in such areas. If the river board do work on channels in built-up areas they would, thereafter, assume full responsibility for maintenance of the improved channel, but would have to rely on the planning authority to prevent future encroachments on the channel or flood path.

67. Another circumstance calling for specal consideration is the comprehensive scheme which might be executed in the interests of a wider area, but which is of particular significance, from the point of view of flood prevention, to certain well-defined built-up areas. When this occurs, it would be open to the river board to constitute an internal drainage board as in paragraph 64 above. But this procedure is often not administratively convenient in built-up areas. Hence, in such instances, we recommend a power to river boards, supplementing the power of local authorities to make contributions under Section 32 of the Land Drainage Act, 1930, to require a contribution from the council of any local authority towards the cost of any drainage works from which the district of that authority derives substantial benefit. The local authority should have a right of appeal, as to the reasonableness of the amount demanded, to the Minister of Agriculture and Fisheries, who would, of course, consult the Minister of Health before giving a decision.

68. As a corollary to our recommendations in paragraphs 65 to 67 we recommend that where the local authority concerned has already incurred loan charges in respect of works of particular local importance for which the river board assumes responsibility or becomes liable under a transfer scheme made under Section 4 (1) (a) of the Land Drainage Act, 1930, the liability for meeting the loan charges should not automatically be transferred but, because the charges relate to works of particular benefit to the local authority, should remain with that authority.

(ii) GENERAL CONTRIBUTIONS FROM THE RIVER BOARD AREA

A proposed new charge

69. For the reasons given in paragraphs 70 to 78 below we recommend that a new charge, which should be known as the drainage charge, should be imposed on all hereditaments that are not assessed to general or drainage rates, and therefore at present make no contribution to the cost of land drainage work. This charge should consist of two parts, one part being at a rate equivalent to the rate of precept on the local authorities within the particular river board area (which for the year 1948-49 averaged about 3d. in the £ of rateable value), and the other part being normally at a fixed rate of 9d. in the £ of net Schedule A value, and general to all river board areas.

The case for the extension of the area of contribution

70. We considered, in the light of our general principle that the first charge in respect of local drainage works should fall on the owners and occupiers directly benefiting, whether there was a case for a special charge on riparian owners and occupiers in respect of works on individual watercourses passing through their lands where such watercourses are not included in a drainage district. In theory, there is much to be said for the levying of such a special charge ; and to avoid a system that would involve calculating and allocating the cost of individual works, we reviewed the possibility of a special annual charge at a flat rate on all owners or occupiers of land fronting on a watercourse for which the river board would be responsible. We dismissed this proposition on the grounds of its administrative difficulty and the varying degree of benefit from, and need for, regular works on lesser watercourses.

71. In paragraph 30 we quoted the view expressed by both the National Farmers' Union and the Association of Drainage Authorities—that it should

be possible to include within a drainage district any land contributing run-off into the watercourses of the drainage district. The Association of Drainage Authorities considered further that there should be a contribution towards drainage works from all agricultural land outside internal drainage districts ; and the National Farmers' Union expanded their view, referred to above, in the following words : " There is wide experience of the fact that the work of drainage districts has substantially increased by reason of the flow of water from land above the present level of liability, from which, at present, no income is derived. It is not suggested that the rate charged in respect of the higher land should be the same as that applicable to the land at present within the ' benefit area ', nor that any drainage rate could be levied on a national basis, nor, indeed, that all land should be subject to a drainage rate ". In paragraphs 30 to 37 we discussed the difficulties inherent in any proposal to extend the boundaries of internal drainage districts for rating purposes, or to distinguish between those properties whose drainage finds its way to a main river through a drainage district and those whose drainage discharges directly into the main river. Some agricultural areas will receive greater benefit from the works of the river board than others, and in the chalk uplands in particular there will be little work for the river board to do. But already, under the existing system, some urban areas receive little or no tangible benefit from drainage works, or the discharge of their surface water may not aggravate the drainage problem of others. Yet all such areas have contributed through the precept at a uniform rate per £ to the funds of the catchment boards or will so contribute to the funds of the river boards.

72. The tendency to spread the cost of public services over wider areas is to be seen in many aspects of local government. We endorse the general principle laid down by the Royal Commission on Land Drainage in 1927, which found expression in the Land Drainage Act, 1930, that the main responsibility for financing the work of catchment boards should rest with the community in general which benefits directly or indirectly from controlled drainage. This principle has since been repeated in the River Boards Act, 1948, and we think that it should not be disturbed in future legislation. We recommend, therefore, that the levying of precepts by river boards on county and county borough councils within the river board area should continue. We have mentioned previously that, between the report of the Royal Commission on Land Drainage in 1927 and the passage of the Land Drainage Act in 1930, agricultural land was derated by the Local Government Act, 1929. One of the major principles recommended by the Royal Commission—namely the extension of the area contributing towards the cost of drainage work—was therefore only partly implemented, and agricultural land outside internal drainage districts does not at present contribute towards the cost of arterial drainage works. The Catchment Boards' Association and the Association of Drainage Authorities, in their evidence, drew attention to this position. Land drainage work on existing main river provides better outfalls to local drainage systems and thus is of advantage to hereditaments within the river board area generally, including, of course, agricultural land, which, outside internal drainage districts, at present makes no contribution to the cost of work done by the river board. The effects of this work will be more widespread if, as we propose, river boards assume responsibility for lesser watercourses ; works on these are of particular concern to the agricultural land through which they flow and are an important factor in increased production. Riparian owners and occupiers would be relieved of liabilities they may now have for the upkeep of these watercourses. Some catchment boards have been reluctant in the past to incur expenditure on such streams out of income derived from county

and county borough rates. These difficulties would not arise were contributions to become universal.

The case for a drainage charge on land not subject to rates

73. For the reasons set out in paragraphs 70 to 72 above we consider that it is fair in principle (and this view has been borne out by many of the Associations who have given evidence before us) that all land within the river board area should make some contribution towards the cost of works carried out by the river board ; accordingly we recommend that a special drainage charge should be levied on those hereditaments that are not assessed either to a general or to a drainage rate. The charge would be a contribution for land drainage purposes quite distinct from the general rate levied by the local authorities ; and would be on a uniform basis, just as the precept on local authorities is applied without differentiation throughout the river board area. Bearing in mind the financial arrangements for restoration work on lesser watercourses which we recommend in paragraph 63 above, and the fact that the work which the river board will undertake on the additional watercourses will for the most part be in the nature of regular maintenance, we further recommend that the proposed drainage charge should be borne by occupiers.

74. We have considered whether riparian owners and occupiers should, as a class, be placed under further special obligations in respect of watercourses. We propose in paragraph 110 that such owners and occupiers should be placed under certain obligations to protect river board works : we consider that these obligations, together with the liability resting on occupiers to pay the drainage charge and the obligation which will fall on certain owners under our recommendations in paragraph 63, should be the extent of the general responsibilities of riparian owners and occupiers in respect of watercourses outside internal drainage districts.

75. We have given a great deal of thought to the best method of providing the additional revenue which river boards will require in order to meet the additional responsibilities in respect of lesser watercourses that we propose they should undertake. We can think of no satisfactory alternative to a drainage charge, levied on those hereditaments which are not assessed to general or drainage rates. We appreciate that considerable work and some expense would be involved in the collection of such a charge, but, if direct provision for the care and maintenance of these additional channels is to be made—and we are in no doubt whatever that it must, in the national interest, be made—the provision of the necessary revenues through such a charge seems to us inevitable. We make recommendations below as to the basis of the charge and the method of collecting it.

The basis of the drainage charge

76. It seems clear to us that the charge must be based on value, since a flat charge per acre, however small, would be too heavy a burden on large holdings of very poor land, and on small holdings the contribution would be small and not worth collecting. We consider that it would be impracticable to provide for a special valuation of de-rated agricultural hereditaments for the purpose of such a charge. We have investigated various methods of making the charge and we recommend as follows :—

(*a*) The net Schedule A assessments determined for the purposes of income tax under the Income Tax Acts should be the basis for the drainage charge.

(*b*) Where a property, such as a farm, is in part subject to the general rate, relief from the drainage charge should be given in respect of

that part of the property which is rated ; and the assessment for the charge should be the net Schedule A annual value of the property less its rateable value.

(*c*) The charge should be levied on all properties not subject to the general rate, but it should not be levied within internal drainage districts, because agricultural lands in these districts already contribute materially to the cost of land drainage through the drainage rates.

The assessment on which the drainage charge will be based is referred to hereafter in our report as the " chargeable value ".

77. The adoption of net Schedule A annual values as the basis of the drainage charge would mean that poor land of low annual value would have to make only a small contribution as compared with good agricultural land, and we have been satisfied on this point by figures obtained from the Inland Revenue Department of net Schedule A values on upland farms in a number of districts. The Inland Revenue Department investigated 308 of these upland farms in various parts of the country, with acreages of 500 acres and above, and with net Schedule A assessments of £100 and above, and the following table briefly analyses the figures supplied to us and indicates the drainage charge calculated at an assumed rate of 1s. in the £.

Analysis of incidence of drainage charge on 308 *upland farms*

Net annual values	£100—£299	£300—£499	£500 and over	
Drainage charge (at 1s. in £)	£5 0 0 to £14 19 0	£15 0 0 to £24 19 0	£25 0 0 and over	
Acreage of farms				*Totals*
500 to 999	144	23	2	169
1,000 to 2,999	78	34	11	123
3,000 and over	4	6	6	16
Totals	226	63	19	308

78. The basis adopted for the drainage charge will differ from that prescribed in the Land Drainage Act, 1930, for the purpose of drainage rates in internal drainage districts, the former being the net Schedule A assessment of annual value and the latter, the gross. The chargeable value will thus be closely comparable with the rateable value which would have been placed on the land if it had not been de-rated ; and the net Schedule A assessments are well known. It is not, in fact, essential that a common basis should be used for drainage charge and drainage rate, as they will be collected by different authorities and in different areas.

The collection of the drainage charge

79. We consider that local rating authorities (i.e., the councils of county boroughs and county districts) could most conveniently collect the drainage charge within the river board area ; and the Rural Districts Councils' Association, with whom the matter has been discussed in general terms, do not think that the collection of the charge on an agency basis by local authorities would give rise to any difficulty. The rating authorities have had many years' experience of rate collection ; their organizations are in being ; and the charge would in the main have to be collected from people who are already paying local rates in respect of their non-agricultural properties and are well known to the rate collectors. We are assured that the cost of collection of the drainage charge on agricultural land will not be prohibitive, and there is no reason to expect that it will exceed 5 per cent. of the gross amount collected. It might in fact be a much lower figure since the machinery for collection is already in existence.

The determination or apportionment of chargeable values

80. The net Schedule A assessment for hereditaments within the local authority's area would be obtainable from the Board of Inland Revenue, who have agreed that they could provide the information required. The local authority would appear to us to be the appropriate body for determining the chargeable value of any hereditament which has no Schedule A value and for apportioning chargeable values where the boundary between two river board areas cuts through particular hereditaments. Where the boundary of an internal drainage district cuts through a particular hereditament the local authority should determine the chargeable value of that part of the hereditament outside the internal drainage district. This should be done in consultation with the internal drainage board concerned, and the assessment of the hereditament for the purposes of the drainage rate should be taken into account. Where a hereditament, wholly within a river board area and wholly outside an internal drainage district, lies within the areas of two or more local authorities, the latter should agree among themselves who shall collect the charge. Since farm houses and farm cottages are normally included in one Schedule A assessment with the land and farm buildings, it will be necessary for the rating authority—as recommended in paragraph 76(*b*) above—when computing the chargeable value of the hereditament to deduct its rateable value from its net Schedule A value : we are advised that the rating authority would find no practical difficulty in basing the drainage charge in this way. Difficulties may arise in connection with bare land holdings which will not appear on the books of the rating authority ; but we see no reason to think that these and similar difficulties could not be overcome.

Rights of appeal

81. The occupier of the hereditament should have a right of appeal to a court of summary jurisdiction against a determination or apportionment, similar to the right of appeal given by Section 29(3) of the Land Drainage Act, 1930, against a determination or apportionment made by a drainage board for the purposes of drainage rates. Where the chargeable value is not a determination or an apportionment, but is based on the net Schedule A annual value, there would, as in the case of such assessments for the purpose of drainage rates, be no right of appeal (except, of course, in relation to income tax, which would be no concern of the local authority). A right of appeal, similar to the right given by Section 30 of the Land Drainage Act, 1930 (i.e., on grounds of faulty procedure, property not within the river board area, or other error, etc.), should, we consider, be available to individuals against the drainage charge. We deal with the question of appeal against the level of the drainage charge generally throughout the river board area in paragraph 84.

Factors controlling the amount of the drainage charge

82. In considering what amount of drainage charge on agricultural land can be justified we have proceeded on the basis of the following principles :—

(*a*) Since both built-up areas and farm lands contribute run-off, and since built-up areas, though not necessarily benefiting from drainage works, contribute to them through the precept (see paragraph 71 above), it seems just that farm lands should make a corresponding contribution through the drainage charge. Apart from this, the farming industry in general will, as a result of the additional liabilities to be assumed by the river boards, derive particular advantage of a similar nature though perhaps not to the same extent as that derived by lowland farmers from the work of internal drainage boards. We

consider that the drainage charge must take both these factors into account and should therefore exceed the rate of contribution from local authorities through the precept.

(*b*) The financial position of river boards should not in general be worsened by our proposals to impose additional liabilities on them ; but as circumstances will obviously vary between river board areas, the average additional liabilities in all river board areas should be considered in determining the rate of the charge.

(*c*) The charge should not be calculated at such a rate as, taking the country as a whole, would relieve the expenditure now being carried by the precepts on local authorities. Subject to this, we consider that the sums received from the drainage charge should, in common with the revenue of river boards from all other sources, be generally available to meet the expenses of the board whatever the service ; and that any system under which river boards would be required to keep separate accounts for different classes of watercourses—those which were former " main river " and the additional watercourses for which we recommend they should in future be responsible—must be avoided.

The amount of the drainage charge

83. In considering what the amount of the drainage charge should be we have started by relating the charge to the estimated average additional liabilities in all river board areas which will result from the additional burden which river boards will be called upon to carry. In paragraph 61 we calculated that the total expenditure on work which it is desirable to do on additional watercourses would amount to about £1,140,000 a year. The total area of agricultural land which will be subject to the drainage charge is estimated at 27½ million acres and the net Schedule A value of this land on current assessments, after deductions in respect of houses and cottages subject to local rates would, it is estimated, be of the order of £23,000,000. An average drainage charge of 1s. in the £ of net Schedule A value on all agricultural land not subject to drainage rates should, therefore, produce the amount needed to meet desirable expenditure on additional watercourses. On the basis of this figure, and bearing in mind that the present average rate of precept on local authorities is approximately 3d. in the £, we recommend that the drainage charge to be levied by all river boards should be a variable amount, equivalent to the current rate of precept for each river board area, plus a fixed amount of 9d. in the £ of net Schedule A annual value. We attach at Appendix VI an example showing the incidence of the proposed drainage charge on a specific hereditament. We consider that the fixed part of the drainage charge might be made subject to adjustment in the circumstances referred to in paragraph 84 below. On the average, taking the country as a whole, the amount collected through the new drainage charge should balance expenditure on the average additional liabilities for upland watercourses assumed by the river boards. But in areas where the precept is low, the rate of drainage charge will be correspondingly low ; and in areas where the precept is high, the yield from the drainage charge will, on the average, more than cover the sums needed to enable the river boards adequately to discharge their new liabilities and some contribution will be made to work on existing main river of the river board. As the areas in which the precept is high are generally rural areas and are often areas in which internal drainage boards make substantial contributions to the river board and where excessive run-off has the most serious consequences, this seems to us equitable. In the Great Ouse area, as an example, the sums collected from the drainage charge may well help to keep within

reasonable bounds the contributions which are necessarily required from internal drainage boards.

Provision for local variation of the drainage charge

84. As we mentioned in paragraph 49, some river boards may take time fully to assume their new responsibilities. Some boards may, as a matter of policy, avoid clearance work on upland watercourses for fear of aggravating lowland problems, and there may be some exceptional river board areas in which there are very few upland watercourses or in which very little work on such watercourses may need to be done. In these circumstances some river boards will require a smaller contribution from agricultural land, and we recommend that they should be empowered to levy a lesser figure than 9d. in the £ of Schedule A value for the fixed part of the drainage charge. There should be a right of appeal to the Minister from any body appearing to him to be substantially representative of agricultural interests against the failure of a river board to exercise this power in the circumstances set out above. We would emphasize that the appeal would lie on general policy grounds alone—not on expenditure in any particular part of the river board area. It would be necessary to bear in mind that the drainage charge forms part of the general funds of the river board, and it would be a defence to a charge of neglect of one part of their area for the board to say that, for the time being, they were concentrating on another part.

Provision for statutory modification of the drainage charge

85. The amount of 9d. in the £ of Schedule A value for the fixed part of the drainage charge, which in paragraph 83 above we have recommended should be generally applicable to river boards, may, in the light of experience, prove to be inappropriate, or may become out of date through a substantial revision of Schedule A values, or may require alteration because of some other material change in circumstances. We therefore recommend that in such circumstances the Minister should be empowered to modify the figure by Order, and that the Order should be subject to an affirmative resolution of each House of Parliament.

Listing of chargeable values

86. It would be necessary for each local authority to draw up a list of the chargeable values of those hereditaments or parts of hereditaments in their area which are not subject to the general or drainage rates, comparable with the list of rateable values already available; and the requirement under Section 10(4) of the River Boards Act, 1948, on councils of counties and county boroughs to supply a statement of the total of rateable values in their areas would be extended to cover chargeable values also. Section 10(1) of the Act would be amended to require the river board to take into account both rateable and chargeable values when apportioning amongst the counties and county boroughs the balance of their expenses not met from other sources. As in the case of precepts under Section 23 of the Land Drainage Act, 1930, so in the case of the drainage charge it would be open to any county or county borough council lying within more than one river board area to average out requirements of different river boards to a uniform rate applicable throughout their local government area.

(iii) CONTRIBUTIONS FROM THE EXCHEQUER

Exchequer grants for capital works

87. We consider that in the majority of cases the varying needs of river boards, over and above the revenue obtainable from the sources which we have discussed above, could be met by varying rates of Exchequer grants for

capital works. We therefore recommend that grants should continue to be paid to river boards under provisions corresponding to Section 55 of the Land Drainage Act, 1930. Unlike the grants to internal drainage boards, which in paragraph 99 we recommend should be at a flat rate, we recommend that Exchequer grants to river boards in respect of capital works of land drainage should continue to vary with the needs and resources of each river board area. It is clear to us, however, that even allowing for high Exchequer grants, for the additional contributions from agricultural land, and for contributions in certain cases from frontagers in respect of particular works, some river boards will, because of the low rateable value of their areas in relation to their commitments, be unable adequately to discharge their liabilities, except by raising to a disproportionately high level their precepts on county councils and county borough councils, with a corresponding increase in the drainage charge on agricultural land.

The case for Exchequer equalization grants

88. As shown in Appendix II, the majority of catchment boards have already found it necessary to exceed the precept of 2d. in the £ which is the maximum they can, under the Land Drainage Act, 1930, levy on the county and county borough councils within their area, without the express consent of the majority of the members representing those councils ; and the average for the country is about 3d. in the £. The limit of 2d. has been raised to 4d. in the River Boards Act, 1948, but it seems clear to us that, having regard to the functions additional to land drainage which are to be placed on river boards, and to the rise in costs since the Land Drainage Act was passed in 1930, this sum does not represent an effective increase on the limit set in the 1930 Act. We have received representations that the limit of 2d. in the Land Drainage Act, 1930, and 4d. in the River Boards Act, 1948, should be raised and we recommend that these amounts should be reviewed when legislation is introduced. This does not, however, appear to us to be a solution to the problem we have set ourselves of placing all river boards in a sound financial position. There may still be some boards which have extremely costly works, e.g., for the protection from tidal inundation of low-lying lands fronting on the sea, which can only be met by raising the precept to a figure well above the maximum laid down in the River Boards Act ; while there will, on the other hand, be boards which, because of the high rateable value of their areas, can keep well within the 4d. precept. Many of the witnesses we have examined have claimed that sea defence works—which have proved to be a heavy burden on some catchment boards—should be a national responsibility, and that the catchment board should act as an agent of the State in carrying out sea defence works, the cost of which should be wholly borne by the State. We consider, however, that where the river board sea defences are an integral part of their drainage responsibilities in connection with the main river they should not be regarded as a separate issue ; and moreover, that it would be inequitable for the local interests, who undoubtedly derive economic benefit, to be relieved entirely of their liability for sea defence. We note that the Coast Protection Act preserves the principle that those who derive particular benefit from public works should make a contribution ; under the provisions of that Act, authorities and persons who are directly concerned with the efficacy of the coast protection works will continue to bear some proportion of the cost. We accordingly recommend that, however small their contribution, the river board concerned should bear some part of the cost of their sea defence work. We feel that this will ensure a proper measure of care and economy in the work done. Exchequer grants of up to 85 per cent. of the cost of capital works carried out in respect of sea defence are already made to catchment boards, but even with this aid some boards

find that their commitments, particularly in respect of annual maintenance works, are out of proportion to their financial resources. Similarly, some river boards will have to deal with special fenland drainage problems involving high annual costs of maintenance. We suggest that provision should be made enabling the needs of the most hardly pressed river boards to be met by Exchequer equalization grants, in addition to grants in respect of specific capital works; but we think that it would seldom be necessary to use this provision.

89. In administering the equalization grant it would be necessary for the State to exercise some control to ensure proper economy in administration and the execution of works. The effect of such grants would be to bridge the gap between the liabilities and financial resources of the river board, after the owners and occupiers of land benefiting directly from the work of the river board, and the wider community benefiting directly or indirectly, had paid their full share. We consider that a general grant-in-aid of this character in cases of proved necessity is preferable to proposals we received for grants in respect of particular classes of work, e.g., maintenance. If grants were made available to all boards in respect of some particular class of work, it might involve unnecessary payments to certain authorities, while still leaving the position of other authorities inadequately covered.

(4) CONSTITUTION OF RIVER BOARDS IN RELATION TO FINANCIAL PROPOSALS

90. We have, in general, avoided making recommendations on issues that were settled by the passage of the River Boards Act, 1948. The proposal for extending the responsibilities of river boards and for raising revenue from agricultural land seems to us, however, to give rise to a special issue in regard to the constitution of river boards. We consider that the constitutional provisions of Section 2 of the River Boards Act should be amended to provide for the appointment by the Minister of Agriculture and Fisheries of persons representing farming interests in the river board area. This would be in line with the principle behind the present constitution of river boards—that those bodies contributing directly to the river board's revenue should be represented on it. The agricultural representation should be in addition to the maximum number of river board members and should be limited to three or four members, the number being determined according to the size of the river board area. The appointments would be made after consultation with and consideration of nominations by such bodies or persons as appeared to the Minister to be representative of farming interests in the river board area.

(5) FINANCING OF INTERNAL DRAINAGE BOARDS

(i) Rates on owners and occupiers

BASIS OF ASSESSMENT OF RATES

91. Work carried out by internal drainage boards, whose districts cover the area which will derive benefit or avoid danger as a result of drainage works, is entirely of local interest and we feel that these drainage boards should be able to recoup their expenses by levying a rate on the owners and occupiers in the drainage district. We have considered suggestions for altering the basis of assessment for drainage rates as between agricultural and non-agricultural property, and have received evidence from many Associations on the question. We have considered the matter very carefully but find no sufficient grounds for suggesting that the present basis of assessment should be altered in this respect. We recommend, therefore, that drainage rates on agricultural land should continue to be at a uniform amount in the £ of gross annual value as

determined for Income Tax purposes under Schedule A of the Income Tax Acts ; and, on any other land, they should be on one-third of the gross annual value. We have also received numerous suggestions concerning rating procedure ; they comprise matters of detail, however, and we have referred them to the Ministry of Agriculture and Fisheries for their consideration when amending legislation is being prepared.

INCIDENCE OF RATES ON OWNERS AND OCCUPIERS

92. We do not overlook the fact that our recommendation in paragraph 45—that river boards should be responsible for carrier watercourses in internal drainage districts—may cause the incidence of maintenance costs of those watercourses to shift from occupiers to owners. At present, the cost of maintaining these channels, in so far as they are not already main river of the catchment board, is met by the internal drainage board from the occupier's drainage rate. When the channels are taken over by the river board, however, the latter may decide to cover some part of their additional expenditure by requiring the drainage board to make a contribution which, under existing legislation, must be wholly defrayed from the owner's drainage rate even where the work is maintenance. Whilst we are of the opinion that the general principle should continue to be that, within an internal drainage district, the cost of new works should fall upon owners and the cost of maintenance upon occupiers, any system under which a river board would be required to make a distinction between costs of capital works and maintenance in relation to the contribution would, we consider, give rise to great practical difficulties and we do not go so far as to propose that this should be done. We suggest, however, that, where there is a departure from the normal apportionment of land drainage costs and the fairness of agreed rent between landlord and tenant is thereby disturbed, there would, *prima facie*, be a case for considering an adjustment of rent.

DIFFERENTIAL RATES

93. Flexibility of the rating system is one of the main factors contributing to the smooth working of an internal drainage board and we have considered the arrangements for the levying of differential rates in drainage districts. We make recommendations on certain aspects of differential rating in paragraphs 109, 116 and 117. We consider that differential rating should be the exception rather than the rule, but that it can be justified where there is a substantial difference in the benefits derived from the internal drainage board's works or in the works problems of different parts of the internal drainage district. We have considered the relative merits of the present system of differential rating and the procedure under the old drainage law of treating sub-districts as separate rating units. This latter method would seem to be appropriate where two or more separate drainage systems are included in a single drainage district, and where the cost of particular works can therefore clearly be allocated to particular sub-districts, or where loan charges should clearly be borne by particular sub-districts : the administrative costs and cost of works which are of equal benefit to the whole district being, of course, spread over the whole area. One of the chief advantages of this method would be that the necessity for a new differential rating order every year or so would be removed. We consider, however, that districts where the allocation of expenses is clear cut are exceptional, and there will be districts where benefit varies widely but where it will not be possible to make a precise allocation of expenses to sub-districts. Apportionment of expenses would have to be made, and in such cases we consider that the present method of making a differential rating order under the provisions of Section 24 of the Land Drainage Act, 1930, would be preferable since it settles the issue of proportions

in one action before the rate is laid. We appreciate that, while the present system of differential rating is on the whole satisfactory, the system of rating by sub-districts could be introduced with advantage in some drainage districts. We recommend, therefore, that internal drainage boards should be able to use either method of differential rating according to which is most suitable for the particular circumstances of their district. Where a differential rating order is based on a precise allocation of expenses to sub-districts, this has, in the past, often resulted in the use of complicated fractions to express the proportions which the rates in the sub-districts bear to each other ; our recommendation that boards might use the alternative method of treating sub-districts as separate rating units will, we hope, render unnecessary the use of such inconvenient fractions. We have also considered the provision in Section 24 for the making of exemption from rating orders. While the occasions for using it arise only infrequently, we consider that in certain circumstances the provision is a useful one and we accordingly recommend that it be retained.

(ii) Financial arrangements in urban areas

94. We have reviewed the provisions of Section 25 of the Land Drainage Act, 1930, under which a rating authority of an urban district may make an agreement with an internal drainage board to pay to them a sum equal to that which could have been collected as drainage rates from that part of the urban area which lies within the drainage district, and we consider that this is a useful provision which, with the modifications we suggest below, should continue to apply. As the effect of such an arrangement is to transfer the burden of the drainage rate to the general rate we consider that, however administratively convenient it might be, the initiative in seeking it must remain with the local authority. Subject to this we recommend that similar provisions should apply to the built-up areas of rural districts ; and it should be made clear in legislation that the arrangement need not apply to the whole of the council's area lying within the drainage district, but may be limited to part only. We are advised that, if the provision is used under present arrangements, the drainage ratepayers in the urban area lose their voting power, and we recommend that this defect should be remedied by providing, in the agreement, for an electoral district to be prescribed for the urban area concerned. The local authority should be empowered to appoint a specified number of members to the drainage board in lieu of election by individual ratepayers. The number of representatives to be appointed by the local authority should, in general, bear the same proportion to the total membership of the drainage board as the amount contributed by the local authority bears to the total drainage rates collected by the board, subject, however, to the limitation that their representatives should number less than half the membership of the board. We further recommend that it should be open to the local authority to decide whether the sum payable to the drainage board is to be recovered as a special rate on that part of the county district which is inside the drainage district, or through the general rate.

(iii) Financial arrangements with river boards

CONTRIBUTIONS BY RIVER BOARDS TO INTERNAL DRAINAGE BOARDS

95. We recommend in paragraph 45 that internal drainage boards should be responsible for drains taking water off land within their districts, and that river boards should be responsible for watercourses taking water through or past their districts. Where this distinction is clear-cut, there will in general be no case for contributions by the river board to the internal drainage board in support of their internal works. Often, however, a drain which is the responsibility of an internal drainage board will also carry a proportion of

highland water from outside the district. In such cases, a payment from the river board to the drainage board should rightly be made in recognition of the fact that the internal drainage board in performing their own functions are also performing functions that belong to the river board.

CONTRIBUTIONS BY INTERNAL DRAINAGE BOARDS TO RIVER BOARDS

96. River boards will frequently do works to provide an outfall for the internal drainage systems ; and will maintain embankments on their watercourses to protect low-lying areas within the internal drainage districts from flooding. In addition, some river boards will maintain pumping stations, the operation of which will benefit the internal drainage district. In respect of these works on watercourses from which the internal drainage district derives particular benefit, a contribution should, as at present in respect of " main river " works, properly be required from the internal drainage board by the river board. On the other hand, some internal drainage boards, in our opinion, have in the past borne an unfair burden in the maintenance of those channels which, under our recommendations in paragraph 45, are now to be the responsibility of river boards. We can see no better method of assessing the contributions required by river boards from internal drainage boards than that contained in Section 21 of the Land Drainage Act, 1930, i.e., such contribution as the river board may consider to be fair.

WORKS BY INTERNAL DRAINAGE BOARDS ON WATERCOURSES PASSING THROUGH THEIR DISTRICTS

97. As we have suggested in paragraph 45, there are circumstances in which it is desirable for an internal drainage board, if they so wish, to carry out works, on an agency basis, on the watercourses passing through their district. We have suggested in paragraphs 87-89 that in certain circumstances there is a necessity for Exchequer grants in respect of river board works, but we indicate in paragraph 99 below that we regard grants in respect of internal drainage works as a matter of expediency rather than necessity. It is important to avoid a position under which the definition as a drain of a channel which should rightly be regarded as a watercourse, or, alternatively, the assumption by a river board of responsibility for a watercourse that should clearly be the concern of an internal drainage board, would give rise to disputes as to the appropriate rate of government grant. The distinction between drains and watercourses must be maintained ; and will be determined when the Minister approves the scheme submitted by the river board on the lines set out in paragraph 47.

INTERNAL DRAINAGE DISTRICTS SOLELY FOR RATING PURPOSES

98. In paragraph 64 we have suggested circumstances in which a river board might choose to retain or establish an internal drainage district solely for rating purposes, and obtain from it a contribution towards the cost of the work of the river board from which the district derives particular benefit. But, as we have shown in paragraph 45, the re-classification as watercourses of channels which are at present the responsibility of internal drainage boards will, in general, relieve many such boards of onerous liabilities for the discharge through their districts of upland water.

(iv) Exchequer contributions

99. If, in the national interest, the Government considers it expedient to encourage internal drainage boards to carry out capital works (and the need for them seems likely to persist) it follows that grant-aid should be continued. We recommend that this should, as at present, be at a flat rate on all capital works and not at a varying rate according to the resources of the drainage district. If the value of the land is not sufficiently increased by improved

drainage to bear the cost of the drainage work with the present rate of Government grant of 50 per cent. (or, in the case of sea defence works, of 75 per cent.) the work will not, generally speaking, be worth while, and there will be no argument for a higher rate of Government grant.

(6) CONSTITUTION OF INTERNAL DRAINAGE BOARDS IN RELATION TO FINANCIAL PROPOSALS

100. It has been represented to us that members of internal drainage boards should be appointed by the Minister of Agriculture and Fisheries, local authorities and river boards rather than be elected, but we are unable to accept this view. We have recommended in paragraph 91 above that the cost of work carried out by internal drainage boards should continue to be met by the owners and occupiers within the internal drainage district and therefore we consider that the elective principle, which in general is working satisfactorily, should be preserved.

Chapter V.—Review of Powers and Obligations of Authorities and Persons in Relation to Land Drainage

(1) GENERAL

101. In this Chapter we review drainage powers and obligations generally, and in Chapter VI we discuss the relationship between drainage and other interests. Many of the suggestions for amendment of the various Sections of the Land Drainage Act, 1930, which have been placed before us, are of a detailed nature. We have considered fully the helpful comments made to us by the Catchment Boards Association, the Association of Drainage Authorities and other bodies but have not sought to deal with these detailed matters in our report. We have instead referred them to the Ministry of Agriculture and Fisheries for consideration, in consultation with the interested parties, when amending legislation is being prepared. We have already, in paragraph 91, referred to rating procedure ; and a further example is election procedure. The present election procedure has proved, in practice, to be cumbersome in some respects. We recommend that the Ministry should, before legislation is introduced, and in consultation with the bodies concerned, devise a simplified system, taking into account the experience of the past 20 years and the detailed suggestions placed before us by the Association of Drainage Authorities.

102. It was clearly the intention of the Land Drainage Act, 1930, that the law relating to land drainage and its administration should be brought into conformity with the provisions of the Act through the submission of proposals by the different catchment boards. We find that this intention has only partially been realized and we have considered how best to speed up and complete the process. We have already made recommendations in paragraphs 52 to 55 about certain miscellaneous authorities whose powers should be ended by a direct provision in the new Act itself and not by relying on the making of schemes thereunder ; but it is also necessary to consider the position of drainage boards constituted before the Act of 1930, and also the customary obligations resting on individuals to do drainage works. The latter obligations are discussed in paragraph 111 below.

Powers in local Acts

103. Many drainage boards have general powers under local Acts for matters for which provision is also made in the Land Drainage Act, 1930, and which are applicable to them, e.g., provisions relating to the recovery of rates, borrowing, the acquisition of land, powers of entry and the making of byelaws. We consider that the continuance of separate local Act provisions on such general matters is an anachronism, and that new legislation should contain a provision that any such general provisions contained in a local Act should cease to have effect so far as land drainage is concerned, as they will be replaced by the provisions of the principal Act.

(2) POWERS AND OBLIGATIONS OF RIVER BOARDS

(A) Powers of an administrative character

(i) POWERS IN RELATION TO DRAINAGE BOARDS ESTABLISHED BEEORE 1930

Review of constitutions

104. The Royal Commission recommended in paragraph 83 of their report that " all Internal Drainage Authorities should have their constitution amended to conform in respect of membership with the general drainage law for the time being in force in relation to elections ". Section 4 (1) (b) (vii) of the Land Drainage Act, 1930, requires a catchment board to make such provision where it appears to them desirable. There are still in existence many pre-1930 boards of which the membership is wholly or in part by appointment. It has been suggested that it would be more in accordance with modern ideas for all rating authorities to be elective, although it is also fair to note that we have had no evidence of any dissatisfaction felt by ratepayers in non-elective districts. We accordingly limit ourselves to drawing the attention of river boards to their powers of reconstituting drainage boards on an elective basis and recommending that this action should certainly be taken by the river board, or if necessary by the Minister, if there is evidence among the ratepayers of any real feeling of dissatisfaction with the internal drainage board.

Review of boundaries

105. The districts of internal drainage boards operating under local Acts have in many cases not been re-defined in accordance with the modern conception of benefit area as interpreted by the " Medway letter ". We recommend in paragraph 109 below that the boundaries of all internal drainage districts should be subject to review by river boards at regular intervals, and we suggest that river boards should in the first period pay particular attention to the boundaries of internal drainage districts which have never been the subject of a scheme under Section 4 (1) (b) (i) of the Land Drainage Act, 1930.

Special case of the Middle and North Level Commissioners

106. The Middle and North Level Commissioners, who are constituted under local Acts, and who derive some of their powers from these Acts, occupy a unique position in the land drainage administration of this country. They are responsible for the principal drainage works in very large areas in the Fens in which the drainage systems are of paramount importance. Not only are the Commissioners' areas internal drainage districts in themselves for the purposes of the Land Drainage Act, 1930, but they also comprise within them many internal drainage districts administered by boards whose interests and systems of drainage are largely dependent on those maintained by the Commissioners. These two authorities have over a period of many years built up highly efficient drainage systems, and the evidence we have received has

unanimously been against making fundamental changes in the drainage administration in these areas. With these views we are in agreement. We recommend, however, that in common with other drainage boards deriving powers under local Acts, any provisions in their local Acts for such general matters as recovery of rates, borrowing, acquisition of land, powers of entry and the making of byelaws, should be replaced by the corresponding provisions in the general legislation.

(ii) POWERS IN RELATION TO INTERNAL DRAINAGE BOARDS GENERALLY

Supervisory and default powers of river boards

107. River boards will have general supervisory powers over the drainage of their areas. There should be close working co-operation between them, their internal drainage boards and County Agricultural Executive Committees, particularly regarding works at or near to the points where areas of responsibility join. We see no reason for making any material change in the existing relationship between the river board, as successor to the catchment board, and their internal drainage boards. River boards should retain the supervisory powers of Section 7 of the Land Drainage Act, 1930, and also the powers of Section 11 to assume, in appropriate cases, under an order of the Minister, the functions of any internal drainage board. We suggest, however, that the latter power should only be invoked after the river board have exercised to the full their powers under Section 7 of the Act, and directions for guidance of the internal drainage board have been persistently ignored. It does not appear that the powers of Section 10, which enable river boards to carry out works in default, have been very much used, and it seems to us that, if matters have reached a state in which the exercise of such default powers must be contemplated, it would be better to proceed under Section 11. We suggest, therefore, that the new legislation should not include any power enabling the river board to carry out works in default.

Supervision by river boards of the elections of internal drainage boards

108. Elective drainage boards sometimes fail to hold their elections at the appropriate time ; this rarely occurs but each occurrence usually gives rise to serious legal and administrative difficulties, with the result that the work of the board is brought to a standstill until their constitutional position has been regularized. The procedure for doing this is involved and may be very protracted. We accordingly recommend that internal drainage boards should notify the river board at the various stages in the procedure for holding their elections. Where, in spite of the supervision of the river board, an election is not held at the appropriate time, the Minister should be empowered under a simple procedure to extend the life of the existing board for a period not exceeding one year to allow time in which to place the administration of the drainage district on a satisfactory footing. Similarly, in the case of a newly appointed board who may not have had sufficient time before the expiry of the period of office to prepare the Register of Electors and Rate Book for the district, the Minister should be empowered, at the request of the internal drainage board and after consultation with the river board, to extend the period of office of the board for a further period not exceeding one year.

Provision of safeguards for drainage ratepayers

109. Experience has shown that the existing legislation might with advantage be strengthened in the following respects with a view to ensuring the remedy of legitimate grievances voiced by substantial groups of owners and occupiers within an internal drainage district.

(*a*) Controversies often arise regarding the boundaries of internal drainage districts and here, as at present, the river board should have power to put forward to the Minister a scheme proposing amendments. Pressure for amendment comes most frequently from areas parts of which have become built-up since the boundaries of the district were first delineated. We take the view that persons who develop land within an internal drainage district do so in full knowledge of the fact that the property will be subject to drainage rates ; and that there is no ground for frequent alteration of boundaries as and when development takes place. None the less, when an area within an internal drainage district, but above flood level, has become substantially built-up, it will generally be reasonable that it should, in course of time, become excluded from the district. We recommend, therefore, that the boundaries of internal drainage districts should be subject to review by the river board at intervals of, say, ten years, when special opportunities would be given to owners and occupiers to make representations to the board that the boundary of the drainage district should be re-delineated in accordance with the terms of the " Medway letter " to allow for changes in circumstances such as those mentioned above. For administrative convenience, the timing of the periodical reviews of the different internal drainage districts in one river board area should be staggered. The periodical review would not, of course, preclude action by the board in the intervening period. Orders providing for altering the boundaries of internal drainage districts are subject to the approval of the Minister. Nevertheless the initiative in re-drawing boundaries should rest with the river boards and we do not contemplate any general failure on their part to exercise this power fairly. We recognize, however, that river boards may sometimes be in a difficult position, being called upon to decide whether to initiate action when their own interests are involved. We recommend, therefore, that there should be a right of appeal to the Minister against any decisions given by the river board in connection with the periodical reviews ; and if the Minister decided there was a *prima facie* case for considering a revision of boundaries he should, after making such local enquiries as he thought necessary, be empowered to require the river board to take the appropriate action.

(*b*) We are of opinion that differential rating by internal drainage boards is an important factor in facilitating extensions of existing districts and amalgamations of neighbouring districts that may be desirable in the general interests of the drainage ratepayers, and we recommend that river boards should be empowered to include provision for differential rating in schemes promoted by them for the establishment or re-organization of internal drainage districts under Section 4 (1) (*b*) of the Land Drainage Act, 1930. It would, however, be necessary to make such provisions subject to amendment by the internal drainage board at any time after their first election. We make further recommendations on differential rating in paragraphs 93, 116 and 117, and the procedure recommended in paragraph 116 would be applicable to any such amendment by the internal drainage board.

(*c*) When the functions of an internal drainage board are taken over by the river board under Section 11 of the 1930 Act, the elected board goes out of existence. Hence, not only do the drainage ratepayers lose control through elected members over the amount of the rates levied in the internal drainage district ; but also they can no longer avail themselves of the provision in Section 21 (5) of the Act for appeal against contributions required from them by the river board. This seems to us to be a defect in the Act ; and we therefore recommend that the river board should be required to publish locally the contributions required by them from the internal drainage district and that it

should be open to owners in the internal drainage district, representing not less than one-fifth of the total annual value of the area, to present a petition to the Minister against the amount of any contribution. In respect of rates levied to meet the cost of works on drains which are carried out by the river board in their capacity as internal drainage board, there should be no right of appeal beyond that available to individual drainage ratepayers generally ; but a representative body of drainage ratepayers should have power to petition the Minister to revoke the Section 11 order and re-establish an elective drainage board.

(*d*) Where, under our recommendations in paragraph 64, a river board retain or create an internal drainage district for the purpose of collecting a contribution in respect of drainage works which are of vital concern to the district, we recommend that the contribution from the district should be regarded as a contribution demanded under the provisions of Section 21 (1) of the Land Drainage Act, 1930, and that the owners in the district should be allowed the same right of appeal against the contribution as is recommended in the preceding sub-paragraph when similar contributions are demanded from internal drainage districts taken over by a river board under Section 11 of the Act.

(iii) POWERS OF RIVER BOARDS IN RELATION TO RIPARIAN OWNERS AND OCCUPIERS AND OTHER PERSONS

Enforcement of byelaws

110. Riparian owners and occupiers should be placed under an obligation not to damage or endanger any watercourse or works for which the river board are responsible, e.g., by permitting obstructions in the watercourse, allowing stock to tread in the banks to their detriment, or causing or permitting any other form of damage. They should also be placed under an obligation not to do anything that might seriously impede the board in the exercise of their statutory functions. In so far as it is necessary to enforce these obligations by byelaws, we call attention to the fact that the present statutory provisions for dealing with a breach of a byelaw made by a drainage board, i.e., a fine, including a continuing fine on conviction, have not always been effective, and we consider that they should be strengthened. Some persons convicted of breaking a byelaw may find that it is in their interests to act in default and pay a continuing fine rather than make good the damage, and the drainage board have no power under present legislation to carry out and recover the cost of the work necessitated by the offence. We suggest that where a person has been convicted of a breach of a byelaw, the drainage board should be entitled to serve on him a notice requiring him to remedy the position within a specified time, failing which the board should themselves be entitled to recover from that person the reasonable cost of the work carried out by them in his default. In certain cases it is necessary to take immediate action against the damage arising or likely to arise from the contravention of a drainage board's byelaw and where such an emergency arises we consider that the board should remedy the damage forthwith, and be entitled to recover the reasonable cost thereof from the offender. In order to prevent this power from being abused it should be made conditional on the board that they should at the same time take proceedings under the byelaws ; and that, if they lose their case, they should themselves meet the cost of the work.

Customary obligations of private persons

111. In paragraph 54 we have made certain recommendations about obligations resting on authorities and persons by virtue of enactments ; there remain the obligations resting on persons by reason of tenure, custom and

prescription. In relation to watercourses and drains for which responsibility is assumed by a drainage authority, we recommend that the latter obligations, in so far as they relate to the execution of drainage works, should cease and should be replaced by those obligations on owners and occupiers recommended in paragraph 110 above together with those recommended in paragraph 121. These requirements will also replace the statutory obligations contained in Section 35 of the Land Drainage Act, 1930 ; and the powers of Sections 57, 58 and 59, which provide the machinery to overcome difficulties arising from the failure on the part of a private person to co-operate in the construction and maintenance of essential channels in his area will, if our recommendations in paragraph 121 below are adopted, become unnecessary. Customary or other obligations in relation to structures in or adjoining the watercourse or drain should, however, be retained or should be subject to commutation. If this view is accepted, Sections 9 and 37 of the Land Drainage Act, 1930, will need to be modified. Where a power to enforce obligations of this character has already been transferred to a catchment board or river board, it should not be disturbed.

(B) General powers and obligations of River Boards in relation to drainage works

112. Whilst river boards will assume responsibility for substantial additional lengths of watercourses over and above those at present marked as main river, no obligation to carry out works on all of those watercourses will rest on the river board. Many of the watercourses will be largely self-maintaining. The extent to which works are carried out on any particular watercourse will be at the discretion of the river board and the board will, as under the Land Drainage Act, 1930, not be liable for non-feasance. We do not consider it would be practicable in a matter such as drainage, where there is so much scope for difference of opinion as to what works are reasonably necessary, to make the river board liable for neglect to use their permissive powers. In respect of certain classes of watercourses, e.g., canals, etc., the board's power to do works is usually limited by statute. We consider that the protection contained in Section 61 of the Land Drainage Act, 1930, should with modifications continue to apply, and in Chapter VI we recommend what modifications seem to us to be desirable. It is reasonable to expect that river boards will exercise their full powers in respect of the additional lengths of watercourse brought under their jurisdiction and in respect of which they will receive additional revenue in accordance with our proposals in Chapter IV ; but that they will exercise them with due regard to the interests of other authorities and persons concerned with each watercourse, and in consultation with them where appropriate.

113. Stated in general terms, the land drainage functions of the river board are to keep all watercourses under their jurisdiction in a condition to take the drainage from the neighbouring lands and afford a safe passage of surplus water to the sea ; and to maintain in good condition all drainage works on or adjacent to the watercourses or their flood channels, including flood embankments and sea defence works. Should the river board fail to exercise their land drainage functions, default powers are available to the Ministers under the provisions of Section 22 of the River Boards Act ; but we see no reason to think that occasion for their exercise will arise.

114. We consider that the general powers of river boards contained in Section 34 of the Land Drainage Act, 1930, to carry out works will, so far as they are applicable, be adequate for the exercise of their land drainage functions. In Chapter VI we deal with the powers of river boards in regard to structures in watercourses and the deposit of spoil. We recommend, however, that river boards should be given powers, similar to those possessed by internal drainage

boards under Section 39 of the Land Drainage Act, 1930, to execute works outside their area with the consent of the river board of the area concerned when these are necessary for the performance of their land drainage functions. This power will be exercised particularly in relation to boundary embankments to which we refer in Chapter VI. Under the provisions of Section 16 of the River Boards Act, 1948, river boards have adequate powers of entry to discharge their land drainage functions. We have considered representations, which were occasioned by the 1947 floods, that in times of emergency river boards' powers are inadequate and that special emergency powers should be vested in the Minister ; but we consider that to draw up a set procedure for use in time of emergency is more likely to have the opposite effect to that desired. We accordingly endorse the line taken by the Government during the passage of the River Boards Bill—that full responsibility and freedom of action should remain with the river boards who have adequate powers to carry out the necessary work, and that, as in the 1947 floods, the Government should help as much as possible by administrative action.

(3) POWERS AND OBLIGATIONS OF INTERNAL DRAINAGE BOARDS

(A) Powers of an Administrative Character

115. We have indicated in paragraph 19 the conditions that appear to us necessary for the efficient functioning of an internal drainage district. They are that the district should comprise an area with a drainage problem that is largely localized, and that it should be compact and self-contained with an area of benefit from drainage works that is reasonably large in relation to the length of the drains, embankments, pumping stations and other works to be maintained. In addition, the district should be large enough and have sufficient resources to provide for the services of a competent clerk and engineer, and to this end self-contained districts could often, with advantage, be amalgamated to form a larger district. As an alternative to the amalgamation of drainage districts, it might be convenient, as at present, for neighbouring boards to share the services of a clerk and engineer so that those officers, even if not full-time, would be employed for a considerable part of their time on drainage work and would thus acquire specialized knowledge. There is no doubt that, in the past, some upland watercourses and the areas drained by them, which do not fully comply with the criteria set out in this paragraph, have been brought within internal drainage districts because the 1930 Act contained no other suitable machinery to secure their regular maintenance. The recommendations we have made regarding river board jurisdiction will mean, if they are adopted, that it will no longer be necessary to apply the internal drainage board procedure to such upland areas, for which it was not primarily designed and to which it is not suitable.

DIFFERENTIAL RATING

116. In paragraph 93 we considered the circumstances in which differential rating within an internal drainage district would seem to be justified, and proposed two methods of levying such rates : either by expressing the rate in each sub-district as a proportion of the full rate, or by treating sub-districts as separate rating units. It has been represented to us that the existing differential rating provisions are too rigid, with the result that sections of ratepayers sometimes suffer injustice against which they have little or no remedy. Under present legislation, the initiative to rate differentially rests solely with the internal drainage board ; further, a differential rating order requires confirmation by the Minister, who has power to confirm or reject, but not to amend. Consequently it may happen that a differential rating order, to which

there are valid objections on the ground that it does not go far enough, is confirmed because that course offers a partial solution to the problem whereas total rejection offers none. We therefore recommend that persons representing a substantial interest in the drainage district should have the right to petition that the district should be differentially rated : or, if a differential rating order is already in force in the district, that they should have certain rights of appeal, exercisable at any time after two years from the date of the order. In the " proportion " type of order, the appeal could be against the proportions as well as against the areas of the sub-districts to which the proportions apply ; in the " sub-district " type, where a separate rate is levied on each sub-district, it could only be against the areas of the sub-districts, as no appeal against the rate poundage can be made. These rights of appeal would be additional to the rights of representation before confirmation of an order, conferred by Section 24 (8) of the 1930 Act. We have considered the appropriate authority to confirm differential rating orders. As rating affairs should normally be a matter within the discretion of the responsible local authority, and since the terms of a differential rating order are based solely on local factors, we consider that the river board, by reason of their local knowledge and experience, are fully competent and may be relied upon to make a fair assessment of what the apportionment of the drainage rate throughout the internal drainage district should be. We therefore recommend that in future the river board should be given the task of approving differential rating orders and considering the appeals referred to above, except in a case where the river board themselves are acting in the capacity of an internal drainage board, when the decision should rest with the Minister. There should be power on considering an appeal for the river board themselves to make such differential rating order as they considered necessary in default of action by the internal drainage board, or to direct the internal drainage board to prepare a further order on lines laid down in the direction.

117. Where differential rating exists, we consider that it would often be advantageous to establish electoral districts. We consider that the representation of electoral districts on the internal drainage board should not be based solely on either annual value or on acreage, but that an apportionment, in which both factors should be taken into account, should be made. In districts in which there is no differential rating the constitution of electoral districts should be at the discretion of the internal drainage board. In paragraphs 93 and 109(*b*) we discuss certain other matters affecting the differential rating powers of internal drainage boards.

(B) General powers and obligations of internal drainage boards in relation to drainage works

118. The function of internal drainage boards will be to keep the drains in their areas in good condition, and to execute and maintain such works as are necessary for the drainage of land and the prevention and control of flooding in their districts. On the drains for which they are responsible they should exercise the same byelaw powers and other measures of control as are recommended in relation to river boards in paragraphs 110 to 112 above. The extent to which works are carried out on any particular drain will be at the discretion of the internal drainage board and, as under the Land Drainage Act, 1930, they will not be liable for non-feasance. However, should they fail to carry out their functions adequately, the river board may in the last resort and under an order of the Minister assume their functions under the procedure recommended in paragraph 107 above.

119. We consider that the general powers of internal drainage boards to execute works, contained in Section 34 of the Land Drainage Act, 1930, will,

so far as they are applicable, be adequate for the exercise of their functions. Under the existing legislation they have the same powers of entry to perform their functions as catchment boards. Since, however, catchment boards will eventually be superseded by river boards, who have more adequate powers of entry under Section 16 of the River Boards Act, 1948, we recommend that internal drainage boards should be given powers of entry similar to those of river boards.

120. It will be seen that we recommend little change in the general powers of internal drainage boards ; and we expect little extension of their areas since we have rejected any solution of the problem of the lesser watercourses that would involve an extension of the areas of internal drainage districts. Certain Associations have recommended drastic changes in the provisions for dealing with internal drainage. The Rural District Councils' Association in particular, on the grounds that the whole trend of modern legislation is against the imposition of special charges for special purposes, advocated a widespread abolition of drainage rating and the spreading of the costs of internal drainage over the whole river board area. The Association recognized, however, the existence of certain special localized problems in respect of which a special charge, e.g., to meet the cost of a pumping station, might be reasonable. In our view, the majority of existing internal drainage districts comprise just those localized benefit areas which the Association had in mind.

(4) OBLIGATIONS OF RIPARIAN OWNERS AND OCCUPIERS

121. In relation to all ditches, including woodland ditches comparable with farm ditches, the responsible occupier should, in addition to the requirements of the rules of good husbandry so far as his own land is concerned, be placed under an obligation towards his neighbours comparable with that imposed by Section 35 (1) of the Land Drainage Act, 1930. But this provision has in practice proved defective, since it can only be invoked when obstructions to a watercourse have actually arisen, whereas what is needed is adequate maintenance to ensure that obstructions do not, in fact, arise. Moreover, the procedure for securing enforcement has proved in practice to be unduly cumbersome. Enforcement has largely rested in the hands of county councils, and we have proposed that they should cease to exercise land drainage functions. We accordingly propose a new and more positive obligation in regard to this particular class of fixed equipment, and a procedure for enforcement by County Agricultural Executive Committees comparable with that available under the Agriculture Act, 1947. Our suggestion is that the obligations of owners and occupiers under the rules of good estate management and good husbandry respectively (as defined in Sections 10 and 11 of the Agriculture Act, 1947), which relate to the management and farming of their own land, should, in relation to the ditches passing by or through their land, be supplemented by new obligations to maintain or repair them in such a way as to avoid damage arising to neighbouring land. These obligations would replace those contained in Section 35 of the Land Drainage Act, 1930. They would be enforceable by the County Agricultural Executive Committee under a procedure identical with that of Section 14 (3) of the Agriculture Act, 1947. The provisions of Section 106 of that Act, giving powers of entry to the Committees, and the provisions of Section 15, giving owners and occupiers concerned an opportunity to make representations to the Minister on proposals to issue directions in appropriate cases, and, where the direction involves the provision of fixed equipment, giving the persons concerned (in the circumstances set out in sub-section (2)) the right of appeal to the Agricultural Land Tribunal, should also apply. The decision as to whether a direction should be served on the owner or occupier would rest, as at present under the Agriculture Act, 1947,

with the County Agricultural Executive Committee, the owner or occupier having their normal rights at Common Law if they consider the direction to be *ultra vires*. The responsibility as between owner and occupier would be governed by their tenancy agreements or, in the absence of any reference in such agreements, by the regulations made under Section 37 of the Agriculture Act, 1947, to which we refer in paragraph 25. Where a ditch forms the boundary between two holdings the legal responsibility for its maintenance may rest on either or both of the occupiers. We envisage that the powers we suggest will be used, where necessary, to secure co-operation in joint proposals for works or maintenance on ditches serving more than one holding. It is also necessary to ensure adequate protection of ditches and, as is proposed in paragraphs 110 and 118 above in relation to the watercourses and drains of drainage authorities, so also in relation to ditches should there be an obligation on the occupier not to damage ditches passing by or through his land by permitting obstructions, permitting stock to tread in the banks or causing or permitting any other form of damage to agricultural land or drainage systems. This obligation should apply whether or not the occupier concerned is generally responsible for keeping the ditch clear, since a ditch is very frequently the boundary between two adjoining holdings.

122. To ensure that the administrative arrangements proposed in the foregoing paragraph will operate effectively in practice, we would stress the importance of making available to owners and occupiers an efficient works service. The Ministry of Agriculture and Fisheries and its County War Agricultural Executive Committees and their successors have, over the past 10 years, built up a valuable body of technical knowledge and experience on farm drainage matters and methods of dealing with lesser watercourses, on which the effectiveness of farm drainage systems largely depends. The Ministry owns and operates, through its Committees, a considerable quantity of specialized drainage machinery. We hope that this service will be continued and also that contractors will be encouraged to provide labour and machinery. We believe that in many cases drainage authorities may wish to use these services on a contract basis and help to secure that continuity of work which is necessary for economic operation. We recommend that where drainage authorities have the local organization to meet the requirements of farmers they should be empowered to do work on farm ditches on a repayment basis. There is no doubt that an efficient works service is, in many areas, essential for the adequate maintenance of farm ditches and is, in general, the key to the administrative provisions we propose.

Chapter VI.—Drainage Works in Relation to the Interests and Works of Other Persons and Authorities

123. We have dealt in previous chapters with what we consider should be the main powers and responsibilities of river boards and internal drainage boards (referred to collectively as drainage boards). It remains for us to consider how their work fits into the general pattern of local administration and what further alterations or additions to their powers are desirable to provide a fair basis for co-operation with other persons and authorities. From the many suggested amendments to land drainage legislation which have been collected for us by the Ministry of Agriculture and Fisheries, and on which we have obtained the views of the Associations mainly concerned, we have found that

the work of drainage boards in relation to the work of other persons and authorities requires review in the light of the trend of modern legislation. In this chapter we make recommendations on the more important issues, which are designed to ensure the smooth administration of the work of drainage boards while at the same time recognizing the rights and obligations of individuals and bodies affected by their work.

(1) STRUCTURES IN WATERCOURSES AND DRAINS

124. We have made certain recommendations in paragraph 110 above about the obligation of riparian owners and occupiers to keep watercourses and drains clear of obstruction (e.g., fallen trees, treading in the banks by stock, etc.). We review here the provisions in land drainage legislation relating to structural works which are likely to affect the flow of water in watercourses and drains, and the protection afforded to certain statutory authorities against damage or interference from the works of drainage authorities. The provisions in question are :

Section 44 of the Land Drainage Act, 1930, as extended by Section 16 of the Agriculture (Miscellaneous War Provisions) Act, 1940, and

Section 10 of the Agriculture (Miscellaneous Provisions) Act, 1943—relating to dams, weirs and like obstructions.

Section 64 of the Act of 1930—relating to the construction of bridges over the " main rivers " of catchment boards.

Section 17 of the Act of 1940 and Section 10 of the Act of 1943—relating to control of sluices.

Section 61 of the Act of 1930 under which protection is afforded to certain statutory authorities.

We have not thought it necessary to deal with each of these provisions separately (except to refer to them by way of illustration), but our consideration of them, and the suggestions and evidence placed before us in regard to them, have led us to recommend, in the paragraphs which follow, certain principles which we suggest might form the basis of new legislation.

125. We are advised that the provisions of the Acts regarding dams and like obstructions in rivers apply only to structures which extend across the full width of the river. Further, it seems clear that the provisions of Section 64 of the Act of 1930 relate only to the construction of new bridges and not to the reconstruction or alteration of existing bridges ; moreover, they apply only to the main river of catchment boards.

It is our intention that the principles we suggest below should apply

(*a*) to the drains of internal drainage boards as well as to the watercourses of river boards ;

(*b*) to the reconstruction or alteration of existing structures which affect or may affect the flow of water in watercourses and drains, as well as to the erection of new structures ;

(*c*) to any such structures, including those which do not extend across the whole width of the watercourse or drain ;

(*d*) to any structures other than fences (which could if necessary be dealt with by byelaws) on land adjacent to the watercourse or drain which are likely to impede drainage operations.

126. So far as new developments are concerned, we would lay down the general principle that, on the one hand no person or body of persons should erect or operate a structure or carry out developments in such a way as to

damage existing interests and that the cost of ensuring that no damage is caused should properly be a charge on the developer ; on the other hand, where damage is inevitable and proved, compensation should be paid.

127. Under certain recent enactments (e.g., the Water Act, 1945) various statutory authorities are already under an obligation to notify drainage authorities of any project to erect or alter structures in watercourses. Apart from any statutory provisions of this character, no authority or person should erect a structure in or affecting a watercourse or drain without giving notice thereof to the river board or internal drainage board. As far as the drainage boards are concerned, whilst we do not think a statutory obligation to consult with the numerous interests who are or might be affected by a particular work would be practicable, we consider that drainage boards should develop their projects in the fullest consultation with the interests likely to be affected. Twenty years' experience of the work of catchment boards shows that they do, in fact, proceed in this way. We regard this as necessary because it is most important that there should be the fullest exchange of views between the parties on any proposals, particularly at the formative stage. We consider that by co-operation of this kind the respective interests of the parties can best be reconciled and difficulties overcome and that it should seldom be necessary to bring compulsory powers into play. We recognize, however, that there may be occasions when it is expedient in the national interest that the works of statutory undertakers should be carried out, or should remain undisturbed, as the case may be, despite the fact that drainage interests may be adversely affected ; on the other hand, cases may arise in which the drainage interest is paramount. We therefore consider that neither party should be in a position to place an absolute bar against the proposals of the other, but that there should be provisions for appeal as to whether the work should proceed. Under the provisions of Section 61 of the Land Drainage Act, 1930, drainage boards, before carrying out drainage works which may injuriously affect the works or operations of certain statutory undertakers, must obtain the consent of those undertakers. Any dispute under the Section as to whether particular works would injuriously affect the interests of the statutory undertaking is referable to arbitration. We consider that protection of these authorities should continue on the modified basis suggested in paragraph 128 below and might indeed extend equally to all statutory authorities (e.g., highway authorities), with the provision for determining in particular cases whether proposed drainage works should go ahead even though the interests of statutory authorities are affected.

128. We recommend the following procedure for the settlement of difficulties which cannot be resolved by negotiations between the parties :—

Whether the matter in dispute is either the implementation of

(*a*) a proposal to erect, reconstruct, alter or remove a structural work which is likely to affect the flow of water in a watercourse or drain, or impede the operations of a drainage board, or

(*b*) a proposal of a drainage board which is likely to affect the interests of another authority or person

and the party, other than the drainage board, is a statutory authority, it should be referable for final settlement to Ministers concerned ; and, in any other case, to the Minister of Agriculture and Fisheries. The Ministers or Minister, as the case may be, should have powers to refer technical or financial issues to arbitration.

129. Subject to the general suggestions we have made in paragraphs 125 to 128 above, we set out below certain principles for consideration in connection

with the new legislation which should prevail over any existing statutory provisions to the contrary.

(A) Works of drainage boards

130. We recommend that a drainage board in carrying out their work should, as far as possible, avoid damage to the works or interests of any body or person. The drainage board should not, however, be prevented from executing necessary works because by doing so they might damage existing interests. Where damage by the board is proved they should pay compensation.

(B) Works of other authorities or persons

(i) NEW STRUCTURES OR THE RECONSTRUCTION OR ALTERATION OF EXISTING STRUCTURES AFFECTING WATERCOURSES AND DRAINS

131. We make the following recommendations :—

(*a*) No authority or person should, without the previous consent of the drainage board concerned, erect a new structure or reconstruct, alter or remove an existing one in, over or under a watercourse or drain or on adjacent land, so as to impede the operations of a drainage board.

(*b*) If an authority or person takes such action without first obtaining consent, the drainage board should be empowered to require the authority or person by whom the work was done to remove it or to remedy the injury to land drainage and meet the cost ; and the drainage board should be empowered to recover the cost of any such work which they deem necessary to carry out in default.

(*c*) Where an authority or person is put to extra expense in carrying out work on a structure in such a way as to obviate injury to existing land drainage interests the extra cost should be borne by that authority or person ; any requirements of a drainage board over and above what is necessary to obviate injury to existing land drainage interests (e.g., requirements in anticipation of drainage improvement works) should be complied with, but the extra cost arising from such additional requirements should be paid for by the drainage board. Thus, if the supports of a proposed new bridge would restrict the flow of water, the drainage board would be entitled to ask for the plans to be altered to allow normal flow, without cost to themselves. If, however, the proposed bridge would not restrict the flow but the drainage board wished the supporting pillars to be set back to comply with their own plans for a future improvement scheme, the developer should comply with the wishes of the board, but the board should meet the extra cost. Similarly, in the case of reconstruction of a bridge on the old pillars, if the board insist upon a single span instead of double span in order to get rid of the pillar in the channel, the extra cost involved should fall on them.

(*d*) Where an existing structure is causing or threatening damage to land drainage and it has not been possible by negotiations to effect a remedy, the drainage board should be empowered either to give notice to the owner of the structure to take such steps as are necessary to stop the injury or threat to land drainage, or to execute the work themselves.

(*e*) The cost of any work carried out on a structure under (*d*) above should be borne by the drainage board, unless it can be shown that the structure was defective, from the point of view of land drainage, at the time it was constructed, in which case the board should be

empowered to require a contribution from the owner. The owner might also reasonably be required to make a contribution, where the work incidentally benefits him, or where he has asked the board to carry out the work in such a way as to improve the structure from his own point of view. Where a structure is removed or rendered less effective, the drainage board should be liable to pay compensation based on the then existing value.

(*f*) Liability for the maintenance of a structure which has been improved under these arrangements should remain that of the person in control of it, but where the cost of the maintenance has been increased by the improvement, the drainage board should make a contribution towards the increased costs. That should, however, be the limit of the drainage board's liability : they should not, for example, be held liable for the subsequent security of the structure.

Thus, under (*e*) and (*f*) above, if a culvert belonging to, say, the Railway Executive of the British Transport Commission has become inadequate for drainage purposes (because of natural causes, e.g., the shrinkage of land, or because the standard of drainage has improved since the culvert was built, or because the drainage board wish to change their drainage system), but is adequate for the Executive's requirements, it ought to be possible, subject to the appeal procedure we have suggested, for the drainage board to arrange with the Executive to do the reconstruction work. Assuming that the improvement in the structure was limited to drainage requirements the drainage board would bear the cost of the improvement, but liability for the subsequent maintenance would remain with the Executive ; but if the cost of maintenance had been increased by the improvement the drainage board could be required to make a contribution towards such increase. This would, however, be the limit of the drainage board's liability; they would not, for example, be held liable for the subsequent security of the embankment through which the culvert passes. Where the Executive, in reconstructing the culvert to comply with the wishes of the drainage board, take the opportunity to reconstruct the culvert in a special way to meet their own requirements, e.g., to allow room for a man to pass through the culvert, and this involves higher cost than is necessary for land drainage purposes, they should take this fact into account in assessing the charge on the drainage board. If it can be shown that the culvert was defective at the time it was constructed some liability should rest on the Executive. If injury to drainage interests is due to failure to repair the culvert, the Railway Executive would be liable for the cost of repair under sub-paragraph (ii) below.

(*g*) Where a drainage board are unable to secure the removal or alteration of a structure owing to the provisions of a local Act the board should be given the power to submit a scheme for altering the provisions of the local Act. Provision would have to be made for advertising the scheme, for the receipt of objections from persons aggrieved by it and, if necessary, the holding of a public local inquiry. The scheme should be subject to confirmation by order of the Minister and the special parliamentary procedure should apply.

(ii) REPAIR OF STRUCTURES

132. Where a structure is causing or is likely to cause damage to land drainage interests because it is in need of repair, we recommend that permanent provisions, similar to those contained in Section 16 (1) of the Agriculture (Miscellaneous

War Provisions) Act, 1940, as amended by Section 10 of the Agriculture (Miscellaneous Provisions) Act, 1943 (relating to dams and sluices) should apply to enable the drainage board to secure the proper repair and maintenance of the structure at the expense of its owner.

(iii) CONTROL OF STRUCTURES

133. Where the appropriate remedy for damage caused by a structure in a watercourse or drain is to regulate its use, we consider that the responsiblility for securing that the structure is properly regulated should be on the person having control of it. Provisions relating to the control of sluices similar to those contained in Section 17 of the Agriculture (Miscellaneous War Provisions) Act, 1940, as modified by Section 10 of the Agriculture (Miscellaneous Provisions) Act, 1943, should be included in permanent legislation. We recommend that the provisions should, however, apply generally and not solely for agricultural purposes. It has been suggested to us that a drainage board should be empowered to issue directions in this connection on the authority of a court of law only ; we recommend instead that provision should be made for a right of appeal to the Minister on the ground that the requirements of the drainage board are unreasonable. We recommend that, in an emergency, the drainage board themselves should have power to act.

(C) Obligations in respect of water rights

134. We have given consideration to the rights of mill-owners who, by prescription or otherwise, have acquired rights to a head of water. It may be useful to recapitulate those of our recommendations which will affect mill-owners. In paragraph 131 (*a*) we have recommended that no one should, without the previous consent of the drainage board concerned, erect a new structure or alter an existing one in, over or under a watercourse ; in paragraph 131 (*d*) and (*e*) we have recommended that a drainage board should, subject to conditions as to payment, be empowered either to give notice to an owner to abate any present or threatened injury to land drainage for which he may be responsible, or to take action themselves, though in exercise of this power drainage boards should have regard to the essential needs of the industry concerned ; in paragraph 132 we have recommended that where damage to land drainage interests is due to the state of disrepair of a structure, the drainage board should be able to secure the repair and maintenance of the structure at the expense of the owner ; and in paragraph 133 we have recommended that, subject to certain conditions, a drainage board should have power to require the person in control of a dam or sluice to regulate the sluice if they think such action necessary to prevent or arrest injury to land. In addition to these recommendations, which affect the operation of the structure itself, we consider that the owner of the water rights should be placed under an obligation to maintain in good condition the embankments connected with those rights and all other works ancillary to them. This obligation should be taken into account in assessing compensation where the drainage board find it necessary to acquire any particular water rights. Where injury to land drainage interests is due to failure to use the water rights, the drainage board should be able to recover the cost of remedying the injury from the owner ; unless the owner elects to dispose of his water rights to the drainage board, who, in the assessment of compensation due to the owner, would take into account the cost of the work necessary to remedy the injury.

(2) NAVIGATION

135. We have reviewed the powers of drainage boards in relation to channels which are being, or have been used for purposes of navigation, with the object

of making the best practicable arrangements for ensuring that the channels are efficiently maintained for the purpose of land drainage. Under our recommendations all channels, other than ditches, will be brought under the jurisdiction of a river board or internal drainage board and we see no reason for making any exception in the case of navigable waters. Where, however, a navigation authority is active and maintains the channel for the efficiency of its navigation, such maintenance is usually adequate for drainage purposes and it will not normally be necessary for the drainage board to do work on such a channel. The provisions contained in Section 40 of the Land Drainage Act, 1930, under which voluntary arrangements may be made between navigation and drainage authorities in the interest of drainage ; in Section 41 of the same Act which gives power to the Minister by order to vary navigation rights within a drainage district for the purpose of securing the better drainage of any land ; and in Section 8 of the River Boards Act, 1948, under which it is possible, in the general interest, for the functions of the navigation authority to be transferred to a river board by order of the Ministers, appear to us to be inadequate in relation to channels which are not in active use for navigation.

136. The really serious land drainage problems arise in relation to those channels which are no longer required for navigation, or have so far deteriorated as to be ineffective for that purpose. For example, when a natural channel has been deepened and widened for the purpose of navigation, but is no longer used for that purpose and is not maintained in its improved state, costly drainage works may become necessary : locks and sluices may have fallen into disrepair, or, if the channel is wholly artificial and the banks are not properly maintained, there may be seepage of water on to neighbouring land. The Ministry of Transport have estimated that approximately 150 miles of channels which have not been taken over by the British Transport Commission have fallen into disuse. We understand that there are also approximately 300 miles of channels under the Commission's control which are no longer needed for traffic purposes and possibly a further 300 miles of channels which are of doubtful commercial value.

137. Where navigation is obsolete, we consider that the primary aim should be to make the best practicable arrangements for ensuring, in the general interest, that the channel is maintained in an efficient state for drainage purposes while at the same time safeguarding the rights of persons in relation to the channel, e.g., for water supply. Under the provisions of Section 45 of the Railway and Canal Traffic Act, 1888, the Minister of Transport, in specified circumstances, may grant warrants authorizing the abandonment of canals. We have, however, received evidence that there had been a general reluctance on the part of navigation authorities to resort to this procedure, mainly because of the opposition of authorities and persons concerned with land drainage and water supplies. A canal frequently provides the means of disposing of surface water and trade and sewage effluents from adjoining lands ; and building development may have taken place since the canal was constructed, with a resultant increase in the discharge. The discontinuance of these facilities even where, as in many instances, they are afforded under terminable agreement or no agreement at all, may give rise to great practical difficulties. Similar difficulties may arise in connection with water supplies. Considerable quantities of water are taken from navigation canals for agricultural and industrial purposes, and where no alternative supply is available or where the source is inadequate or unduly expensive, it has not been easy to dispose of objections to the abandonment of the canal. Because of such objections, and because the navigation authority may prefer not to apply for a warrant of abandonment in order to avoid having to pay compensation to those who would become

entitled to it, some canals have been allowed to become derelict without being formally abandoned, and the neglected channels may, through lack of maintenance, cause injury to neighbouring land.

138. The procedure provided by the Act of 1888 for the abandonment of canals does not, therefore, by any means achieve all that is desired, nor are the provisions of the Land Drainage Act, 1930, and the River Boards Act, 1948, referred to in paragraph 135 above, likely to be used to deal with canals which are no longer used for navigation or have so far deteriorated as to be unfit for that purpose. They provide the river board with the power in certain circumstances to take over the functions of a navigation authority, but the river board will, not unnaturally, be reluctant to acquire what may be a heavy and indeterminate liability. It seems unlikely that the British Transport Commission would be willing to assume drainage responsibility for these disused navigation channels unless they saw a prospect of their being able to revive the navigation as a self-supporting concern ; indeed, they would, no doubt, welcome any provision which would relieve them of such responsibility for any channels, already under their control, which have ceased to serve the function of navigation. We are reluctant to suggest that river boards, who under our recommendations will have heavy financial commitments, should undertake additional liabilities ; but they seem to us best fitted, from the point of view of both function and constitution, to deal with the problem of these disused navigations. If, however, river boards are to be encouraged to take them over, we consider that they should be enabled to effect the transfer on the most favourable terms possible.

139. With this object in view, we recommend that the existing statutory provisions referred to in paragraph 135 above, and Section 45 of the Railway and Canal Traffic Act, 1888, should be modified and strengthened in the following respects :—

(*a*) In any proposal to transfer a disused navigation to a river board, the board should, in our view, have first call, after any creditors, on the assets of the navigation authority to the extent that they are put to extra expense in assuming responsibility for maintaining the canal in a reasonable state of drainage. The transfer of such assets would include the property in the canal itself, reservoirs and property connected with it, any subsidiary business, together with all rights under the navigation.

(*b*) The board should be enabled to exploit the properties and rights (e.g., by using the channel for pleasure boating, fishing, selling of surplus water from the channel, etc.) in order to help them to meet the additional financial liabilities incurred or assumed by them on the winding-up of the affairs of the navigation authority. Other authorities and persons may be interested in the proposals and may wish to acquire parts of the channel (e.g., a highway authority may be concerned with bridges over the derelict channel or a local authority may be interested in preserving part or the whole of it for amenity purposes), and the river board should be given full powers to negotiate with them on any matter connected with the transfer of the undertaking.

(*c*) Existing rights over the canal in so far as they are exercisable at the time of transfer (other than the rights of the navigation authority itself) should be preserved or alternative rights provided.

(*d*) In the case of the transfer of a navigation from the British Transport Commission to a river board, provision should be made for

commutation, and the question of compensation to persons affected should be considered in the commutation.

(*e*) On the basis of these suggestions the river board should be empowered to prepare a scheme for the abolition of the navigation and for giving effect to any agreements which they may have reached in relation to it and for winding up the affairs of the navigation authority.

The scheme should be subject to approval by the Ministers of Transport, Agriculture and Fisheries and Health under a similar procedure to that which applies to orders made under Section 8 of the River Boards Act, 1948.

(3) DEPOSIT OF SPOIL

140. Suggestions have been made to us for the amendment of Section 38 of the Land Drainage Act, 1930, which gives powers to drainage boards to deposit spoil removed by them in carrying out their work ; and we have examined these powers with the object of ensuring that they are adequate, while at the same time safeguarding the interests of riparian owners and occupiers who may be affected. We recommend that drainage boards should have the right to enter, and the general right to deposit spoil on the land adjoining any watercourse or drain under their jurisdiction, whatever the character of the drainage work and the nature of the spoil, subject to the general condition that they should deposit and spread the spoil, and if necessary re-seed the area, to the reasonable requirements of the riparian occupier ; and subject also to the restrictions already contained in Section 38, about the deposit of spoil which is likely to constitute a nuisance under the Public Health Acts, and to our further recommendations below. The use which is being made of the land on which it is proposed to deposit the spoil and the time of year when the deposit can most appropriately be made are important factors which a board should take into account. We have no reason for thinking that drainage boards will do otherwise than act reasonably in this matter, bearing in mind the interests of owners and occupiers and the general amenities of the district.

141. We recommend that, apart from the question of compensation which we discuss below, drainage boards, as at present, should not be placed under any obligation to pay for the spoil they remove, but compensation should be paid for trees which have been planted for commercial purposes on the land adjacent to the watercourse or drain, when their felling is necessary as a preliminary to the carrying out of drainage work ; other trees removed by the board would remain the property of the owner, but normally compensation would not be payable. We appreciate, however, that in special circumstances the board may have to buy the land from which the spoil is taken (e.g., in the case of a new cut) or, in some cases, the land on which the spoil is deposited (e.g., land on which the spoil is used for the construction of a large embankment). There are circumstances in which drainage boards find it necessary to arrange to have the spoil removed from the site of the drainage work, as for example where buildings, streets or gardens are situated close to the watercourse or drain, or where the banks are used as quays or for storage purposes. On occasion, authorities or persons may even wish to buy and remove spoil for public or private purposes. It should be made clear that the board can, if necessary, themselves undertake this removal, or can enter into an agreement with any person or body of persons for the purpose, and we recommend that Section 38 (2) of the Land Drainage Act, 1930, should be clarified in that respect.

142. We have reviewed the circumstances in which compensation should be payable in relation to the deposit of spoil by drainage boards. In our view, there should normally be no case for the payment of compensation. It is a reasonable assumption that before the advent of drainage boards owners and

occupiers would, in their own interests as an act of efficient estate management and good husbandry, clean out the channels flowing through their lands and in doing so would deposit the spoil on adjacent land. We appreciate, however, that the extent to which this factor is material will depend upon the size of the watercourse or drain, the amount of spoil removed and the general circumstances connected with the particular work. There will certainly be instances in which compensation clearly ought to be paid. We recommend that where there is clear proof of substantial loss or injury or unreasonable damage, either to the riparian owner or occupier or both, compensation should be payable by the drainage board. Material loss or injury may occur, for example, through spoil being deposited on land on which crops are being grown for harvesting ; spoil may be deposited carelessly or not spread in time to allow cropping ; it may be excessive ; or the amount and character of the spoil may be such as to cause permanent injury to agricultural land, etc. Loss or injury should not generally arise in connection with maintenance work or minor improvement works, provided that drainage boards deposit the spoil in a reasonable manner and to the reasonable requirements of the occupier.

(4) DEFINITION OF AND RESPONSIBILITY FOR BANKS

143. We have received evidence that drainage boards have encountered difficulties in the interpretation of the term " banks " as defined in Section 81 of the Land Drainage Act, 1930, particularly in regard to the provisions of Section 38 (Disposal of Spoil), Section 47 (Byelaws) and in connection with the liability to maintain " barrier banks." In our recommendations contained in paragraph 140 above, about the power of drainage boards to dispose of spoil, we have avoided using the term " banks " and have referred instead to the " land adjoining the watercourse or drain." It is our intention that this latter expression should include such depth of land as is necessary to allow the board to carry out their function of improving, maintaining and protecting the watercourse or drain. We think that this offers a solution to one of the difficulties which have arisen in the interpretation of the term " banks " and we recommend that in new land drainage legislation the term should no longer be used. Its use might be avoided in other connections by making use of the terms " watercourse " and " drain," which in each case would be defined as including the bed and batters of the channel, and " embankment " which would apply to all artificial banks and would include the so-called " barrier banks " which prevent floods from main river channels discharging into an adjacent drainage system. Where such a bank separates the areas of two river boards, it might, for convenience, be termed " boundary embankment " as different administrative considerations arise.

144. As regards boundary embankments we recommend that the responsibility for their maintenance should rest on the river board responsible for the watercourse whose waters are confined by the embankment ; and that any powers or obligations which any other drainage board might have over it should be transferred to that river board. Provision should, however, be made empowering the river board responsible for the boundary embankment to require from the neighbouring river board such a contribution towards the cost of maintenance as they consider fair. The second board would have a right to appeal to the Minister against the amount of the contribution. The river board might agree with the second board, or some other drainage board, for the latter to execute works on the embankment on an agency basis. If the administrative boundary between two river board areas runs along the top of the boundary embankment, being the only true watershed, it should be made clear that the river board

responsible for the embankment have full power, in consultation with the adjoining river board, to do works outside their area for the maintenance of the boundary embankment.

145. A drainage board may be deterred from constructing minor flood embankments, particularly where the proposed embankment is of considerable length, if it is necessary to purchase the land for the purpose. We recommend that drainage boards should be empowered to enter on land and construct small flood embankments without having to purchase the land. This should not, however, exclude the right of owners and occupiers of such land to compensation where loss can be proved. As an alternative to the purchase of land for the purpose of making and maintaining embankments, we consider that drainage boards should be empowered to acquire a permanent easement to use the land for the purpose of the embankment and its maintenance.

(5) MINING SUBSIDENCE

146. We have noted the recommendations of the Turner Committee on Mining Subsidence but have not felt it proper to consider in detail a matter on which recommendations have already been made by another Committee for consideration by the appropriate Departments. We consider, however, that the question of mining subsidence is of the greatest importance from the point of view of land drainage and we hope that early and effective action will be taken to deal with the land drainage aspect of the problem.

(6) PLANNING

147. In relation to potential development by other authorities or persons, we consider that river boards should have plans available indicating, in relation to all watercourses for which they are responsible, the areas adjacent thereto on which, in the interests of land drainage or flood prevention, any development or development of a particular type should not take place. As a matter of administrative arrangement, the local planning authority should regularly consult with the river board regarding any proposals for development in the areas so delineated, and we understand that this is, in general, the practice. It may be, in some cases, that other considerations will over-ride the land drainage consideration ; and that development will be authorized in full knowledge of the drainage problems that will be created. A particular case in point is the construction of New Towns or large housing estates in areas where only small local brooks are available nearby to take the surface water and increased volume of sewage effluent. In such cases, when the development proceeds, we consider that the responsibility for the cost of any drainage improvements necessary to prevent damage arising in neighbouring areas is properly a charge on the developer. The cost of maintaining any improved channel should fall on the river board. This is perhaps a particular case of the general problem we discussed in paragraphs 65 and 67. It may be contended on behalf of the developer that as the new property will contribute through the rates to the funds of the river board, it should be relieved of any special obligation to contribute to the cost of works necessary to ensure the safe discharge of its storm water and additional effluent. We feel strongly that it is an obligation of a developer to carry out his development in such a way as will not injuriously affect the surrounding area.

Chapter VII.—Summary of Recommendations

(1) MAIN RECOMMENDATIONS

148. Our main recommendations may be summarized as follows :—

(i) We recommend that every channel should be maintained in a reasonably efficient state for drainage purposes, and that the execution of such works as are necessary should be the direct responsibility of some authority or person, the allocation of responsibility being as follows :—

(*a*) The responsibility for watercourses should lie with river boards.

(*b*) The responsibility for drains should lie with internal drainage boards.

(*c*) The responsibility for ditches should lie with owners and occupiers (38).

(For the definition of " watercourses," " drains," and " ditches," and for elucidation of the principles determining their identity and underlying the recommended allocation of responsibility, reference should be made to paragraphs (27) and (40-44). Paragraph 45 explains the relief that will be given to some internal drainage boards through the assumption by river boards of responsibility for certain carrier watercourses.)

(ii) It follows from our first recommendation that the funds of river boards will need to be augmented to meet their additional liabilities, and we recommend that all land within a river board area should contribute to the funds of the river board, and that for this purpose a new charge—the drainage charge—should be levied on all those hereditaments that are not assessed to general or drainage rates (69) (73).

(iii) We recommend that the drainage charge should consist of two parts, one part being at a rate equivalent to the rate of precept on local authorities in the area ; and the other part being normally at a fixed rate of 9d. in the £ of net annual value determined for purposes of income tax under Schedule A of the Income Tax Acts (69) (76-78).

(iv) We recommend that the drainage charge should be borne by occupiers (73) ; and that it should be at a uniform rate within the river board area (71-73).

(v) We recommend that the drainage charge should be collected throughout the river board area by the local rating authorities on an agency basis (79).

(vi) We recommend that in consequence of the introduction of the drainage charge there should be representation on river boards of farming interests (90).

(2) FURTHER RECOMMENDATIONS CONCERNING THE FINANCE OF RIVER BOARDS

149. We make the following recommendations to provide additional funds to enable river boards adequately to carry out their functions :—

(i) We recommend that a river board should have power to collect contributions in the circumstances described below :—

(*a*) Where the new allocation of responsibility for watercourses results in the execution by the river board of much of the work

formerly done by an internal drainage board, we recommend that the river board should be empowered to take over all the works functions of the internal board, and to retain the internal drainage district solely for the purpose of securing a contribution to the cost of the river board's works : or, where no internal drainage board already exists, and the area is one which might reasonably be made subject to drainage rates, that the river board should have power to establish an internal drainage district for the sole purpose of securing the drainage rate (64) (98).

(*b*) We recommend that where a river board take over responsibility for an upland watercourse they should in certain circumstances be empowered to require the riparian owners to contribute to the cost of the initial scheme of restoration, and that this power should be exercisable by the river board for a period of five years from the passage of the amending legislation (63).

(*c*) Where in built-up and industrial areas unplanned development has encroached on the natural flood-path of a channel, and the local authority ask the river board to execute works to obviate consequential flooding, or where a local authority wish works of a river board to be elaborated in the interests of local amenities, we recommend that the river board should be empowered to require the local authority to meet part of the cost (65) (66) (67) (147).

(*d*) We recommend that the river board should (subject to appeal) be empowered to require a contribution from the council of any local authority towards the cost of any drainage works carried out in the interests of a wider area but from which the local authority derive major benefit (67) (147).

(*e*) When a river board take over a watercourse formerly the responsibility of a local authority, and the local authority have already incurred loan charges for works on that watercourse of particular local benefit, we recommend that the loan charges shall remain with that authority (68).

(*f*) We recommend that, in respect of works on watercourses from which an internal drainage district derives particular benefit, the river board should be empowered, as at present, to require a contribution from the internal drainage board (96).

(ii) We recommend that Exchequer grants for capital works should continue to be paid to river boards under provisions corresponding to Section 55 of the Land Drainage Act, 1930, and that these grants should continue to vary with the needs and resources of each river board area (87).

(iii) We recommend that in exceptional cases Exchequer equalization grants should be paid to river boards to balance their annual revenue from all sources with their annual estimated expenditure on works and administration (88) (89).

(3) RECOMMENDATIONS CONCERNING THE FINANCING OF INTERNAL DRAINAGE BOARDS

150. We have considered proposed changes in the present arrangements for financing internal drainage boards, and make the following recommendations:—

(i) We recommend that in the case of agricultural land, drainage rates should continue to be at a uniform rate in the £ on the gross annual

value as determined for Income Tax purposes under Schedule A of the Income Tax Acts, and in the case of any other land, on one-third of the gross annual value (91).

(ii) As regards powers of differential rating, we recommend as follows :—

(*a*) that internal drainage boards should be empowered to levy differential rates either by the present method of proportions or by treating sub-districts as separate rating units (92) ;

(*b*) that differential rating should be the exception rather than the rule (93) ;

(*c*) that differential rating orders should require confirmation by the river board and not, as at present, by the Minister (116) ;

(*d*) that representative bodies of persons within the drainage district should have a right of appeal to the river board on differential rating matters (116) ;

(*e*) that the power of an internal drainage board to make exemption from rating orders should be retained (93) ;

(iii) We recommend that the power given in Section 25 of the Land Drainage Act, 1930, to the rating authority of an urban district to pay a sum to the internal board in lieu of drainage rates levied on individual hereditaments should be retained, and extended to that of a rural district in respect of built-up areas within the district ; and, since the drainage ratepayers in such an area lose their voting powers, that the local authority should be empowered to appoint members to the internal drainage board (94).

(iv) We recommend that where a drain which is the responsibility of an internal drainage board carries a proportion of highland water from outside the district, the river board should contribute towards the cost of work done on that drain by the internal drainage board (95).

(v) We recommend that any grants that may be made by the Minister of Agriculture and Fisheries under Section 15 of the Agriculture Act, 1937, towards the cost of new works or the improvement of existing ones, should continue to be at a flat rate (99).

(4) RECOMMENDATIONS CONCERNING THE POWERS AND OBLIGATIONS OF RIVER BOARDS

151. Our main recommendations will carry with them new obligations on river boards, and recommendations designed to meet these are included in those summarized below :—

(i) We recommend that a river board should prepare, and submit to the Minister for his approval, a scheme and map determining the watercourses for which they will be responsible, and that the scheme and map should be subject to amendment and review (40-43) (47) (50) (51).

(ii) We recommend that river boards should be empowered to include differential rating provisions in schemes made under Section 4(1)(*b*) of the Land Drainage Act, 1930, but that such provisions should be subject to amendment by the internal drainage board at any time after their first election (109).

(iii) We recommend that the boundaries of all internal drainage districts should be subject to review at regular intervals, say every ten years, by river boards ; and that there should be a right of appeal to the Minister against the decisions of the river board by owners and occupiers of land affected (105) (109).

(iv) We recommend that powers for the enforcement of byelaws in the Land Drainage Act, 1930, should be strengthened by the obligation on a person in default to pay for the repair of the damage he has caused (110).

(v) We recommend that river boards should be given powers to execute works outside their areas, with the consent of the river board of the area concerned, when such works are essential to the efficient performance of their land drainage functions (114).

(vi) In connection with the supervision exercised by river boards over internal drainage boards we recommend as follows :—

(*a*) That river boards should retain the general powers of Sections 7 and 11 of the Land Drainage Act, 1930, but that the new legislation should not include any power enabling river boards to carry out individual works in default, as is given under Section 10 of the Land Drainage Act, 1930, (107).

(*b*) That when the functions of an internal drainage board are taken over by a river board under Section 11 of the 1930 Act, there should be a right of petition to the Minister by owners and occupiers against the amount of any contribution required by the river board from the internal drainage district in respect of works carried out on the watercourses of the river board (109).

(*c*) That drainage ratepayers should have the power to petition the Minister to revoke a Section 11 order and re-establish an elective drainage board (109).

(*d*) That river boards should be notified by internal drainage boards at stages in the procedure of their elections (108).

(5) RECOMMENDATIONS CONCERNING THE POWERS AND OBLIGATIONS OF INTERNAL DRAINAGE BOARDS

152. We recommend that the jurisdiction of internal drainage boards should continue to be limited to well-defined areas which present local and specialized problems of vital concern to the owners and occupiers in the internal drainage district ; and we recommend little change in the general powers of internal drainage boards (39) (115) (120). Recommendations of a comparatively minor character are as follows :—

(i) We recommend that, following the proposed re-allocation of responsibility, internal drainage boards should survey their areas and record on a working map the drains for which they are to assume responsibility, and that these maps should be subject to modification (48-51).

(ii) We recommend that the elective principle should be preserved, and that the procedure should be simplified. We suggest certain modifications in respect of differentially rated areas and of urban and rural areas for which the local authority may elect to pay a lump sum equal to the drainage rates which could have been collected within that part of their area inside the drainage districts (93) (100) (101) (117).

(iii) Paragraph 151 (vi) (*d*) above records our recommendation that the progress of elections of internal drainage boards should be reported to the river board. Where, nevertheless, an election is not held at the appropriate time, we recommend that the Minister should have power to extend the life of the board for a period not exceeding one year and that this power should also be exercisable in appropriate circumstances on behalf of a newly appointed board (108).

(iv) We recommend that internal drainage boards should have the same powers as river boards in respect of :—

(*a*) Entry on to land (119).

(*b*) Enforcement of byelaws and other measures of control recommended in paragraph 110 of the report (118).

(6) RECOMMENDATIONS CONCERNING THE OBLIGATIONS OF OWNERS AND OCCUPIERS

153. As a consequence of our main recommendations regarding allocation of responsibility, the customary obligations of riparian owners and occupiers to do any drainage works in relation to watercourses and drains will cease, and we recommend that they should be replaced by the following statutory obligations :—

(i) We recommend that owners and occupiers should be placed under an obligation not to damage or endanger the works for which the river board are responsible and not to do anything that might seriously impede the board in the execution of their statutory functions (110).

(ii) We recommend that any person convicted of breach of a byelaw should be obliged to make good the damage or pay the reasonable cost of the remedial work (110).

(iii) We recommend that in relation to all ditches, the responsible occupier should be placed under an obligation, in addition to the requirements of good husbandry as far as his own land is concerned, to maintain and repair them in such a way as to avoid damage to neighbouring land (121).

(iv) We recommend that the obligation not to damage the works for which a river board are responsible (sub-paragraph (i) above) should be extended to cover all drains and ditches (121).

(v) We recommend that all practical steps should be taken to ensure that an efficient and permanent works service is available for all classes of drainage work (122).

(7) RECOMMENDATIONS CONCERNING MISCELLANEOUS DRAINAGE AUTHORITIES

154. The assumption by river boards and internal drainage boards of the full responsibilities recommended in this report will make redundant the land drainage powers at present held by various authorities and we therefore make the following recommendations :—

(i) We recommend that county and county borough councils should no longer be called upon to exercise land drainage functions (20); but we consider that where under local enactments urban authorities exercise control over specific watercourses for the purpose of the disposal of sewage and storm water, these local Act powers might be retained (20) (53).

(ii) We recommend that powers and obligations relating to land drainage vested in persons or authorities under old Inclosure Acts and Awards should, subject to certain conditions and with certain exceptions, cease from the date of the assumption by the river board or internal drainage board of their new responsibilities (21) (54).

(iii) We recommend that the office of all Commissioners of Sewers still in existence should be abolished and all their powers and duties revoked, as from the date of the assumption of their new responsibilities by the river board or internal drainage board within the Commissioners' district (22) (55).

(8) RECOMMENDATIONS CONCERNING THE RELATIONSHIP OF DRAINAGE AUTHORITIES TO OTHER AUTHORITIES AND INTERESTS

155. We recommend that the legislation governing the relationship of land drainage works to the works of other authorities and persons should be revised in accordance with the trend of modern legislation and in the light of experience gained from the working of the Land Drainage Act, 1930, and other enactments relating to land drainage ; and in Chapter VI we make detailed recommendations on the following specific points :—

(i) Structures in watercourses and drains (124-134).

(ii) Navigation (135-139).

(iii) Deposit of spoil (140-142).

(iv) Definition of and responsibility for banks (143-145).

(v) Mining subsidence (146).

(vi) Planning (147).

(9) MISCELLANEOUS RECOMMENDATIONS

156. In addition to the recommendations given above, which fall into well-defined groups, we make the following recommendations :—

(i) Many drainage boards have general land drainage powers under local Acts relating to matters, e.g., the recovery of rates, for which provision is also made in the Land Drainage Act, 1930, and we recommend that any such general provisions contained in local Acts, including those of the Middle and North Level Commissioners, shall cease to have effect and shall be replaced by the provisions of the principal Act (103) (106).

(ii) We recommend that a river board should continue to pay some part of the cost of sea defence works necessary for land drainage purposes within their area, and that the cost should not be wholly borne by the State (88).

(iii) We recommend that no set procedure for use in time of emergency, e.g., floods, should be prescribed, but that full responsibility and freedom of action should remain with river boards, and that if necessary the Government should assist by administrative action (114).

(iv) Where a local authority elect to pay a lump sum in commutation of the drainage rates which might be collected from that part of their area which lies within a drainage district, we recommend that the rating authority should be empowered, if they wish, to recover the sum through the general rate (94).

(10) PHASED PROGRAMME FOR THE INTRODUCTION OF THE NEW ARRANGEMENTS

157. In order that the new arrangements may come into force in an orderly and convenient sequence, we recommend the following programme :—

(i) *Immediately on the passage of the amending legislation*

For a period of five years, river boards to have power to charge to riparian owners the net cost of clearing neglected watercourses (63).

Cessation of general powers in local Acts relating to land drainage (103) (106).

Assumption of additional or amended supervisory powers of river boards over internal drainage boards (107) (108).

Measures for strengthening and supplementing byelaws (110).

Provisions for safeguarding drainage ratepayers (109).

Power of river boards to execute works outside their areas (114).

(ii) *Six months from the passage of the amending legislation*

Assumption by owners and occupiers of new responsibilities in relation to ditches (49) (121).

(iii) *About two years from the passage of the amending legislation at the beginning of a financial year*

Completion of arrangements for the levy of the drainage charge (69-86).

Cessation of powers of Award authorities (54).

Abolition of Commissioners of Sewers (55).

Cessation of exercise of land drainage powers by county and county borough councils (53).

River boards and internal drainage boards will assume their new responsibilities at the same time, but if by this time the drainage board have not completed their survey we have recommended a procedure in paragraph (49) for application when responsibility for a length of channel is in doubt.

Acknowledgements

158. We should like to express our gratitude for the readiness with which the various organizations concerned placed their knowledge and experience at our disposal and for the willingness of the witnesses to be questioned at meetings which often lasted for many hours. We have been impressed throughout our inquiry by the anxiety on all sides to see more efficient drainage, and the general willingness to subordinate sectional interests to the broader national interest. This was particularly evident in the visits we paid as a Committee to see for ourselves the drainage problems in different parts of the country. The most thorough and helpful arrangements for these visits were made by the people on the spot. We found these visits most instructive and helpful in considering the effect of any recommendations we might make.

We wish to place on record our appreciation of the service rendered by the assessors appointed by the Government Departments who were interested and involved in this complicated question of land drainage. Information was frequently sought from them and was readily given and this has helped us greatly in arriving at our conclusions. We would particularly like to thank Mr. Hugh Gardner, whose advice has been invaluable, and Mr. Hodgson, whose long experience of land drainage on the Ministerial side has been of great assistance to us.

We also wish to thank our secretaries. Mr. Dean provided the preliminary information and helped us at the early meetings until illness unfortunately deprived us of his services. He was succeeded by Miss Sutcliffe, who bore the brunt of the secretarial work during our deliberations and who accompanied us during our visits in the country. Mrs. Hussey then took over the finishing stages and brought the work to a conclusion.

We wish to express our thanks to them all.

ARTHUR P. HENEAGE (*Chairman*)
JOCELYN BRAY
WYNNE CEMLYN-JONES
JOHN HIRST
S. R. HOBDAY
J. N. McCLEAN
CECIL NEWMAN
D. B. TOYE
N. F. S. WINTER
G. A. WORTH

D. HUSSEY
(*Secretary*)

Appendix I

A

Written evidence was given by the following organizations :—

Association of Drainage Authorities.
Association of Internal Drainage Authorities within the South Level.
Association of Municipal Corporations.
British Waterworks Association.
Canal Association.
Catchment and River Boards' Association.
City of Lincoln.
Council for the Preservation of Rural England.
Country Landowners' Association.
County Councils' Association.
Essex County Council.
Federation of British Industries.
Humber Conservancy Board.
Kingston-upon-Hull Corporation.
Land Agents' Society.
Lee Conservancy Catchment Board.
Lindsey County Council.
National Association of Fishery Boards.
National Farmers' Union.
National Union of Agricultural Workers.
National Union of General and Municipal Workers.
National Union of Public Employees.
Royal Institution of Chartered Surveyors.
Rural District Councils' Association.
The Law Society.
Transport and General Workers' Union.
Urban District Councils' Association.

B

Oral evidence was given by the following organizations :—

Organizations	*Witnesses*
Association of Drainage Authorities	Lt.-Col. C. T. A. Beevor. Mr. R. C. Treadgold, M.B.E., F.R.I.C.S., M.I.Mun.E., M.T.P.I.
Association of Municipal Corporations	Alderman J. W. F. Hill, M.A., Ll.M. Councillor G. H. Wigman. Mr. C. H. Pollard, O.B.E. Mr. G. H. Banwell (Sec.).
British Waterworks' Association	Mr. K. L. Forster, M.I.C.E. Mr. L. W. F. Millis, O.B.E., B.Sc. (Econ.) Barrister-at-Law (Sec.).
Catchment and River Boards' Association	Lt.-Col. E. T. L. Baker, O.B.E., T.D. Sir Charles Browne. Mr. W. J. S. Bew. Mr. R. H. R. Davey. Mr. J. Morley, M.B.E.
Country Landowners' Association	Lord de Ramsey. Lt.-Col. W. R. Burrell, M.B.E., T.D., D.L. Mr. F. F. Taylor, F.L.A.S. (Sec.).
County Councils' Association	Sir Arthur Hobhouse. Sir Joseph Lamb. Mr. W. J. Cumber, C.B.E. Mr. H. T. Tate.
National Association of Fishery Boards	Major A. T. R. Houghton, M.A., M.C.

National Association of Fishery Boards—(*contd.*)	Major J. Inglis Spicer, M.B.E.
	Mr. H. C. Wickham (Sec.).
National Farmers' Union	Capt. H. J. M. Holmes.
	Mr. W. A. Muddell.
	Mr. H. D. Barry.
	Mr. J. F. Phillips, Ll.M. (Asst. Gen. Sec.).
National Union of Agricultural Workers	Mr. T. Bavin.
	Mr. H. Collison.
Royal Institution of Chartered Surveyors and the Land Agents' Society	Mr. B. W. Howe, A.R.I.C.S.
	Mr. J. Bruce Galloway, O.B.E., F.L.A.S., A.M.I.C.E.
Rural District Councils' Association	Mr. Neville Hobson, M.C., J.P.
	Mr. S. E. Holton.
	Capt. F. Johnson, J.P.
The Law Society	Lt.-Col. E. T. L. Baker, O.B.E., T.D.
	Mr. W. J. Taylor.
	Mr. H. Horsfall-Turner (Under Sec.).
Urban District Councils' Association	Mr. J. Poole.
	Mr. D. J. Jones, O.B.E.
	Mr. V. Seaton Gray, M.B.E.
	Mr. J. H. Lees, B.A., Ll.B. (Asst. Sec.).

C

Informal discussions on subsidiary points were held with the following organizations :—

Organizations	*Witnesses*
Association of Drainage Authorities	Lt.-Col. C. T. A. Beevor.
	Mr. W. J. S. Bew.
	Mr. G. C. Chandler.
	Mr. H. Swann.
	Mr. R. C. Treadgold, M.B.E., F.R.I.C.S., M.I.Mun.E., M.T.P.I.
Association of Municipal Corporations	Alderman J. W. F. Hill, M.A., Ll.M.
	Mr. M. Morris, O.B.E.
	Mr. A. Pickard, C.B.E.
	Mr. J. M. Hawksworth.
British Transport Commission (Docks and Inland Waterways Executive)	Mr. R. Davidson, C.B.E.
	Mr. W. L. Ives, Ll.B.
(Railways Executive)	Mr. A. Dean, M.Sc., M.I.C.E., D.I.C.
	Mr. J. H. Churchill, B.A.
Catchment and River Boards' Association	Mr. G. Dallas, C.B.E., J.P.
	Mr. R. H. R. Davey.
	Mr. W. E. Doran, O.B.E., B.A.I., M.I.C.E.
	Mr. W. A. Gibson.
	Mr. W. H. Haile, O.B.E., M.I.C.E.
	Mr. J. Morley, M.B.E.
	Mr. A. S. P. Saint.
Country Landowners' Association	Lord de Ramsey.
	Lord St. Aldwyn.
	Mr. W. G. Coates.
	Mr. F. F. Taylor, F.L.A.S. (Sec.).
Federation of British Industries	Mr. G. W. Andrew.
	Mr. H. E. Hopthrow, C.B.E., M.I.M.E.
Land Agents' Society	Mr. C. L. Pendlebury, M.C., T.D., F.R.I.C.S., F.L.A.S.
	Mr. A. C. Small, F.L.A.S., F.A.I., F.V.I.

National Farmers' Union	Mr. H. Woolley. Mr. W. A. Muddell. Alderman W. A. Sumner. Mr. J. F. Phillips, Ll.M. (Asst. Gen. Sec.).
Royal Institution of Chartered Surveyors	Mr. B. W. Howe, A.R.I.C.S.
The Law Society	Mr. W. J. Taylor. Mr. H. Horsfall-Turner (Under Sec.).
Urban Districts Councils' Association	Mr. H. Haslem. Mr. W. R. Hastings. Mr. D. E. Nash. Mr. J. H. Lees, B.A., Ll.B. (Asst. Sec.).

Appendix IV

REPORT OF THE TECHNICAL PANEL

CONTENTS

INTRODUCTION

1. The Sub-Committee on Land Drainage Legislation, appointed by the Central Advisory Water Committee, in the course of hearing evidence from witnesses, was confronted with suggestions that land drainage operations may affect the flow of rivers and thus be at least a contributory cause of inundations on the one hand and water shortages on the other. The popular press has tended to go further and to attribute the abnormal water shortages and floods of recent years largely to the intensification of land drainage works. These statements have not been supported by conclusive evidence, nor have they been authoritatively disproved.

2. The question is clearly an important one since public confidence is involved. The value to agriculture of all types of drainage, particularly field drainage, is not in question. Even if floods of recent years could be shown to have been more severe and more frequent because of the extension of land drainage, then the value of drainage to agriculture would have to be carefully balanced against the wider interests of the community at large ; if there is no connection between the two, their independence should be firmly established. The Sub-Committee, therefore, felt the need for an impartial estimate of the importance of land drainage in relation to other than agricultural interests, and accordingly asked the Ministry of Agriculture and Fisheries to invite a panel of technical specialists to collect and examine all available evidence. The report of the Panel follows.

CONSTITUTION OF THE PANEL

3. The Panel consisted of :—

Mr. E. A. G. Johnson, B.Sc., M.I.C.E., M.I.W.E., A.M.I.Mun.E., Chief Engineer, Ministry of Agriculture and Fisheries (Chairman).

Mr. W. Allard, O.B.E., B.Sc., M.I.C.E., M.I.W.E., Senior Engineer-in-charge, Inland Water Survey, Ministry of Health.

Dr. S. Buchan, B.Sc., Ph.D., P.A.I.W.E., Geologist-in-charge, Water Department, Geological Survey.

Mr. W. E. Doran, O.B.E., B.A., B.A.I., M.I.C.E., Chief Engineer, River Great Ouse Catchment Board.

Dr. J. Glasspoole, M.Sc., Ph.D., P.A.I.W.E., Principal Scientific Officer, Meteorological Office, Air Ministry.

Mr. H. H. Nicholson, M.B.E., M.A., Reader in Soil Science, School of Agriculture, University of Cambridge.

Dr. H. L. Penman, M.Sc., Ph.D., F.Inst.P., Physicist, Rothamsted Experimental Station.

Mr. H. G. Ramsay, M.I.C.E., M.I.W.E., Chief Engineer, South Essex Water Works Company.

Mr. W. H. E. Rivett, F.G.S., F.L.S., F.Z.S., A.I.B.A.E., Geological Drainage Assistant, Surrey County Agricultural Executive Committee.

Mr. L. A. Rhodes, M.B.E., A.M.I.C.E., M.I.W.E., Chief Engineer, Severn River Board.

Dr. R. K. Schofield, M.A., Ph.D., F.Inst.P., Head of Physics Department, Rothamsted Experimental Station.

Mr. J. V. Spalding, B.A., M.I.C.E., A.M.I.W.E., Deputy Chief Engineer, Ministry of Agriculture and Fisheries.

Mr. R. V. W. Stock, M.C., B.Sc.(Eng.)Lond., M.I.C.E., M.I.Mech.E., Chief Engineer, Thames Conservancy.

Mr. G. H. Theobald, A.M.I.C.E., A.R.I.C.S., A.M.I.W.E., A.M.I.Mun.E., Ministry of Agriculture and Fisheries (Secretary).

TERMS OF REFERENCE

4. The Panel's Terms of Reference were :—

I. To examine broadly the information available as to the effect of land drainage operations on the flow in rivers and upon water resources ;

II. to report on the methods at present adopted by drainage authorities to enable riparian users to obtain a supply of water ; and

III. to consider what practical steps might be taken, if necessary, by drainage authorities to conserve water without impinging on the functions and interests of water undertakers and other river users.

5. It will be convenient to consider the problems under three headings corresponding to the terms of reference, though the terms are so closely related that complete separation is impossible and some repetition is inevitable.

I—THE EFFECT OF LAND DRAINAGE OPERATIONS ON THE FLOW IN RIVERS AND UPON WATER RESOURCES

Works carried out by drainage authorities and the farming community

6. The works carried out by drainage authorities and farmers have three objects. These are :—

(1) DRAINAGE, to reduce the water content and increase the air content of agricultural land so as to avoid waterlogging.

(2) FLOOD PROTECTION, to minimize the spilling of water from river channels on to built-up areas, or on to crops which would thereby be harmed.

(3) CONSERVATION, to hold water in the river channels for the benefit of riparian users and navigation.

Types of drainage works

7. The main types of drainage works are :—

(1) Under-drainage by tiles and moles, and similar operations.

(2) Farm ditching and moorland gripping.

(3) In special circumstances, as, for example, where the valley subsoil is permeable, or in extensive flat areas such as the Fens, the improvement of streams or river channels with the object of lowering the water level therein, so as to effect a corresponding reduction in the level of the water table in the adjoining land.

Effect of drainage works

8. These works have the effect of enlarging the zone of soil available to plant roots and thus promoting their growth ; advancing the warming of the soil in spring and thus encouraging earlier germination ; and, by removing surface waterlogging, extending the grazing season on grassland.

Scope of flood protection works

9. Flood protection consists in the main of works directed towards the improvement of the channel by straightening, widening, deepening and removing obstructions to the flow and by the building of flood embankments ; and of the provision of special basins and flood paths which may include areas of grassland which can be inundated.

Conservation works

10. Conservation works include the erection and maintenance of weirs, dams, sluices, locks and other control structures to hold up water for stock watering, irrigation, stock barriers, water power, navigation and other purposes.

Water users' interest

11. The principal sources from which water is obtained for use are :—

(1) streams, rivers and springs, by means of gravitation (perhaps after impounding) or pumping or a combination of the two ;

(2) underground sources, by means of pumping from shallow or deep wells, including boreholes.

12. The interests of the water user are best served by any process which :—

(1) tends to even out the flow of rivers over the year and so increases the rate of flow during periods of dry weather, and

(2) allows the maximum possible amount of water to go into underground storage.

Factors affecting the problem

13. The effect of land drainage operations on the flow in rivers and upon water resources is most complex. There have been many theories, and the few practical experiments and field trials which have been carried out have yielded results too localized to be capable of general application. The quantity of water draining off the land and its destination and rate of flow depend on many factors, most of them variable and some of them unpredictable, such as the amount, intensity and distribution of rainfall, topography, soil and subsoil texture and surface conditions, vegetation including afforestation, evaporation from the leaves of plants and soil surfaces, and the extent to which towns and roads are sewered. It is therefore impossible to state any general rule and the result for any given set of circumstances must depend on the inter-relationship of the various factors affecting the conditions.

Areas in which drainage works are necessary

14. Considerable expanses of land are of an impermeable character and drainage work is essential to their agricultural utilization. Thus, over 4,000,000 acres are occupied by the exposures of clay formations and heavy land, most of which is concentrated in the south-eastern half of the country. The proportion of such land in the catchment areas of the Great Ouse and the Suffolk and Essex rivers exceeds one-third, and in them ditching and underdrainage is practised to the fullest extent. Mole draining in particular is widely practised in these parts of the country.

15. In contrast to these heavy land regions, in the north-western half of the country the rivers have to cope with the surplus of much higher rainfalls in mountainous catchments of an impermeable nature. In them the area of rough grazings, a reflection of hill land, frequently exceeds one-third of the total surface, as for example in Wales and the northern counties of England. It is in such regions that moorland gripping is a potential factor in the water regime.

Areas in which drainage works are unnecessary

16. Drainage works are not usually required in the upland areas where there are permeable subsoils. Such areas include the chalk of the Yorkshire and Lincolnshire Wolds, the Chiltern Hills, the North and South Downs and Salisbury Plain, in addition to belts of limestone and sandstone in other parts

of the country, in all exceeding 8,000 square miles. In this type of country there are practically no ditches or small streams. The absence of any drainage work is of paramount significance when considering the interests of water users, as these areas form the main collecting ground for underground supplies. Instances may occur when drainage is needed in permeable soils but such instances are comparatively rare.

Method of approach

17. It will be convenient to consider separately, in relation to river flow and water resources :—

A. The removal of water from the soil by underdrainage, moorland gripping and field ditches.

B. Main channel improvement works to facilitate the passage of surface water and excess soil water after its removal from the soil.

A. THE REMOVAL OF WATER FROM THE SOIL

Usual types of under-drainage works

18. The most usual methods of under-drainage are *tile drainage* and *mole drainage*, although other and older methods such as stone, bush or sod draining are still carried out where the more modern methods are unsuitable or uneconomic. *Tile drainage* is carried out by digging trenches into the soil and laying pipes with open joints in the trench bottoms. If an impermeable soil is treated in this way, the trench is dug through the upper layer into the impermeable clay subsoil, and since the soil in the back-filled trench is relatively open and permeable, the water in the soil will find its way down the trench into the pipes. Some negligible quantity may find its way through cracks in the clay to the trench. Tile drainage performs a rather different function in permeable soils through which water can percolate easily, for the work is designed to prevent the body of ground water rising above drain level into the root zone of the soil. *Mole drainage* is only suited to heavy land with a clay subsoil fairly near the surface. The essence of the operation is to draw channels in the subsoil clay by mechanical means, into which the water enters either by the cut made by the blade of the machine or by the fissures and cracks formed in the surrounding clay during the passage of the mole. The channels so formed have a limited life of between five and ten years depending on the suitability of the soil but in exceptional conditions they may last much longer.

Brief history of under-drainage works

19. There is nothing new in the practice of under-drainage of agricultural land, for the use of covered drains in great variety dates back some hundreds of years. Tiles first came into use at the end of the eighteenth century, but before then channels were formed in the drain trench bottom with flat clay tiles, stone slabs, or the surface turf. Earlier still the trenches were partially filled with stones or bushes. There was a great expansion of this work in the middle or third quarter of the nineteenth century and another small expansion from 1939 onwards. A prototype of mole draining in clay soil, called plug draining, was first described in 1724, and the mole plough was the logical development. In those parts of England and Wales where artificial drainage is necessary, it is rare to find a field which has not been drained at some period or other ; and much of the work being carried out to-day consists of re-conditioning or replacing old systems.

Water-holding power of heavy soils and the seasonal weather cycle

20. Soil is capable of holding a certain amount of water which cannot be drained away by natural or artificial means, and which can be removed only

by evaporation or by the action of plants. A soil containing this amount of moisture and no more, is said to be at " field capacity". When the moisture content of the soil rises above this " field capacity " the excess water will begin to drain away if natural or artificial drainage channels exist. An efficient system of drains will continue to discharge so long as the soil above the drains contains water in excess of " field capacity". In normal summer months transpiration exceeds rainfall in most districts and the soil is dried out below field capacity. During the autumn and early winter, when the monthly rainfall normally exceeds the monthly transpiration, the excess of water is used in moistening the soil up to field capacity ; only after this has been accomplished is any appreciable amount of water available for percolation or drainage, so that a period of time—usually several months—must elapse between the time of maximum soil moisture deficit (about August) and the first winter discharge of drains. In dry winters in some areas, such as East Anglia, there may not be sufficient rainfall to moisten the soil up to field capacity before the drying out process begins again in the following spring ; consequently there is no discharge from the land drains. On the other hand, during a summer period of excessive rain, a wetting-up may take place which will temporarily raise the water content of the soil above field capacity with a consequent discharge from the land drains.

Effect of under-drainage works on soils of limited permeability

21. A close textured clay soil exhibits a shallow surface layer more open than the natural clay underneath. In the summer drying-out period the soil dries progressively from the surface downwards causing shrinkage and fissures in the clay. During the autumn re-wetting the sequence of events in an undrained soil is that the soil is re-moistened to field capacity, the fissures close up through swelling of the soil aggregates and any further rain causes exclusion of air and eventual water-logging. Apart from any horizontal flow through the more open surface layer, additional rain will stand on the surface in pools, or run off into ditches or watercourses. The sequence of events in a drained soil is the same until the soil is re-moistened to field capacity, after which further moderate rain will find its way to the drains and be discharged. If the rainfall is intense and prolonged, some will be stored temporarily in the surface layer and eventually the soil might even become temporarily completely waterlogged and some surface ponding and run-off will occur.

22. With the cessation of rain the drained field would be relieved of waterlogging quickly and the discharge from the drains would diminish in a relatively short time. The soil would again be aerated and capable of absorbing moderate amounts of rain in excess of drain capacity. Discharge from the undrained field would be prolonged and in the winter months in particular the soil would remain in or near a waterlogged condition. A moderate additional amount of rainfall would again cause surface ponding and run-off.

Effect of under-drainage works on permeable soils

23. In most conditions it is unnecessary to drain permeable soils as surplus water will percolate naturally down to the body of ground water below the surface. In some places, however, the ground water encroaches on the space required for root growth and may even reach the surface ; some form of drainage is then needed to permit development of plant roots by holding down the free level of the ground water. These places may be found where a shallow permeable layer rests on an impermeable bed, or where a permeable layer is in a hollow. Although the waterlogged state of the permeable area may arise from rain falling within the area, it is more often caused by an influx of ground water from outside the area.

24. Where the entry of ground water from outside can be ignored, the annual cycle of events can be summarized as follows. Without drainage, the soil will probably be completely waterlogged at the end of the wet season, and thereafter, as drying out progresses, the water table will sink lower and lower as the water is removed by transpiration and natural lateral drainage to streams and rivers. As the water table sinks, moderate rainfall can be absorbed by the soil without waterlogging, the stored water gradually being discharged. Thus a temporary storage capacity is built up in the soil above the water table. This " cushioning " action will continue until the rate of re-charge begins to exceed the natural rate of discharge : the water table will then rise to the surface. Installation of a drainage system will lower the water table and prevent it from rising appreciably above drain level except when the intensity of rainfall exceeds the discharge capacity of the drains. During dry weather the water table may fall below drain level and no major discharge from the drains will then occur until sufficient rain has fallen to make good the water transpired by vegetation or naturally drained away and to raise the water table to drain level again. From then onwards during the wet season further rain will largely appear as drainage discharge, the incidence of drainage being somewhat delayed by temporary storage in the soil layer above the drains.

25. Where an influx of ground water from outside the area occurs, the water table in undrained permeable soil may be maintained at or near the soil surface and local rainfall will usually be discharged rapidly as extra run-off. The installation of a drainage system will lower the water table to drain level within the area, and cause a slight depression in the external area adjacent to the drained area without in any way accelerating the rate of flow from the external into the drained area. As before, the temporary storage capacity established between drain level and the soil surface will have a " cushioning " effect on the discharge of local rainfall.

Effect of under-drainage works on springs

26. Springs which most often cause damage to agricultural land occur where the water table in a permeable stratum intersects the surface because of an impermeable stratum or other cause and the ground water seeps out on to the impermeable layer. Drainage is effected by constructing channels, either tile drains or ditches, in such a position that the overspill is intercepted before it reaches the ground surface and is led away to the nearest convenient ditch or watercourse. This also has the effect of depressing the water table in the immediate locality, but does not affect the rate of flow of the spring.

Under-drainage and soil moisture deficit

27. One effect of under-drainage common to all types of soil is the removal of water from the top soil and its replacement by air, thereby deepening the layer of soil suitable for plant root growth. The amount of water transpired by plants is directly connected with the extent of root growth. Broadly speaking, the amount of water available to plants during rain-free periods is that held within, or just below, the depth of rooting and in such periods it is the plants that have the deepest root systems that will grow best and survive longest. Drainage extends the period of growth and increases the root development and thus more water is transpired and a greater soil moisture deficit is built up. Direct evidence of amount is lacking, but other experience suggests that in places and seasons where total rainfall in two consecutive summer months is less than three inches, the difference in deficit between drained and undrained soil might be one inch or more (measured as a rainfall equivalent). In general this much extra autumn or winter rain must fall before any appreciable quantity of water is available to move down to the drains or water table.

Under-drainage and flood risk

28. The connection between field drainage and flooding in rivers has been the subject of debate for many years. It is recorded that in 1861 the Institution of Civil Engineers occupied four evenings in discussion of this problem without arriving at any agreed conclusions. At the onset of *maintained heavy rain* the rate of discharge from undrained and drained soils of low permeability will depend to some extent on the storage capacity then existing in the soil and the detentive effect of surface irregularities. These in turn will be governed by the extent of recent rainfall. Assuming, however, that this has been very moderate, it is likely that the drains in the drained soil will begin to discharge before there is any run-off from the undrained land ; the latter first making use of a very limited storage capacity in the soil itself and then of a much greater surface detentive capacity. Throughout this period there will have been continuous discharge from the drains of the drained soil, delaying it reaching a waterlogged condition and the beginning of surface detention. Later still, while the rate of surface run-off from undrained soil is increasing, the drained soil will still be making use of its surface detentive capacity and it is only in conditions of prolonged and intense rainfall that any appreciable surface run-off would occur.

29. During a period of *intermittent rain* there would be little difference in the sequence of events in the undrained soil except for a delay in the build-up due to the intervening dry periods. On the drained soil, however, the drains will continue to discharge the excess water in between the storms and so renew the temporary storage capacity. If these intervals are sufficiently long the discharge from the drains in the drained soil will react separately to each individual storm but the discharge from the undrained area will be largely governed by the cumulative effect of preceding storms. During periods of *very heavy rain*, the intensity may exceed the rate of infiltration and surface ponding and run-off will take place on any kind of land even before the temporary storage capacity is completely filled.

30. The same considerations will apply in situations where drains are needed in permeable soils, but the temporary storage capacity of the soil will have a greater cushioning effect.

31. Accepting this generalized argument of the relative phases of the discharge from drained and undrained land, it is possible to combine the many variable factors such as slope of land, surface cover, type of drainage, duration, intensity and pattern of rainfall, drain capacity, soil permeability and storage capacity, surface detentive capacity, etc., in ways that will demonstrate the higher peak flow to be from either drained or undrained soil. Which of these ways is applicable to practical conditions cannot be decided, because field observational data do not exist in a sufficiently comprehensive form to make such a decision possible.

32. The drainage of springs is unlikely to affect flood flows, since their reaction to rainfall is relatively slow and, as stated above, the installation of a drain does not draw more water away from the spring but merely confines the flow to defined channels.

Under-drainage and river abstraction

33. It has been shown in paragraph 27 above that drainage operations cause increased root growth and consequently increase the drying of the soil in summer. More rain will therefore be required to eliminate the deficit and remoisten the soil to field capacity, and thus under-drainage may protract the time of minimum flow in late summer and early autumn. Any prolongation

of the period of very low river flow must have an adverse effect on water supplies abstracted from rivers.

34. Once the soil has reached field capacity there will probably be a quicker discharge from the drained soil at the onset of rain storms, as explained in paragraph 28 ; that is, the build-up from summer to winter flow is likely to be in the form of a series of peaks, especially from mole drained fields, in contrast to the steadier build-up of seepage or surface flow from undrained fields.

35. Over a complete annual cycle the total discharge from the drained soil, whether of high or low permeability, may be slightly less than that from the undrained, due to the increased root penetration and greater soil moisture deficit. To this extent the interests of the water undertaking or individual consumer abstracting from a river might again be adversely affected.

36. The tendencies outlined in paragraphs 33-35 will not operate in all years, and in any year they may be suppressed or emphasized by local factors, so that here, too, no general statement can be made about the effect of drainage works on river abstraction.

37. It is possible that the drainage of springs will be beneficial to the user of river water since, by the collection of the water in defined channels, there will be a smaller loss by evaporation than when the water is allowed to trickle over the surface of the land. The total amount will be increased but the fluctuations in flow, if any, will be unaffected.

Under-drainage and underground resources

(*a*) Soils of low permeability

38. Underground water resources cannot be directly affected by the drainage of impermeable soil as the water is unable to penetrate beyond the top few feet of the soil even when fissured in summer, and there is no body of ground water capable of forming a source of supply. There may, however, be some effect where the discharge from the impermeable area passes over a permeable intake area. Drainage of slightly permeable soils may have a slight effect upon underground storage as some water may enter the drains which otherwise would find its way underground.

(*b*) Permeable soils

Since underground water supplies are replenished by the rain which falls on exposed permeable formations such as chalk and limestone, and drainage operations are rarely executed in such soils, field drainage cannot have any appreciable effect on underground resources. In exceptional places where a drainage system may be necessary there is unlikely to be any adverse effect on underground resources, as the water naturally percolates down past the pipe zone as long as the body of ground water is below pipe level ; it is only when the water table rises up to pipe level that water will run off through the pipes. Shallow wells sunk in or near the drained area will have their water levels lowered perhaps to drying-out level, but such wells are liable to dry out in any case during drought, are subject to pollution and cannot be considered as satisfactory sources of water. Wells more distant from the drained area will not be affected, even if they draw water from the same layer, because the depression of the water table by the drainage system does not extend very far beyond the boundary of the drained area.

39. The same reasoning applies to the drainage of springs. The overflowing of water from the permeable layer, which occurs before drainage, is due to the rainfall percolating into the layer faster than it is being extracted by any users of that particular underground source. It is, therefore, surplus to requirements and is already being lost to any underground storage. The

collection of the water in defined channels and the leading of it away will not alter the total amount available to the users, and the drainage of this type of spring, therefore, has no effect upon underground water resources. Shallow wells sunk on, or adjacent to, the line of the drain may be affected as described above.

MOORLAND GRIPPING

40. On the upland sheep-walks and fells, where the value of the land renders normal methods of under-drainage uneconomic, a relatively cheap form of drainage has been evolved which consists of cutting a series of open trenches some 14 inches deep, 22 inches wide at the top and 6 inches wide at the bottom. The work was done originally by hand but in recent years a machine has been designed for the purpose which has resulted in an appreciable increase in this class of work. The arrangement adopted can be considered as broadly equivalent to a suitable shallow tile drainage system in which the tiles are replaced by open grips. Its effect, however, differs slightly from normal under-drainage and merits special consideration. The practice is confined to areas which have high rainfall and soil of low permeability, conditions favouring the formation of peat. Broadly speaking, two types of land are involved, namely, deep beds of peat and impermeable soils which have a few inches of peat at the surface.

Effects of moorland gripping on the soil

41. In its ungripped state the soil is waterlogged for most of the year so that rainfall ponds on the surface of the flatter areas forming bog pockets and runs off the steeper areas into the natural watercourses or on to the flat areas. It is possible that there is a slow dry-weather discharge from these areas as the ponded water gradually seeps away.

42. Our investigations do not support the generally accepted impression that peat is highly permeable but rather suggest that wet peat is very resistant to water movement and that dry peat is almost non-absorbent. Observations show that immediately after the cutting of grips there is a sudden flush of water derived mainly from surface water on the saturated ground. At the same time a limited amount of water drains away from the peat on the sides of the grips but as the total amount of such drainage is small the flush gradually dies away. During dry periods evaporation and transpiration still further reduce the moisture content of the peat on the sides of the grips and the surface of the moor, causing shrinking and cracking and thus enabling the drying action to proceed somewhat deeper into the peat. Subsequent rainfall on the dried-out areas then quickly finds its way through the fissures into the grips and only when there is a prolonged wet period will the peat begin to absorb water and swell.

Moorland gripping and flood risk

43. The run-off from an area of undrained peat will closely resemble the sequence of events on undrained soils of low permeability. Similarly the run-off from the drained peat will resemble the run-off from drained soils of low permeability but the initial discharge until the peat is remoistened and the cracks disappear is likely to be more pronounced; thereafter the surface detentive capacity will have a greater delaying effect. Again the relative effects, severally and collectively, of the various factors and lack of observational data prevent any definite conclusion being reached.

Moorland gripping and impounded water supplies

44. Most moorland gripping is carried out at the headwaters of rivers, in areas that usually provide the most suitable sites for impounding reservoirs.

On undrained reservoir catchment areas the water retained on the surface and in bogs during the winter gradually seeps away into the natural streams throughout the summer, providing a steady flow of water into the reservoir. Drainage prevents or reduces this detention of water on the surface, and the discharge from the drained area falls off fairly rapidly at the onset of a dry period. On the other hand, the run-off responds quickly to summer storms but no data are available to compare these intermittent discharges with the steady flow from the undrained areas.

45. Over the annual cycle it is probable that gripping has very little effect on the total discharge. The tendency, however, will be towards a slightly greater quantity from a gripped area because the changed surface conditions favour a small reduction in summer evaporation.

Moorland gripping and underground supplies

46. Underground supplies are unlikely to be affected by moorland gripping as the nature of the ground virtually prevents percolation. In some areas, however, where the peat overlies limestone, the drainage schemes are designed to discharge into potholes, but whether this water goes to increase the underground resources or reappears in local springs must depend on the conditions prevailing in each individual site.

FIELD DITCHES

47. Under-drainage systems may discharge directly into watercourses, but usually their outlets lead into ordinary farm ditches adjoining or passing through the drained area, which, in turn, conveys the water to the natural watercourse. In many places, however, the ditches also drain the land through which they pass and therefore fulfil the dual role of drain and carrier. The relative importance of each of these functions will depend on the siting of the ditch and the conditions prevailing in the locality. The drainage effect of ditch improvement will be similar to the effects of under-drainage described above, whilst the effect as carriers will be similar, but on a smaller scale, to the effect of channel improvements described below. The effect of improving dual function ditches in any given case will depend therefore on the relative importance locally of each function.

B. CHANNEL IMPROVEMENT WORKS

Definition of Floods

48. Natural river channels are seldom capable of containing more than a third to a half of the peak flow. When the channel capacity is exceeded the water level rises above the level of the adjoining land and the river spreads out, thereby making use of both an enlarged flow area and a temporary storage capacity to accommodate some of the excess water until it can flow on downstream. This condition is a state of " flood " as used in this report.

Flood protection policy

49. It is not normally a drainage engineer's objective to eliminate all flooding. In many river valleys an occasional spilling over on to the adjacent grassland does no harm, and is thought by many even to be beneficial. It is, however, important that channels should be kept sufficiently free from obstruction to contain most summer floods, so that hay crops are not menaced, and to avoid prolonged winter flooding in these areas. The need for complete flood protection works arises only in those places where the rivers are flanked by extensive areas of arable land, or where there has been building or industrial development in the flood plain. These works, which sometimes may not be economic, include enlargement of the channel by dredging, removal of obstructions,

building of flood embankments, straightening of the channel, construction of flood diversion channels and other ancillary works.

Effects of channel improvement works on a single watercourse

50. Channel improvement works in themselves have only relatively local effect on velocities and levels. Water is not drawn from any great distance by reason of these works. On the other hand the prevention of local flooding eliminates a certain amount of local storage so that the water which would normally have caused the flooding is now contained in the channel and is passed on downstream. Whether the addition of this water is likely to cause embarrassment downstream must depend on its volume in relation to the flow in the river. Clearly, the avoidance of flooding on an area adjacent to a small stream must have a greater effect on that stream lower down than the avoidance of an equal amount of flooding adjacent to a large river.

Effects of channel improvement works on a river system

51. During and after heavy rainfall that is general over the catchment area, water will drain off the catchment area into all the tributary rivers and thence into the main river. The effect upon levels in the main river depends upon many factors, but in general the most important is the timing of the arrival of the contributions from the tributary streams. For example, if conditions are such that the contributions from the tributaries lower down on the system are carried away by the main river before the arrival of contributions from the higher part of the system, down-river levels will be lower than they would be if the flood peaks from the upper and lower tributaries coincided or nearly coincided. Improvement work, therefore, which results in accelerated flow either on the main river or the tributary may be beneficial if it enables the water to get away before the arrival of the flood peak from above. The beneficial effect may be completely reversed by the distribution of rainfall, as, for example, when heavy rainstorms occur higher up the system an appreciable time before they occur lower down ; in this way the peaks may be caused to coincide. It will be seen, therefore, that no general statement can be made about the effect of channel improvement on main river floods.

52. Some quantitive indication of the possible effect downstream of channel improvement works undertaken to avoid flooding is given by calculations* carried out in 1933 for the River Trent basin, where it was shown that the effect of protecting an area of some 2,500 acres which normally flood to an average depth of 2½ feet affected the flood level in the vicinity by 4 or 5 inches. These results have since been confirmed by laboratory model tests, but it is interesting to note the model tests indicated that the effect was negligible a few miles downstream. In the opinion of the Panel, however, it must be conceded that the general effect of any local channel improvement which stops or reduces the inundation of adjoining land is to increase peak and near-peak flows downstream. Taken individually, these increases might be insignificant but we are of the opinion that the collective effect of numerous improvements to ditches, watercourses, streams and rivers in a catchment area may be substantial in the lower reaches of a river system.

Research into flood incidence, rainfall and underground storage

53. Three members of the Panel have furnished the results of investigations of existing records carried out by them in relation to particular areas. These are :—

(*a*) Mr. Rhodes, Chief Engineer to the Severn River Board for the Severn Catchment Area.

* " The effect of flood relief works on flood levels below such works " being a Paper read by Mr. E. C. Hillman to the Institution of Civil Engineers on the 25th February, 1936.

(*b*) Mr. Stock, Chief Engineeer to the Thames Conservancy for the Thames Catchment Area.

(*c*) Dr. Penman, of Rothamsted Experimental Station, for the River Stour (Essex and Suffolk) Catchment Area.

Details of these investigations and the interpretations placed upon the results by the Panel are given in the following paragraphs.

Examination of River Severn records

54. Two series of investigations were carried out on the Severn area records :—

(i) At the Bewdley Gauging Station measurements were made of the rates of rise and fall of river levels over two periods : Period I of 18 years, 1921-38 inclusive, and Period II of 10 years, 1939-48 inclusive. The choice of periods was determined by the date (1937) of the Agriculture Act. It would for present purposes have been preferable if Period II could have been of longer duration. Comparisons were made between the two periods with respect to rises of 10 feet and over, rises between 7·5 feet and 10 feet, and rises between 5 feet and 7·5 feet ; and in all three ranges there was on average a very marked increase in both the rates of rise and of fall in Period II compared with those in Period I.

(ii) The second investigation was into the magnitude and duration of floods at Worcester, and a " chimney " graph was plotted which gave a record of both height and duration of every flood at Worcester from 1862 to date, a period of 88¼ years. (The " chimney " graph is attached as plate 1 to this report.) The datum used, namely 44·35 feet above O.D., represents bank-full condition of flow, and every rise in water level above that datum has been classified as a flood. The " chimney " graph shows a long period cycle in flood frequencies and it is interesting to note that since 1925, that is, before the passing of the Land Drainage Act (1930) and the wartime increase in works, there has been a tendency towards an appreciable increase in the flood height, and of 14 floods rising to or above 48·0 O.D. no less than seven have occurred since 1938.

Examination of River Thames records

55. The Thames investigations were made independently and relate to the natural river flows at Teddington Weir.

(i) Rates of rise and fall over two periods 1926-38 and 1939-47, resembling those used for the Severn, were investigated and it was found that the average rate of rise in Period II was a little greater than in Period I. On the other hand the average rate of fall showed a decrease in rate in Period II.

(ii) A " chimney " graph was plotted showing the magnitude and duration of floods at Teddington from 1883 to the present day (plate 2 of this report). This graph does not, however, give any indication that floods in the past 10 years have occurred any more frequently, lasted longer, or reached higher peaks than they did formerly.

Interpretation of the Severn and Thames results

56. It might be suggested that the increase in the magnitude of the Severn floods in the past 10 years, as shown by the relevant " chimney " graph, and also the increases in the rates of rise and fall of the river at Bewdley could be ascribed to intensified land drainage activities carried out since the passing of

the Agriculture Act, 1937, and particularly to the greatly increased amount of open channel improvement executed in a comparatively short time, due to the use of machinery for the first time, and on a large scale, in land drainage operations. The panel considered the above suggestion and their views may be summarized thus :—

57. The flood hydrographs at Bewdley show steeper rises and falls between 1939 and 1948 than between 1921 and 1939. Qualitatively these changes are of the kind to be expected as a result of open channel improvement and possibly of field under-drainage, but quantitatively the effect cannot be assessed without knowledge of the proportion of the catchment area that has been affected. This information is not available, and as other factors (a long term trend in weather ; changes in land utilization and agricultural practice ; a change in the ground water storage in the area) could produce the same effect, no definite conclusion can be drawn until further evidence is obtained.

58. Although the investigations of the two sets of records were carried out on a different basis (height of river level and rate of river discharge respectively) and one cannot compare any quantitative deductions from them, it is possible to contrast their tendencies. There is, however, a difference between the catchment areas above the recording points which needs to be noted. The drainage area above Worcester on the Severn represents rather less than one-half of the total river basin although approximately two-thirds of the total run-off is derived from it. On the other hand, Teddington is at the lower end of the Thames basin and receives most of its run-off.

59. At Worcester and Teddington the rivers have gone through a number of cycles of high and low flood frequency between 1862 and 1949 : the extremely high floods of the Severn have been more frequent since 1938 but the Thames floods have not been equally so in the same period. Meteorological evidence is given on Plate 3 showing the running ten-year means* of general rainfall over England and Wales for the period 1847-1949. Similar graphs have been added for the latter part of the period showing the rainfalls in the Severn and Thames basins. For comparison, the running ten-year means of number of flood days at Worcester and Teddington have also been plotted. It will be noted that the last peak in the Severn floods' curve is reproduced in the rainfall curve for that area, which reflects the relatively heavier rainfall in the west of recent years. There is very close agreement between the flood graphs and the rainfall graph, suggesting that the dominant factor in determining flood frequency is the long-term trend in rainfall. In other words, the flood risk will always be high at the end of a period of wet years in which ground water storage has been built up, and will be low at the end of a period of dry years when ground storage has been depleted.

60. The Panel considers it is impossible to isolate any one factor as being the principle reason for the increase in flood frequency in the River Severn. The difficulty in detecting precisely the effect of land drainage operations on the flow of the rivers arises because Nature does not repeat herself. In order to make a direct comparison of the river flow before and after any drainage it would be necessary to compare the flows following similar conditions of (*a*) rainfall amounts over the area for periods of a week or a fortnight ; (*b*) rainfall distributions over the area ; (*c*) the height of the river, state of ground and ground storage and (*d*) of sunshine, wind, temperature and humidity, which have effects on the evaporation. Such similar conditions never recur. The problem while not insuperable is therefore extremely difficult.

* A running 10-year mean is the mean of 10 consecutive years and, in this case, is plotted at the end of the period.

Channel improvement and flood risk

61. Under the term " channel improvement " is included the improvement of all open channels, including ditches and small watercourses. Having considered the effect of channel improvements both theoretically and by examination of records the Panel do not feel that they can express any definite opinion about the effect of such work on flood risk. They consider that there is a great need for further statistical analysis of any existing data and that future river flow records should be planned with due regard to the necessity for improving knowledge of the effect of channel improvements.

62. In the meantime the Panel are of the opinion that, on balance, the most likely effect of schemes which reduce flooding by channel improvement or by the improvement of control structures is to increase the flood peak downstream, and this factor should always be considered when planning works of this kind.

63. This consideration points to the desirability of having some clear conception of the objectives of improvement works throughout the catchment area. For example, it might be the accepted policy of a river board that there should be no attempt to eliminate grassland flooding, but that channel improvements in such areas should be designed on the basis of avoidance of most summer floods. On the other hand it would probably be agreed that the flooding of towns, industrial premises and valuable arable land should be eliminated wherever possible.

River Stour (Essex and Suffolk) investigations

64. The River Stour (Essex and Suffolk) catchment area is basically chalk with a large part overlain by boulder clay in which intensive land drainage operations have been carried out since 1940. The run-off data were combined with the monthly estimates of evaporation based on local weather data to give month to month estimates of ground water storage for the period 1933-1948. These changes were found to agree very closely with those observed throughout the whole period in the water level of a deep well, from which it is concluded that the drainage operations in the later years of the period have had no obvious influence on the seasonal cycle of the river. In other words there is no evidence of any effect on the river as a source of water.

Quantitative effects of channel improvements on water resources

65. Accepting the fact that, in the Severn area at least, the tendency of recent years has been for flood peaks to be higher and rates of rise and fall to increase, and assuming that land drainage might be a contributory cause, the Panel considered the effects that these changes would have on water resources and came to the following conclusions :—

(i) The maximum rates at which water can be abstracted from rivers both with gravity and pumping schemes are seldom more than small fractions of the flood flow. Changes in the shape of the flood hydrographs would not adversely affect the quantities which could be abstracted unless there was also a reduction in the period during which the rivers were flowing at or above the maximum abstraction rate (plus any prescribed minimum flow). Although there are some circumstances where this could prove to be the case they are likely to be few in number.

(ii) Intake into underground storage is not affected by channel improvements.

II—THE METHODS AT PRESENT ADOPTED BY DRAINAGE AUTHORITIES TO ENABLE RIPARIAN OWNERS TO OBTAIN A SUPPLY OF WATER

Demands for water

66. Apart from the demands of water supply undertakings for river water, large quantities are needed by industry for processing and cooling purposes. In addition, agriculture requires water for cattle drinking, milk cooling, vegetable washing, fruit spraying, irrigation and other purposes, and it is in connection with the supply of water for agricultural purposes that drainage authorities play an important part.

Present methods adopted by drainage authorities

67. The operations of drainage authorities in connection with water supply and conservation are more extensive than is generally realized. There are, in fact, some lowland areas where the foremost work of the drainage authority is to keep an adequate supply of water in the ditches, and where disposal of water is of secondary importance. Many sluices and weirs are maintained for the sole purpose of holding up rivers to levels from which water can gravitate through side channels for agriculture and other purposes. In marsh areas it is a general practice to provide some system of water retention during the summer months for cattle drinking and to form a barrier for stock. In such areas it is not uncommon for the sluices to remain completely closed throughout the summer. Examples of this work are to be found everywhere in the Fens and indeed in any marsh area. It is impossible to compile an exhaustive list but mention might be made of Somerset as an area where water supply in summer is regarded as one of the most important functions of the drainage authorities. Water from the Nene, Welland, and all the South Level rivers is abstracted by means of small sluices for irrigation purposes. In Pevensey Marsh in Sussex there is a particularly elaborate and complex system of water distribution, and in Kent there is an interesting example of a channel constructed for other purposes being used by a drainage authority as a reservoir to feed water into the marsh area—this is the Royal Military Canal which encircles Romney Marsh.

68. The provision of cattle-drinking bays along the sides of streams is customary. Where the flow of the stream is liable to dry up, low dams are built just downstream of the drinking place to hold back a small quantity of water.

III—PRACTICAL STEPS WHICH MIGHT BE TAKEN BY DRAINAGE AUTHORITIES TO CONSERVE WATER WITHOUT IMPINGING ON THE FUNCTIONS AND INTERESTS OF WATER UNDERTAKERS AND OTHER RIVER USERS

Practical methods of conservation of water

69. The most obvious way in which to conserve water would be to create some form of surface storage reservoirs. A second way would be artificially to direct excess surface water into underground storage.

Reservoirs

70. Reservoirs may be classified as follows :—

(*a*) accumulation reservoirs to serve a single purpose such as water supply, electric power, irrigation, regulation of the discharge of a navigable waterway and similar purposes ;

(*b*) single-purpose flood control reservoirs. These must be emptied as quickly as possible after each flood at a rate which does not cause flooding downstream ;

(*c*) multi-purpose reservoirs planned and operated for two or more of the purposes mentioned at (*a*) and (*b*) above.

Multi-purpose reservoirs

71. In general, a multi-purpose reservoir must have its total capacity divided into components representing the various uses. For flood prevention it is obviously desirable to keep the water level as low as possible and so have the maximum capacity available to absorb potential flood water, but for conservation it is equally desirable to hold the maximum amount of water against possible dry seasons. The extent to which these components can overlap must depend on the accuracy of any long range weather forecasting. If reliable long range weather forecasting becomes a reality, the operation of a dual purpose reservoir could be comparatively simple and the overlap considerable, but with the present limited time range of weather forecasting reservoir management is very hazardous. Thus, if the flood component were to some extent utilized for conservation in anticipation of a prolonged dry period and a wet period actually occurred, it would probably be impossible to store all the excess run-off and the resulting flood would be all the more disastrous because of the sense of security created by the construction of the reservoir. Similarly, if the water level were unduly lowered in anticipation of a period of heavy rain and a long dry spell actually followed, an acute water shortage might easily result. The Panel has no knowledge of any dual purpose reservoir of any importance in this country.

72. The greatness of the quantities of water discharged during a flood period, compared for instance with the quantities needed for water supply purposes, is seldom fully appreciated. A moderate-sized English river may have an average flood discharge of 10,000 cubic feet per second over a period of seven days, and it is not uncommon for the flow to be above bank-full capacity for the whole period. If it is assumed that the bank-full capacity is 4,000 cubic feet per second, there would be an average excess of 6,000 cubic feet per second for the whole period. Such a quantity would flood no less than 13 square miles of land to a depth of 10 feet. For the sake of comparison it might be noted that this quantity represents some 62 days' supply, at the present rate of demand, for the area served by the Metropolitan Water Board. To be successful in completely eliminating flooding, a reservoir (or series of reservoirs) must be capable of containing any flow above that of bank-full capacity, and as the bank-full capacity of a natural river may be less than half of the peak flood flow it would, on the simplest form of calculation, be necessary, when considering flooding in relation to any particular point on a river, to site the storage capacity in such a way and sufficiently low down the river to allow of at least a half of the flow at that point being detained. In practice, the calculation is further complicated by the changes which take place in the shape of a flood wave during its passage down a river.

73. In rivers having their sources in hills or mountains, sites exist where reservoirs could be constructed, but a single flood reservoir near the source of a river would be quite ineffective in controlling the floods in the lower reaches where the damage occurs. Further, many of the English, though not the Welsh, rivers do not derive their head waters from high hills, but from relatively flat areas with wide valleys. In areas such as these, the necessary capacity to accommodate the surplus water could only be obtained by flooding a very large area to a shallow depth. It must be obvious that in such areas

a flood reservoir is impracticable as the only site available would result in widespread flooding of agricultural land, the interruption of communications, and sterilization of urban development.

74. Even assuming the rare case that a suitable and economic site could be found, the question of size, method of operation and, last but not least, compensation for its use would still remain to be settled. Floods usually occur in wet winters. Generally, a peak flood does not occur suddenly, though it may do so, and under normal conditions the reservoir is likely to be partly filled before the peak flow occurs. Once the reservoir is full, the flood situation with the reservoir is little better than without it, because while it effects a reduction of the flood peak, it results in a prolongation of high discharge conditions, as the accumulated storage has to be discharged in addition to the normal flow in the river. The responsibility for deciding how and when to use a multi-purpose reservoir would be very heavy for any individual to take.

75. Some recent calculations carried out by the Chief Engineer to the Severn River Board show that to eliminate serious flooding at Shrewsbury it would be necessary to build some 20 reservoirs at a very approximate cost of £16 million. These reservoirs would have a decreasing effect on the river's flood behaviour as one proceeded downstream. Similar calculations by the Chief Engineer to the Thames Conservancy show that to prevent inundation in the Thames Valley would entail flooding or otherwise sterilizing, more or less permanently, nearly 17,000 acres of land, and the cost would be in the region of £78 million.

76. The general question of the use of storage reservoirs to reduce flood waters was on the programme of the International Navigation Congress, which took place in Lisbon during 1949. It would seem from the papers which were presented that, apart from water supply, the production of electric power has been the main object of the majority of European reservoirs, although others are used for stream regulation to improve navigation.

77. In the United States, where conditions are so greatly different from those in Great Britain, there is at present in hand a vast programme for building multi-purpose reservoirs, some of which include the diminution of floods among their objects.

78. In Great Britain storage basins, known locally as " washlands," are a feature peculiar to the Fen drainage system. They are to some extent flood control reservoirs but were provided during the reclamation of the Fens before the land was extensively developed. Their periodical inundation has, therefore, always been an accepted condition of their agricultural use.

79. Investigations have been carried out from time to time by authorities concerned with other areas, but the difficulties of siting and management and the enormous costs involved have tended to rule out storage reservoirs as a practicable solution of major flood problems. On the other hand, the method has been successfully used to assist in the control of local floods on minor streams, and is being considered in connection with the River Cray (Kent), where there is storage capacity available in disused ballast pits adjoining the river, but the possibility of this scheme is based on the small size of the river relative to the area of ballast pit available.

Introduction of river water into underground storage

80. Although introduction of water into the ground by spreading it over the surface of permeable beds or by feeding it through pits or wells has been successful in places in some countries, the work has not been carried out for

the purpose of disposal of flood water. In England, where geological conditions are not favourable for the widespread adoption of these methods of artificial re-charge, success has attended a few small-scale attempts to introduce river water into the ground in areas of local over-development, but the artificial re-charge on any but an impracticably large scale is felt to be too slow a process to be of value in flood alleviation.

SUMMARY OF CONCLUSIONS

81. In assessing the importance of the various conclusions summarized below, the extent of any particular type of work must be considered in relation to the areas where no recent works have been carried out. A drainage scheme may have an appreciable effect on a particular field or on the immediate locality, but its effect may be insignificant when considering a whole parish, county or catchment area. Since the inception of government grants in 1940, some 250,000 acres of tile drainage and 400,000 acres of mole drainage have received grant, representing only 2 per cent of the agricultural land in England and Wales. Accurate figures are not available for ditch clearing, but it is known that these are substantially higher.

82. I A. The conclusions reached by the Panel on the effect of field under-drainage operations and moorland gripping on river flows and water resources may be summarized as follows :—

(1) The effects of land drainage depend on the combination of so many variable, and at times unpredictable, factors that any general statement is impossible (paragraph 13).

(2) Drainage works are not required on upland areas with permeable subsoils which form the main collecting grounds for underground sources (paragraph 16).

(3) Most of the under-drainage work carried out in recent years consists of repairing or renewing old existing systems (paragraph 19).

(4) In general, the lack of sufficient observational data makes it impossible to state definitely whether under-drainage of soil has any material effect on flood risk (paragraph 31). There is similar uncertainty about the effect of moorland gripping (paragraph 43). The drainage of springs is unlikely to affect flood flows (paragraph 32).

(5) The increased root growth brought about by drainage works tends to prolong the period of low river flow in summer (paragraph 33). The build up from summer to winter flow is likely to be more irregular with drained soils (paragraph 34).

(6) Over a complete annual cycle the total amount discharged from the soil may be slightly less after drainage (paragraph 35). The total quantity discharged from springs may be slightly increased by drainage (paragraph 37).

(7) Underground water sources are not likely to be affected by under-drainage (paragraph 38) but shallow wells sunk in or near the area drained may be affected (paragraph 39). Moorland gripping is unlikely to affect underground water sources (paragraph 46).

(8) Moorland gripping may cause a slight increase in the amount discharged into impounding reservoirs and the fluctuations in rate of flow may be greater (paragraphs 44 and 45).

83. I B. The conclusions reached by the Panel on the effect of channel improvement works on the flow in rivers and on water resources may be summarized as follows :—

(1) The beneficial effects of channel improvement works are relatively local (paragraph 50).

(2) In any channel, the general effect of any local improvement which eliminates flooding is to increase the rate of discharge immediately downstream (paragraph 50). The effect of the increase on the flood risk in a river system as a whole depends on the timing of the flood contribution from the various tributaries (paragraph 51).

(3) The changes in the shape of the flood hydrographs at Bewdley and in the height and frequency of floods at Worcester may be caused by factors other than drainage. Further evidence is needed before these changes can be definitely attributed to land drainage works (paragraphs 57, 59 and 60).

(4) Pending conclusive evidence to the contrary, the Panel are of the opinion that schemes which reduce flooding by channel improvement or by the improvement of control structures may result in increased flood peaks downstream, and such works should only be undertaken with due regard to the effects downstream and the benefits likely to accrue, particularly bearing in mind that the cumulative effect of numerous improvements to ditches, watercourses, streams and rivers may be substantial in the lower reaches (paragraphs 52, 62). It is desirable that there should be a clear conception of the objectives of drainage works throughout a catchment area (paragraph 63).

(5) Examination of the River Stour (Essex and Suffolk) records suggests that drainage has had no effect on the river as a source of water (paragraph 64).

(6) The abstraction of water supplies from rivers is not likely to be affected by channel improvements except in a few special circumstances (paragraph 65 (i)).

(7) Underground water resources are not affected by channel improvements (paragraph 65 (ii)).

84. II. The Panel is of the opinion that most drainage authorities are aware of and do attempt to satisfy the need for providing a supply of water for agricultural and other purposes. In areas where these needs exist, schemes are in operation to hold up river levels and to effect distribution of water in the summer months ; and the provision of satisfactory cattle-drinking bays is now customary (paragraphs 67 and 68).

85. III. After considering further methods which might be used by drainage authorities to conserve water and their application to flood problems, the Panel concluded that :—

(1) The only possible additional methods of conserving water are by construction of reservoirs or by artificially leading river water into underground storage (paragraph 69).

(2) The construction of reservoirs is not a reasonable solution of flood problems except in special cases (paragraph 79).

(3) The diversion of excess surface water into underground supplies is too slow a process to be of any use in flood alleviation (paragraph 80).

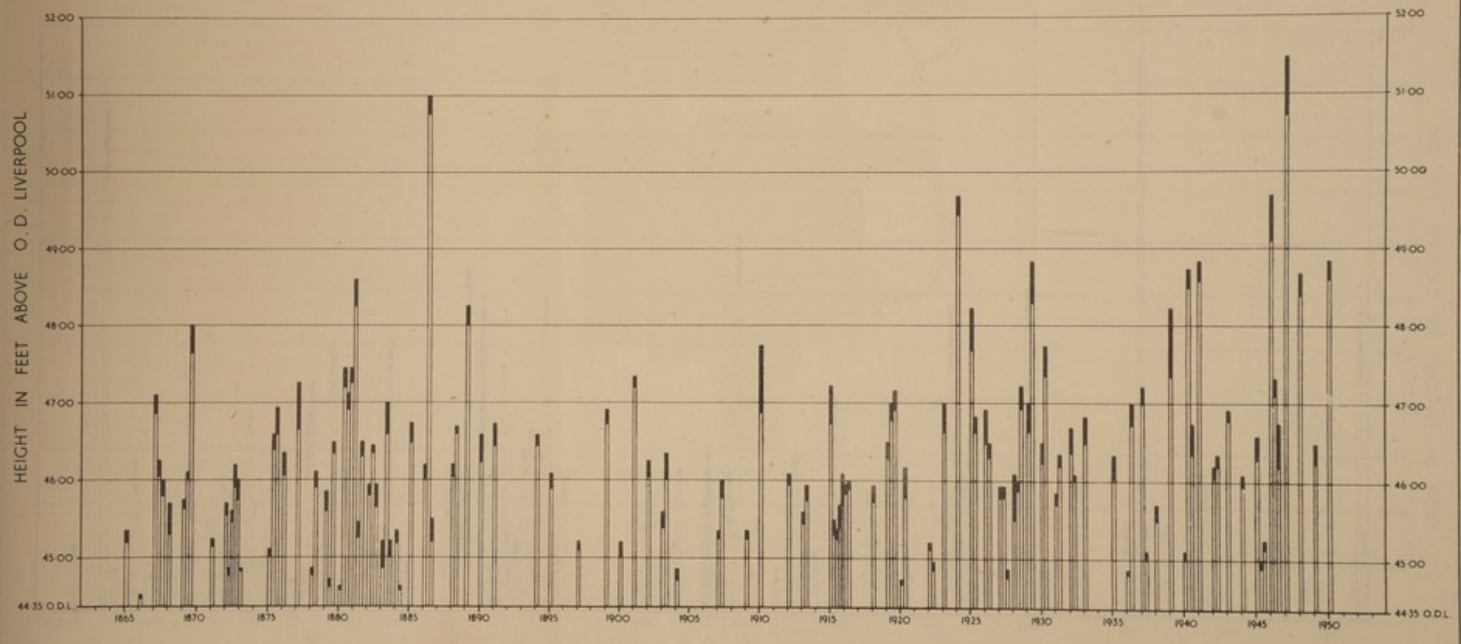
PLATE I

RIVER SEVERN

MAGNITUDE AND DURATION OF FLOODS AT WORCESTER

DURATION OF FLOOD (Water level above 44·35 O.D.L) IS REPRESENTED TO SCALE THUS.

0
5 DAYS
10

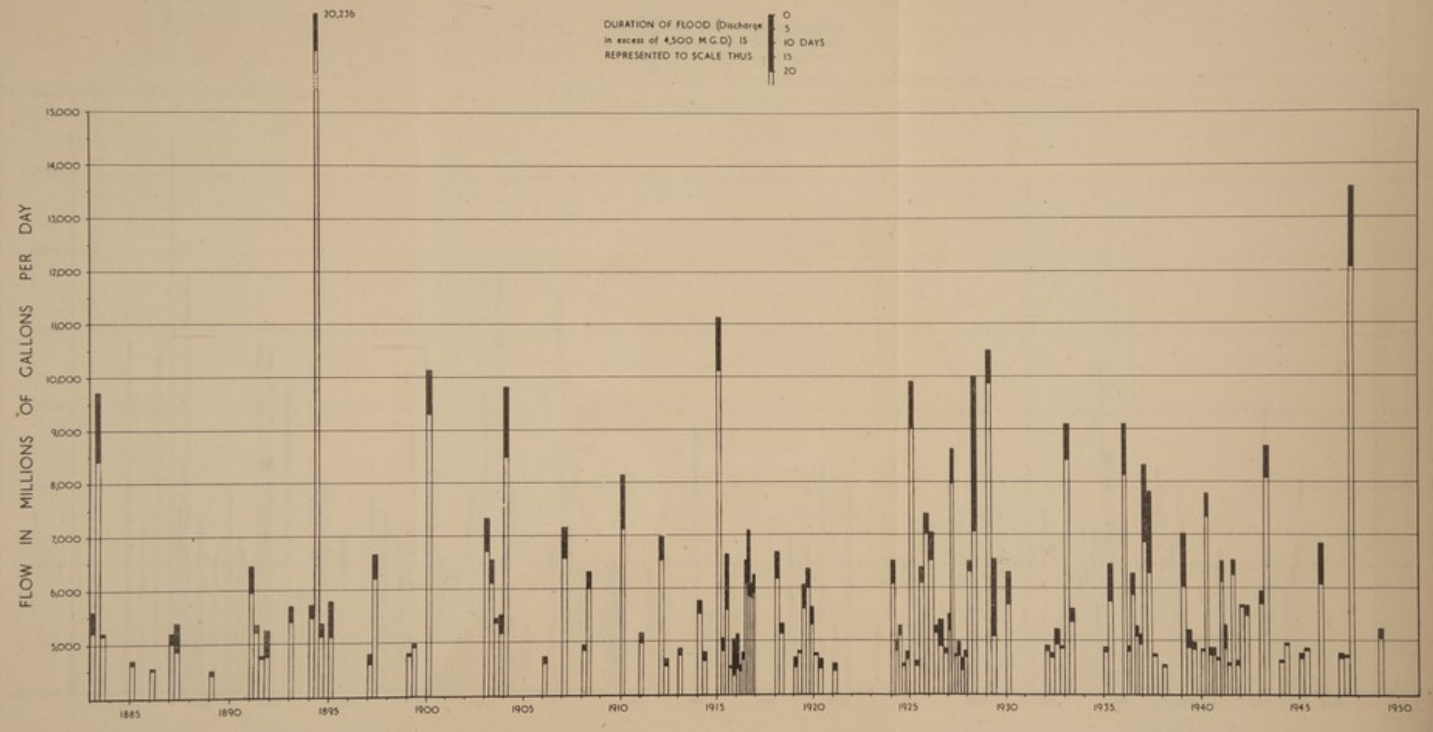


C.B.H. 19624

PLATE 2

RIVER THAMES

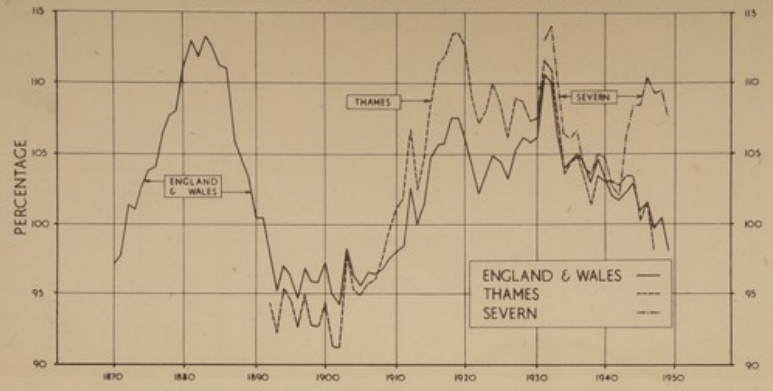
MAGNITUDE AND DURATION OF FLOODS AT TEDDINGTON



GENERAL TREND OF ANNUAL RAINFALL AND RIVER FLOODS

FROM 10 YEAR RUNNING MEANS PLOTTED AT THE END OF EACH 10 YEAR PERIOD

RAINFALL, PERCENTAGE OF STANDARD AVERAGE



THAMES FLOODS AT TEDDINGTON (ABOVE 4,500 M.G.D)

SEVERN FLOODS AT WORCESTER (IN EXCESS OF 10 FT. ABOVE SUMMER LEVEL)

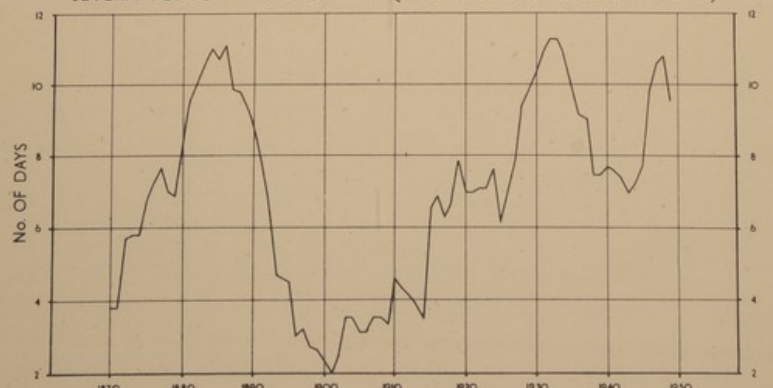


PLATE 3

RECOMMENDATIONS

86. After prolonged and detailed discussion on the problems raised by the terms of reference the Panel feel that certain recommendations are desirable and submit the following for consideration :—

(1) Throughout our deliberations we have been severely handicapped by the lack of observational data, and we consider that there is a definite need for a much wider investigation of the effects of both field drainage and channel improvement works. It is possible that data for the latter might, to some extent, be provided by the future gauging work and studies of the river boards and Inland Water Survey, but steps should be taken to obtain information on the former by field trials or laboratory tests.

(2) There is scope for further examination of existing river flow data by statistical analysis or other methods.

(3) With the present uncertainty and limited knowledge of the cumulative effect of improvement work on rivers and streams, we consider that caution is necessary in planning improvement schemes and due regard paid to the economic necessity.

(4) Drainage authorities should plan their improvement works so that a proper balance is maintained along the river system and in particular between the upper and lower reaches.

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87. We wish to record our appreciation of the work of our Secretary, Mr. G. H. Theobald. The range of specialized interests represented on the Panel and the widely different angles from which the various members approached the problems before them, made the correlation of the mass of facts and opinions and their presentation as a coherent whole a difficult task which Mr. Theobald has carried out with energy and efficiency.

Appendix V

NOTE BY THE MINISTRY'S ENGINEERS ON PROPOSED ADDITIONS TO MAIN RIVER IN EXISTING CATCHMENT AREAS

Terms of Reference

1. The Sub-Committee is proposing that all watercourses which are not farm ditches should become the responsibility of a drainage authority. Generally, within internal drainage districts all watercourses which are not farm ditches are already looked after by a drainage authority ; the Sub-Committee's proposals are, therefore, concerned in the main only with watercourses, outside internal drainage districts, which are not already " main river " and which they recommend should become a responsibility of the river board. The Ministry's Engineers were asked to investigate and report upon the practical application of the Committee's suggestions with regard to the definition of watercourses to be added to existing main river, the extent of these watercourses and the probable cost of their maintenance.

Definition of main river

2. From our investigations it does not appear that any insuperable difficulty would be met in determining the limits of the river board's jurisdiction on the broad principles laid down by the Sub-Committee. It would probably be found that the most useful working method of fixing the limit is to look for a point where two large " farm ditches " meet and form a watercourse which is manifestly larger and more important than either. Many test points have been actually determined on this basis and little difficulty has been found, but on the other hand it is apparent that the size and characteristics of a watercourse at a point where the river board would become responsible and the area draining to it would vary greatly. In heavy clay areas there may be instances where the catchment area would be less than 100 acres, whereas in chalk areas it will not be uncommon to find that the watershed encloses an area which approaches 10,000 acres in extent. Measurement of the catchment area draining to a wide variety of test points indicates that the usual figure for an area with soils of limited permeability will generally be of the order of 300 to 400 acres.

Length of new main river

3. Just as the area draining to the heads of the river board's watercourses would vary from place to place, so but to a lesser degree, the total length of watercourse required to serve a given area would vary.

4. In order to make an estimate of the additional length of watercourses for which river boards would be responsible under the Sub-Committee's proposals, three 1-inch ordnance sheets were chosen at random from different parts of the country. On these, appropriate upper limits were determined by map inspection, specimen points being checked on the site. The results were compared with figures prepared quite independently, using different methods, by Mr. Stock (Chief Engineer, Thames Conservancy), for the whole of the Thames Catchment Area, and were found to be in close agreement. The general indication was that the variation in length of watercourse per unit area was quite small, being more affected by geology than by the other factors such as slope and rainfall. A study of a geological map shows that the permeable and impermeable areas are fairly evenly distributed and the general conclusion reached is that over a large area (i.e., the size of a typical river board area) any variations tend to even themselves out and in practice the *new total length*

of watercourse for which each board would be responsible would be virtually proportionate to the area, and amounts to approximately 1·5 miles per 1,000 acres. This is a round figure and there will, of course, be variations, but it is thought that the total in any Board's area would not vary from this by more than 20 per cent. and hence it is a reasonable figure to take as a basis of calculations.

Length of existing main river

5. At present (1949) the average length of main river for the country as a whole (but excluding the Thames and Lee Catchment Areas) is 0·4 miles per 1,000 acres of catchment area. For individual catchment areas it varies from 0·2 miles per 1,000 acres for the Yorkshire Ouse to 1·06 miles per 1,000 acres for the Crossens. This last figure is abnormally high because more than half the catchment area is lowland covered by the internal drainage board and many lowland drains are scheduled as main river. This consideration applies to several Boards' areas. In general, the large Boards have a low mileage and the small Boards a high mileage relative to their areas. The Thames and Lee are special cases having 0·97 and 1·25 miles per 1,000 acres respectively.

Extent of Works on additional main rivers

6. Although the actual length of watercourse which will have to be taken over can be predicted with confidence, estimating the proportion which will require regular maintenance and the cost of doing the work presents a much more difficult problem. Not only is there a scarcity of data, but the enormous variation of conditions makes it impossible to generalize with certainty.

7. In the mountainous districts in the North of England, in Wales and in Devon and Cornwall, long lengths of watercourse are self-cleansing and require no attention, and it may be that in these and similar areas only a very small proportion of the added watercourses would have to be regularly dealt with by the river board. On the other hand it is the usual experience that where work is required on these fast-running streams, it proves to be difficult and expensive. Floods bring down shoals of gravel which can be just as expensive to remove as the weeds in more sluggish streams ; erosion may present a problem, and the general tendency is for occasional periodic improvements at isolated points to take the place of regular maintenance along the entire length. The shorter length of watercourse requiring to be dealt with in these areas will thus be partially offset by the greater cost of the work.

8. In the rest of England the clearest guide to the length of additional main river on which regular maintenance would be found desirable is revealed in statistics of work actually done in the war years. Lindsey County Council have, since the passing of the Agriculture Act, 1937, carried out voluntary schemes with grant-aid on more than 900 miles of watercourse (equivalent to 1·5 miles per 1,000 acres), a big proportion of which under the Sub-Committee's proposals, would become the responsibility of the river board. Figures for other counties are comparable ; both Warwickshire and Worcestershire County Councils claim to have executed work on more than 80 per cent. of the watercourses in their counties. The Great Ouse Catchment Board carried out schemes under Section 14 of the Agriculture (Miscellaneous War Provisions) Act, 1940, on 1,175 miles of watercourse, equivalent to 0·7 miles per 1,000 acres, i.e., 60 per cent. of the proposed added length. Almost the whole of these watercourses would become the responsibility of the river board in addition to many others. The Thames Conservancy carry out work on every one of their main rivers, though there may be short isolated lengths where

there is no need to do anything. After carefully weighing all the evidence, it is thought that it would be fair to assume that 75 per cent. of the additional main river would require periodical maintenance to keep them reasonably clear of silt-deposit, weed-growth, etc. This figure is based on the assumption that attention will be given to all watercourses giving measurable benefit to agriculture without regard to the extent of the benefit.

Costs of Standard of Work

9. Three County Council Drainage Officers, when asked to estimate the average annual cost of maintaining lesser watercourses, gave figures of £100, £84 and £65 per mile respectively. Three Catchment Board Engineers, when asked a similar question, all quite independently gave £40 per mile and quoted actual experiences in support of the figure. Other figures have been obtained from a variety of sources, and for many different conditions and types of work ; some of these are estimates based on experience and some records of actual costs. The amounts vary widely and range from £20 to £80 per mile per annum. The figures which were most carefully authenticated and worked out in the most detailed and comprehensive manner were those supplied by Mr. Stock (Chief Engineer, Thames Conservancy), who stated the average annual cost would be £53 per mile. This figure is based on a detailed estimate of the cost of 180 watercourses and assumes a high standard of work.

10. Works on the watercourses additional to existing main river will generally have less effect on food production than those in internal drainage board areas, and therefore it will be impossible to justify such a high standard of work, and it is to be hoped that in due course river boards would develop a technique for dealing with watercourses on an " estate " standard. Clearly there should be no attempt to stop all flooding, and the main emphasis should be on the avoidance of waterlogging. Very special care will be needed to ensure that tree clearance is carried out with due regard to the weed growth, which is increased by lack of shade, and that machine work is not carried out in such a way as to increase future maintenance costs.

11. In fairness to drainage authorities we feel, however, that we should draw attention to a factor which does tend to force up costs, namely, public opinion. If a watercourse is known to be the responsibility of a river board and the local inhabitants are contributing to its funds, then if there is anything wrong with a watercourse (whether remedial works are strictly justified on their merits or not) complaints will be made which may compel the river board to take action. When they do work, they must, in justice to themselves, make it apparent that they have dealt adequately with the watercourse, and thus they are inevitably forced into the position of having to do some " window dressing " and do more elaborate and costly work than a private individual, who has only himself to satisfy, might feel justified in doing.

12. Taking all these factors into consideration, we have formed the opinion that the average cost of dealing with those lengths of watercourses needing attention will be of the order of £50 per mile. If this figure is related to the 75 per cent. of total length mentioned in paragraph 8 above, the overall average cost would be £37 10s. If the Committee feel that there should be some measure of restraint, then the figure which we would recommend would be £30 per mile. It seems safe to hope that a total sum based on this figure of £30 per mile, applied to the whole length of watercourse additional to existing main river, would prove sufficient to enable the river board to keep in reasonably good order those portions which require to be maintained. There does not appear to be any immediate prospect of drastically cutting the cost of drainage

work by revolutionary new methods. The most that can be hoped for is a gradual development of improved methods over a long period, but any consequent saving of cost may not be realized if the present tendency continues for wages and other costs to rise.

Summary of Conclusions

The Sub-Committee's proposals would result in the overall average length of watercourses throughout that part of the country not covered by drainage boards, for which river boards would be responsible, increasing from 0·4 to 1·5 miles per 1,000 acres. The cost of maintaining these watercourses in good condition would, after making due allowance for those which require no work on them, average £37 10s. per mile, but it is possible that reasonably adequate work could be done for an average cost of £30 per mile.

Appendix VI

The following example shows the incidence of the proposed drainage charge on a specific owner-occupied hereditament.

Example : 200-acre farm consisting of farmhouse, buildings, and three cottages.
Rent : £300 per annum.

Gross annual value split up as follows :—	£	s.	d.
Farmhouse	50	0	0
Three cottages	45	0	0
Buildings and land	205	0	0
	£300	0	0

Net annual value for Schedule " A " or Rating :—

	£	£	s.	d.
Farmhouse	50			
Less repairs	12			
		38	0	0
Three cottages	45			
Less repairs	11			
		34	0	0
Land and buildings ..	205			
Less repairs	25			
		180	0	0
		£252	0	0
Net Schedule "A"	£252			
Less farmhouse and cottages £38 and £34 ..	72			
		£180	0	0
Drainage—*Fixed charge* @ 9d. on £180 ..		6	15	0
charge —*Precept* @ 3d. on £180 ..		2	5	0
		£9	0	0
Precept to General Rate on house and cottages @ 3d. on £72			18	0
Total Charge		£9	18	0 per annum

Additional charge = 10·8d. per acre
Existing charge = 1·08d. ,,

Total, new and old charges 11·88 pence per acre

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Appendix II

STATISTICS
RELATING TO INDIVIDUAL CATCHMENT BOARDS
FOR THE FINANCIAL YEAR
1948/49

(*The Map in Appendix III shows the extent of the catchment areas of these boards as at* 31*st March*, 1949)

NOTE.—The figures given in this Appendix have been supplied by the catchment boards concerned, who have also agreed to their publication. While the figures as a whole give a sufficiently accurate picture of the general financial position of catchment boards for the purposes of the report, it should be understood that boards use different methods of accountancy and any comparisons between individual boards, based on these figures, might be false and misleading. It is important, therefore, that the Appendix should not be used for this purpose.

INCOME (*Columns 8 to 12*) **EXPENDITURE** (*Columns 13 to 21*) **LOANS**

Catchment Area	1 Area Acres	2 Length of Main River Miles	3 Area in Internal Drainage Districts Acres	4 Number of I.D.B's (a) Independent	4 (b) Taken over by C.B. under Section 11 of Land Drainage Act, 1930	5 Rateable Value (a) County Councils £	5 (b) County Boroughs £	5 (c) Total £	6 Product of 1d. Rate £	7 Rate of Precept Pence in £	8 Precept (a) County Council £	8 (b) County Borough Councils £	9 Contributions from Internal Drainage Boards £	10 Government Grants (a) Grants Against Revenue Schemes £	10 Grant to Meet Loan Charges £	11 Other Sources £	12 Total Income During Year (i.e. total of last 6 columns) £	13 Gross Expenditure on Capital Works Paid out of Revenue £	14 Gross Expenditure on Capital Works Paid out of Loan £	15 Total Gross Expenditure on Capital Works (i.e. total of last 2 columns) £	16 Gross Loan Charges £	17 Maintenance £	18 Grants to Internal Drainage Boards £	19 Administration £	20 Other Expenditure £	21 Total Expenditure During Year (i.e. Total of last 6 Columns) £	22 Total of Outstanding Loan Commitments at End of Year £	23 Loans Taken Up During Year £	
(1) Adur	101,370	43½	4,570	—	1	501,549	Nil	501,549	2,090	2·5	5,224	Nil	100	1,110	Nil	Nil	6,434	Nil	Nil	Nil	4,193	Nil	472	3,592	8,257	Nil	Nil	(1)
(2) Ali	58,196	35½	—	—	—	770,515	647,847	1,418,362	5,910	2	6,421	5,398	Nil	Nil	Nil	198	12,017	6,023	Nil	6,023	7,869	Nil	840	Nil	15,009	2,843	Nil	(2)
(3) Ancholme and Winterton Beck	152,164	112	19,995	—	2	136,799	Nil	136,799	570	12	6,840	Nil	2,450	1,527	9,051	4,169	24,037	56	10,353	10,439	13,265	5,813	1,144	1,636	32,297	133,336	16,447	(1)
(4) Anglesey Rivers	175,811	150	4,566	1	—	187,093	Nil	187,093	780	1·07	1,454	Nil	90	Nil	Nil	118	1,662	72	Nil	72	115	259	Nil	317	26	789	1,496	Nil	(4)
(5) Avon	240,758	95	8,730	—	1	776,868	Nil	776,868	3,237	5	16,185	Nil	150	8,244	Nil	527	25,106	13,714	Nil	13,714	140	9,278	550	2,836	512	27,030	645	Nil	(5)
(6) Avon and Stour	738,911	314½	—	—	—	1,360,288	416,396	1,776,684	7,403	2·75	15,587	4,771	Nil	4,567	2,201	7,949	35,075	11,918	1,782	13,700	7,015	13,380	Nil	4,095	3,463	41,643	27,320	7,058	(6)
(7) Avon (Bristol)	548,602	201	2,417	1	—	1,620,174	3,959,327	5,579,501	23,248	1·16	7,840	19,160	Nil	Nil	Nil	2,209	29,209	13,380	Nil	13,380	1,575	17,211	Nil	3,681	Nil	35,847	4,421	Nil	(7)
(8) Birket and Pender	14,885	20½	—	—	—	124,427	235,987	360,414	1,502	3·33	1,726	3,274	Nil	Nil	Nil	15	5,015	Nil	Nil	Nil	3,019	Nil	1,459	Nil	4,478	Nil	Nil	(8)
(9) Caernarvonshire Rivers	415,887	285	1,864	1	—	479,496	Nil	479,496	1,998	1	5,886	Nil	15	424	645	872	7,842	63	3,078	3,140	3,058	2,285	Nil	3,130	121	11,734	29,731	2,441	(9)
(10) Carmarthenshire Rivers	501,411	197	—	—	—	206,834	Nil	206,834	870	4	3,646	Nil	Nil	Nil	407	2,865	6,918	1,315	9,586	10,901	543	626	Nil	3,231	2,246	17,547	11,600	6,000	(10)
(11) Cheshire Rivers	431,837	245½	—	—	—	1,829,768	156	1,829,922	7,625	3·28	24,998	2	Nil	1,649	1,310	6,430	34,379	202	1,471	1,673	5,142	16,964	Nil	5,930	Nil	29,709	68,587	30,000	(11)
(12) Crowens	37,906	34½	18,039	1	—	103,008	990,052	1,093,060	4,554	2	838	7,868	1,588	Nil	520	306	10,920	Nil	Nil	Nil	3,519	5,616	950	935	Nil	11,020	11,521	Nil	(12)
(13) Cuckmere	44,723	22	1,846	—	1	91,087	Nil	91,087	380	4·23	1,691	Nil	250	211	1,526	76	3,744	285	Nil	285	2,483	940	Nil	395	40	4,509	30,584	Nil	(13)
(14) Dee and Clwyd	728,920	354½	44,540	—	4	1,842,417	409,359	2,251,776	9,382	3	23,030	5,117	1,650	604	2,045	1,573	34,141	6,802	540	6,642	4,215	22,587	Nil	4,694	Nil	38,138	52,433	922	(14)
(15) Douglas	112,065	43½	8,694	—	3	876,147	435,333	1,311,480	5,465	2	7,301	3,628	Nil	260	479	69	11,737	5,164	Nil	5,164	1,661	4,904	Nil	1,490	Nil	13,219	22,510	Nil	(15)
(16) Dyfrdwy	35,189	20	2,644	—	1	16,485	Nil	16,485	69	3	206	Nil	1,977	Nil	Nil	Nil	2,183	589	Northumberland	589	602	870	Nil	131	166	2,358	14,366	Nil	(16)
(17) East Norfolk Rivers (Including the River Waveney)	784,994	273	109,366	22	—	1,079,065	1,135,692	2,214,697	9,228	4	17,983	18,929	2,922	6,749	27,304	9,063	82,550	1,794	38,521	40,315	39,257	16,267	1,825	11,174	3,636	112,474	456,498	38,945	(17)
(18) East Suffolk Rivers (Excluding the River Waveney)	410,809	212	35,206	11	—	627,143	673,552	1,300,695	5,420	3·5	9,581	10,289	5,438	47,795	11,177	10,175	94,455	9,549	44,261	53,810	13,957	12,640	Nil	4,294	4,939	89,640	207,027	61,226	(18)
(19) Eden	596,488	280	9,192	1	1	314,633	422,116	736,749	3,070	4	7,244	7,035	250	6,013	1,077	73	19,692	8,069	40,000	48,069	9,486	934	Nil	4,023	3,267	61,799	59,235	40,000	(19)
(20) Essex Rivers	684,763	393½	99,135	1	14	5,048,717	784,658	5,833,375	24,306	1·02	66,643	10,357	18,547	Nil	37,624	207	134,376	Nil	180,263	180,263	58,920	44,215	9,000	27,569	7,705	327,683	532,445	219,500	(20)
(21) Hampshire Rivers	657,095	228	1,310	—	1	2,672,082	Nil	2,672,082	11,134	1	11,134	Nil	10	1,888	Nil	5,991	19,023	445	Nil	445	Nil	6,090	Nil	3,503	3,309	13,347	Nil	Nil	(21)
(22) Hull	244,480	142½	52,825	5	2	412,138	795,161	1,207,299	5,030	2·44	4,087	8,011	3,357	5,315	559	4,918	26,247	20	Nil	20	2,166	11,417	Nil	6,116	430	20,369	26,181	Nil	(22)
(23) Isle of Wight	94,146	62	4,392	—	1	701,397	Nil	701,397	2,922	2	6,127	Nil	Nil	133	285	1,203	7,748	254	7,956	8,210	508	2,779	Nil	2,033	1,062	14,592	11,488	7,415	(23)
(24) Kent	136,595	99½	10,891	4	—	223,995	Nil	223,995	933	6	5,600	Nil	586	3,709	Nil	203	10,098	4,956	34	4,990	34	2,991	Nil	2,143	164	9,722	Nil	Nil	(24)
(25) Kent Rivers	998,686	469½	148,088	6	2	7,949,805	222,219	7,992,024	32,883	4·02	134,642	3,901	22,917	13,095	27,510	12,190	214,256	22,474	95,596	118,070	57,387	80,028	1,478	41,172	Nil	298,335	808,454	107,000	(25)
(26) Lee	349,862	451	—	—	—	12,574,017	1,109,087	13,683,104	57,013	1·25	67,123	3,921	Nil	3,726	445	6,301	83,599	8,365	20,316	28,681	3,309	24,816	Nil	13,108	9,699	77,613	47,090	14,400	(26)
(27) Lune	299,256	146½	12,869	2	—	530,380	Nil	530,380	2,209	1	2,229	Nil	Nil	542	Nil	6,173	8,944	2,508	Nil	2,508	Nil	3,085	Nil	407	Nil	6,000	Nil	Nil	(27)
(28) Merioneth Rivers	178,489	90	7,395	2	1	83,250	Nil	83,250	347	3	1,040	Nil	1,662	Nil	1,968	304	4,974	Nil	Nil	Nil	3,240	878	Nil	635	830	5,581	31,454	Nil	(28)
(29) Mersey (above Irlam Weir) and Irwell	358,616	165	—	—	—	6,056,673	10,929,159	16,982,832	70,761	·5	12,621	22,762	Nil	Nil	Nil	410	35,793	12,055	Nil	12,055	Nil	23,353	Nil	6,278	Nil	44,818	Nil	Nil	(29)
(30) Mid-Glamorgan Rivers	259,840	102½	4,594	—	19	1,360,708	Nil	1,360,708	5,670	1·06	4,000	Nil	423	2,062	Nil	1,759	10,246	6,913	Nil	6,913	Nil	704	Nil	2,965	523	11,125	Nil	Nil	(30)
(31) Nene	583,468	220	183,700	20	2	1,607,265	808,757	2,416,042	10,067	4·18	27,266	13,990	35,062	Nil	44,673	24,722	145,713	3,304	37,062	40,366	78,951	38,475	500	15,235	2,037	175,564	1,206,226	50,804	(31)
(32) North-East Cheshire Rivers	98,149	50	—	—	—	1,250,494	167,316	1,417,810	5,908	1·35	7,056	944	Nil	Nil	232	27	8,255	Nil	819	819	929	5,431	Nil	1,414	Nil	10,595	1,750	Nil	(32)
(33) North Lonsdale Rivers	195,329	129½	1,766	1	1	330,490	260	330,750	1,378	3	4,131	3	1	382	Nil	361	4,878	367	763	1,130	474	1,709	Nil	280	Nil	3,573	3,849	Nil	(33)
(34) North Norfolk Rivers	183,717	62½	16,214	3	3	161,905	Nil	161,905	675	4	2,643	Nil	6,081	17,409	Nil	3,124	29,256	22,411	Nil	22,411	932	3,997	Nil	2,842	2,635	32,827	3,470	Nil	(34)
(35) Northumberland Rivers	700,184	221½	1,183	1	—	1,005,336	Nil	1,005,336	4,189	3	12,990	Nil	Nil	8,808	Nil	8,709	30,507	14,278	10,901	15,179	Nil	1,645	Nil	4,268	3,824	36,916	Nil	Nil	(35)
(36) Old Hutton (Preesmey) and Bulwerhythe Stream	67,119	70½	16,590	—	1	530,697	979,825	1,509,522	6,290	4·23	9,806	18,088	2,400	30,030	1,047	11,449	72,811	30,004	213	30,217	6,442	10,325	2,000	7,600	37,882	94,466	19,115	Nil	(36)
(37) Ouse (Great)	2,052,500	549	358,005	78	2	3,848,433	Nil	3,848,433	16,005	3·78	60,616	Nil	60,616	23,817	84,312	20,799	250,160	Nil	307,655	307,655	123,318	70,244	Nil	29,397	1,092	531,706	1,583,603	540,220	(37)
(38) Ouse (Sussex)	142,417	60	5,130	—	1	542,602	98	542,700	2,262	2·5	5,655	1	594	1,670	Nil	353	8,550	Nil	Nil	Nil	Nil	4,650	588	579	1,346	7,163	Nil	Nil	(38)
(39) Ouse (Yorks)	2,665,190	536½	421,529	54	4	8,958,514	13,319,837	22,278,351	92,826	2	76,810	114,203	10,565	52,993	Nil	128,666	395,328	150,154	Nil	150,154	Nil	49,092	3,088	21,850	132,994	357,178	Nil	Nil	(39)
(40) Roding	91,485	80½	7,026	—	4	3,085,547	704,051	3,789,562	15,790	1·5	19,340	4,463	Nil	834	1,014	1,271	26,922	9,404	315	9,719	10,000	23,365	Nil	4,777	296	48,221	47,287	5,000	(40)
(41) Rother and Jury's Gut	186,602	119	48,166	3	—	537,598	7,337	544,935	1,437	10·5	14,770	321	17,336	18,198	24,996	45,081	119,692	25,195	177,454	200,649	32,933	37,815	6,397	9,677	900	288,369	455,598	135,044	(41)
(42) Severn	2,866,482	712½	82,607	8	—	5,775,261	3,562,490	10,341,751	43,091	2·06	58,129	30,547	550	31,712	Nil	1,497	122,235	50,887	Nil	50,887	Nil	24,119	Nil	25,051	8,624	131,681	Nil	Nil	(42)
(43) Somerset Rivers	686,632	294	136,136	19	1	2,214,427	41,506	2,255,933	9,408	3·99	36,776	722	16,071	8,971	5,678	61,715	130,931	14,160	7,091	21,251	16,462	37,695	Nil	18,720	40,411	134,539	206,344	18,664	(43)
(44) South Lancashire Rivers	126,080	93½	—	—	—	1,693,785	696,211	2,389,996	9,958	2	14,115	5,836	Nil	2,388	515	854	24,008	11,229	Nil	11,229	5,657	9,213	Nil	1,304	Nil	27,403	10,977	Nil	(44)
(45) South West Sussex Rivers	105,600	78½	12,340	—	1	772,306	Nil	772,306	3,218	1·04	9,772	Nil	Nil	74	Nil	82	9,928	Nil	Nil	Nil	Nil	6,844	Nil	1,329	123	8,296	Nil	Nil	(45)
(46) Stour (Essex and Suffolk)	256,506	115	15,123	—	3	360,997	Nil	360,997	1,504	6·5	9,754	Nil	1,668	292	607	3,412	15,733	Nil	1,916	1,916	1,152	8,481	750	2,801	1,020	16,120	20,239	Nil	(46)
(47) Thames above Teddington Lock	2,459,112	2,382	—	—	—	18,671,780	1,481,213	20,152,993	85,637	2·54	197,467	19,895	Nil	400	Nil	8,264	225,217	12,638	Nil	12,638	46	197,350	Nil	29,193	5,055	244,482	Nil	Nil	(47)
(48) Trent	2,578,540	572½	242,508	28	4	11,874,344	16,050,961	27,925,305	116,355	1·75	86,857	117,409	7,455	25,640	Nil	22,416	259,777	77,571	98,283	175,854	Nil	69,250	1,450	50,721	56,671	353,946	105,286	101,445	(48)
(49) Welland	379,892	200	101,515	6	1	537,857	Nil	537,857	2,241	4	8,964	Nil	31,945	4,549	16,129	6,736	68,323	2,050	241,911	243,961	28,101	16,713	Nil	7,480	Nil	296,255	684,134	260,570	(49)
(50) West Cumberland Rivers	471,738	322	39,487	1	3	667,586	Nil	667,586	2,782	5	13,908	Nil	500	389	4,001	528	19,326	593	15,682	16,275	6,458	7,116	Nil	3,270	1,418	34,537	83,692	18,561	(50)
(51) Witham and Steeping	818,412	278½	332,465	7	—	854,666	479,849	1,334,515	5,560	3·5	12,464	7,118	34,692	26,047	18,815	7,023	106,159	45,142	120,000 (approx.)	165,142	32,404	40,917	507	4,854	1,590	245,412	473,179	87,206	(51)
(52) Wye	1,022,121	255	27,505	3*	—	874,234	Nil	874,234	3,642	3	10,928	Nil	1,801	4,675	1,870	5,439	24,713	12,237	2,543	14,780	4,901	5,477	Nil	3,990	2,263	31,411	63,666	Nil	(52)
(53) Wye	107,296	57½	7,157	2	—	501,173	255,724	756,897	3,154	2	4,176	2,131	Nil	1,880	Nil	418	8,605	6,305	Nil	6,305	103	2,400	Nil	670	Nil	9,478	850	Nil	(53)
	29,240,143	12,761½	2,688,896	292	68	117,740,305	62,119,498	179,859,803		2·8 Average (weighted according to area) of C.A.'s	1,183,298	472,094	292,121	370,370	334,433	457,326	3,109,642	642,244	1,476,365 (approx.)	2,118,609	535,196	1,018,304	29,283	413,473	349,608	4,504,473	7,599,528	1,727,868	

Abbreviations: C.A. .. Catchment Area. C.B. .. Catchment Board. I.D.B. .. Internal Drainage Board.

* 1 Board is only partly in Catchment Area.
† One of these boards is operated by the Glamorganshire County Council under an Order under Land Drainage Acts 1861 and 1918.

APPENDIX III

STATUTORY CATCHMENT AREAS AT 31st MARCH, 1949

This map, showing the catchment areas in England and Wales for which catchment boards were in being at 31st March, 1949, supplements the statistics provided in Appendix II. Its purpose is to show the extent and characteristics of the areas to which the statistics relate. Since 31st March, 1949, many of the catchment areas shown on the map have been absorbed in river board areas and are therefore under river board jurisdiction and the map must not be taken as illustrating the land drainage organisation of the country at the date of the report.

LAND DRAINAGE ACT 1930.

ENGLAND AND WALES

SHOWING MAIN RIVER, COUNTY AND COUNTY BOROUGH BOUNDARIES

CATCHMENT AREAS as at 31st MARCH 1949 for which CATCHMENT BOARDS have been established

APPENDIX III

Areas outside Catchment Areas shown thus

REFERENCE

APP. II REFERENCE		MAP REFERENCE
1	ADUR	50
2	ALT	15
3	ANCHOLME AND WINTERTON BECK	13
4	ANGLESEY RIVERS	23
5	ARUN	46
6	AVON (BRISTOL)	40
7	AVON AND STOUR	44
8	BIRKET AND FENDER	18
9	CAERNARVONSHIRE RIVERS (INCLUDING THE RIVER CONWAY)	22
10	CARMARTHENSHIRE RIVERS	35
11	CHESHIRE RIVERS	19
12	CROSSENS	11
13	CUCKMERE	51
14	DEE AND CLWYD	21
15	DOUGLAS	10
16	DYSYNNI	25
17	EAST NORFOLK RIVERS (INCLUDING THE RIVER WAVENEY)	31
18	EAST SUFFOLK RIVERS (EXCLUDING THE RIVER WAVENEY)	32
19	EDEN	2
20	ESSEX RIVERS	43
21	HAMPSHIRE RIVERS	45
22	HULL	9
23	ISLE OF WIGHT RIVERS	53
24	KENT	5
25	KENT RIVERS	41
26	LEE	37
27	LUNE	7
28	MERIONETHSHIRE RIVERS	24
29	MERSEY (ABOVE IRLAM WEIR) AND IRWELL (ABOVE HUNTS BANK)	12
30	MID GLAMORGAN RIVERS	39
31	NENE	29
32	NORTH EAST CHESHIRE RIVERS	17
33	NORTH LONSDALE RIVERS	4
34	NORTH NORFOLK RIVERS	27
35	NORTHUMBERLAND RIVERS	1
36	OLD HAVEN (PEVENSEY) AND BULVERHYTHE STREAM	52
37	OUSE (GREAT)	30
38	OUSE (SUSSEX)	47
39	OUSE (YORKSHIRE)	6
40	RODING	38
41	ROTHER AND JURYS GUT	48
42	SEVERN	26
43	SOMERSET RIVERS	42
44	SOUTH LANCASHIRE RIVERS	16
45	SOUTH WEST SUSSEX RIVERS	49
46	STOUR (ESSEX AND SUFFOLK)	33
47	THAMES ABOVE TEDDINGTON LOCK	36
48	TRENT	14
49	WELLAND	28
50	WEST CUMBERLAND RIVERS	3
51	WITHAM AND STEEPING RIVER	20
52	WYE	34
53	WYRE	8

THIS POCKET CONTAINS

APPENDIX II

STATISTICS

APPENDIX III

MAP

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