



CENTRAL ADVISORY WATER COMMITTEE

**Sub-Committee on
The Growing Demand
for Water**

FINAL REPORT

LONDON
ESTY'S STATIONERY OFFICE
PRICE 3s. 6d. NET

CENTRAL ADVISORY WATER COMMITTEE

Sub-Committee on
The Growing Demand
for Water

FINAL REPORT

LONDON
HER MAJESTY'S STATIONERY OFFICE
1962

CENTRAL ADVISORY WATER COMMITTEE
SUB-COMMITTEE ON THE GROWING DEMAND
FOR WATER

Members

Professor J. Proudman, C.B.E., M.A., D.Sc., LL.D., F.R.S. (*Chairman*)
D. Clark, Esq., B.Sc., A.C.G.I., A.M.I.E.E.
R. H. R. Davey, Esq., O.B.E.
E. Dunnett, Esq. (*from February, 1961*)
W. Etheridge, Esq., B.Sc., F.R.I.C.
A. H. Hiller, Esq. (*to February, 1961*)
Dr. N. R. Hood, O.B.E., Ph.D., B.Sc., F.R.I.C., M.I.Mech.E., M.I.Chem.E.
H. E. Hopthrow, Esq., C.B.E., M.I.Mech.E.
W. K. Lewis, Esq., B.Sc., M.I.C.E., M.I.Mun.E., M.I.W.E.
The Rt. Hon. the Earl of Malmesbury, T.D., V.L.
A. G. McLellan, Esq., B.Sc., M.I.C.E., M.I.W.E., J.P.
W. A. Muddell, Esq., C.B.E., J.P.
N. A. F. Rowntree, Esq., B.Sc., M.I.C.E., M.I.W.E., M.Cons. E.,
A.M.I.Mun.E.
J. I. Taylor, Esq., M.B.E., B.Sc., M.I.C.E., M.I.W.E.
E. T. Wadman, Esq., J.P.
Ald. J. R. Wardell, O.B.E., J.P.
Mrs. Charles Williams, O.B.E. (*to July, 1961*)
Ald. R. C. Yates, D.L.

Assessors

Ministry of Agriculture,
Fisheries and Food: E. A. G. Johnson, Esq., C.B.E., B.Sc.(Eng.),
M.I.C.E., M.I.W.E.
F. T. K. Pentelow, Esq., M.A.
G. W. Ford, Esq. (*from November, 1960*)
Board of Trade: S. H. Levine, Esq., C.B.E.
Department of Scientific
and Industrial Research: Dr. B. A. Southgate, C.B.E., D.Sc., F.R.I.C.
Ministry of Housing and
Local Government: A. Gérard Boulton, Esq., M.A., M.I.C.E.,
M.I.W.E.
C. H. Spens, Esq., A.C.G.I., M.I.C.E.,
M.I.W.E., F.G.S.
J. E. Beddoe, Esq. (*to February, 1961*)
W. R. Corrie, Esq. (*from February, 1961*)

CONTENTS

| | <i>Paragraph</i> |
|--|------------------|
| I APPOINTMENT AND PROCEDURE . . . | 1-5 |
| II CONCEPT OF CONSERVATION BY RIVER AUTHORITIES | 6-9 |
| III THE CASE FOR RIVER AUTHORITIES . | 10-36 |
| Present multiplicity of authorities and interests | 10-11 |
| Drought and flood 1959-60 | 12-16 |
| The demand for water | 17-29 |
| Examples of the need for overall planning | 30-31 |
| Views of representative bodies | 32-33 |
| General appreciation | 34-36 |
| IV PHYSICAL DEVELOPMENT OF RESOURCES | 37-57 |
| General | 38-40 |
| Artificial recharge of aquifers | 41 |
| Water from the sea | 42 |
| Transfers of water between the areas of different river authorities | 43 |
| National water grid | 44-48 |
| Flood control and water conservation | 49-57 |
| V CONTROL OF ABSTRACTIONS | 58-77 |
| Surface water | 58-60 |
| Ground water | 61-64 |
| Exemption of "domestic" abstractions | 65 |
| General | 66-76 |
| Appeals | 77 |
| VI CONSERVATION AND RIVER BOARDS . | 78-80 |
| VII DUTIES AND FUNCTIONS OF RIVER AUTHORITIES | 81-83 |
| VIII RELATIONSHIP OF RIVER AUTHORITIES TO EXISTING AUTHORITIES AND INTERESTS | 84-102 |
| IX CONSTITUTION AND ORGANISATION OF RIVER AUTHORITIES | 103-108 |
| X FINANCING OF WATER CONSERVATION | 109-122 |
| XI CENTRAL AUTHORITY | 123-126 |
| XII INDUSTRIAL USE OF WATER | 127-134 |
| XIII PRINCIPAL CONCLUSIONS AND RECOM- MENDATIONS | 135-149 |
| RESERVATION ON CONSTITUTION OF RIVER AUTHORITIES | |
| APPENDIX I Glossary | |
| APPENDIX II Present rights in relation to surface water | |
| APPENDIX III Summary of report on visit to Western Germany | |
| APPENDIX IV List of authorities and organisations sub- mitting evidence | |
| APPENDIX V Membership of river/conservancy boards | |

REPORT TO THE CENTRAL ADVISORY WATER COMMITTEE

I. APPOINTMENT AND PROCEDURE

1. Our terms of reference, as given to us in 1955 and extended in 1959 following the presentation of our first report in December, 1958¹, were as follows:

"(a) To consider the extent to which the demand for water for domestic, industrial, agricultural and other purposes is increasing and is likely to increase; to consider the problems involved in meeting these demands, including, in broad terms, the cost; to consider whether there are any substantial economies in the use or cost of water which could be made without reduction in standards of hygiene or in industrial or agricultural efficiency; and to make recommendations.

(b) In connection with their investigations into the extent to which demands for water are increasing and the problems involved in meeting those demands, to enquire into the extent of uncontrolled abstractions of surface water for agriculture, especially irrigation, for industry and for other purposes, and into the effect of such abstractions on the quantity and quality of surface water available for all purposes; to consider whether powers are needed to control such abstractions in general or in particular; and to make recommendations."

In subsequent clarification of the terms of reference we were told that "control" should be interpreted in the positive sense of control in all its aspects, including conservation and control of resources by constructional work and otherwise, as well as consideration of the authority or authorities to be responsible for operating the control.

2. Under these terms of reference we presented our second report in March, 1960; it was adopted by the Central Advisory Water Committee in May, 1960, and published on 9th June, 1960². It was made as a matter of urgency and dealt merely with the basic question whether a need to control abstractions of surface water had been established (ground water³ already being largely subject to control). In it we said that we were satisfied from the evidence we had received that, in circumstances where the situation called for such a step, abstractions of surface water, notably for irrigation, where the water was substantially consumed without return, should be brought under control and that we expected to present a more detailed report at a later date on such matters as the form of authority to operate any system of control and the method of operation, as well as certain other matters held over from our first report. We went on to say that we could not emphasise too strongly that the ultimate object should be a form of control which would also provide for conservation and storage so that water would be available for all legitimate purposes.

3. We now present the more detailed report promised in 1960. Like the previous reports, it refers to England and Wales.

4. Mr. A. H. Hiller resigned from the Sub-Committee in February, 1961, and was succeeded by Mr. E. Dunnett. Advice continued to be available from assessors appointed by the Ministry of Agriculture, Fisheries and Food, the Board of Trade, the Department of Scientific and Industrial Research and the Ministry of Housing and Local Government.

¹ Central Advisory Water Committee. Sub-Committee on the Growing Demand for Water. First Report, 1959. H.M.S.O.

² Central Advisory Water Committee. Sub-Committee on the Growing Demand for Water. Second Report, 1960. H.M.S.O.

³ See glossary.

5. We have met seventeen times since we completed our second report. We decided to consider first the engineering aspects of water conservation and we invited appropriate organisations to submit written evidence under a number of heads and subsequently to amplify this in oral evidence. We then turned to the organisational and legal aspects and received further written and oral evidence. We also studied experience abroad and a delegation from the Sub-Committee visited Western Germany in April, 1961, to study water conservation in North Rhine/Westphalia. A summary of their report is at Appendix III.

II. CONCEPT OF CONSERVATION BY RIVER AUTHORITIES

CONSERVATION

6. We should at this point make clear what we mean by "conservation". We have in mind the preservation, control and development of water resources (both surface and ground), by storage¹ and other means and the prevention of pollution, to ensure that the largest possible amount of water is made available for all purposes in the most suitable and economical way whilst safeguarding legitimate interests. Closely bound up with this are land drainage and the carrying out of flood control measures.

THE IDEA OF "RIVER AUTHORITIES"

7. We have been conscious of a growing body of informed opinion that the need exists for an extended approach to water conservation in this country. The idea of entrusting the development of water resources to comprehensive authorities, each having jurisdiction over a whole river basin or group of basins, is not new. Such an arrangement has been put forward from time to time over the years by Royal Commissions and Government committees and other bodies of standing; it has been adopted by a number of other countries and is advocated in a report published by the United Nations².

8. We are satisfied, after considering the evidence we have received and assessing developments since our last report, that it is time to make a major change in the administration of the water resources of England and Wales. The theme of this report, therefore, is the creation of comprehensive new authorities to manage the water resources of river basins as a whole and to be charged with a positive duty of water conservation. We have called these "river authorities".

9. We elaborate later the reasons which have led us to this conclusion and set out our views on the constitution and functions of river authorities and their relationship to existing bodies and interests.

• III. THE CASE FOR RIVER AUTHORITIES

PRESENT MULTIPLICITY OF AUTHORITIES AND INTERESTS

10. At present there is a multiplicity of authorities and interests concerned with different aspects of the use of water resources:

(i) The *Minister of Housing and Local Government* is charged by Section 1 of the Water Act, 1945, with a duty to "promote the conservation and proper use of water resources and the provision of water supplies in England and Wales and to secure the effective execution by water undertakers, under his control and direction, of a national policy relating to water". The only specific provision in

¹ Storage includes natural ground storage.

² Integrated river basin development. United Nations, 1958.

the Act, however, enabling him to discharge his duty of promoting water conservation is Section 14, which empowers him to designate conservation areas and within those areas to control new abstractions of ground water. For surface water the Act deals only with what may be done by statutory water undertakers, with or without the Minister's consent. It contains no machinery for the promotion of an active policy to secure the objectives of water conservation and the proper use of water resources.

The Minister is also responsible under Section 9 of the River Boards Act, 1948, for approving schemes prepared by river boards for the measurement and recording of rainfall and the flow or volume of inland surface waters and has powers of direction in this respect. He also has power to direct river boards to furnish information about abstractions of water from, and discharges of effluents into, surface waters.

Under the Rivers (Prevention of Pollution) Acts, 1951 to 1961, the Minister is the appellate authority against decisions of river boards relating to the control of discharges of effluents.

(ii) The *Minister of Agriculture, Fisheries and Food* is empowered under Section 55 of the Land Drainage Act, 1930, and Section 15 of the Agriculture Act, 1937, to make grants towards the cost of approved works or schemes of land drainage carried out by river boards or internal drainage boards. Under Section 9 of the River Boards Act, 1948, the power to make grants was extended to gauging schemes. Section 81 of the 1930 Act defines the drainage of land as including defence against water (including sea water), irrigation and the supply of water.

The Minister also has powers of general supervision over the exercise by river boards of their control of fisheries under the Salmon and Freshwater Fisheries Acts, 1923 to 1935.

(iii) *River Boards* (34 in number, including for this purpose the Conservators of the River Thames and the Lee Conservancy Catchment Board) are responsible under the Minister of Agriculture, Fisheries and Food for land drainage as defined in (ii) and the control of fisheries, and under the Minister of Housing and Local Government for the control of pollution and the measuring and recording of rainfall and the flow or volume of inland surface waters. Some also have certain navigation functions. Section 9 of the River Boards Act, 1948, also places on them a duty, in exercising their functions under the Act, to "conserve as far as practicable the water resources of their areas" but this does not constitute a sufficient power. Special statutory provisions apply to the Thames and Lee Conservancies.

(iv) *Internal drainage boards* (nearly 400 in number, covering some 3½ million acres out of the total of 37½ million comprising England and Wales) are responsible, within some river board areas and under the general supervision of the river boards concerned, for the drainage of certain areas of land which "derive benefit, or avoid danger as a result of drainage operations". Some of these are administered by the river board for the area concerned.

(v) *Statutory water undertakers*¹ (693 in number) are responsible under the Minister of Housing and Local Government for the provision of public water supply. This frequently involves the construction of major works for the abstraction and storage of water having a substantial effect on river flows and on the water resources of the river basin. On occasion their abstractions may

¹ See glossary.

represent a total loss to the river basin if they are returned as effluents to a different river basin or to the sea. There is also a number of non-statutory water undertakers providing water supplies, mostly on a smaller scale.

(vi) *Navigation authorities*¹ are concerned with navigation works on navigable rivers and with canals. In navigable rivers they are particularly interested in the maintenance of adequate water levels and may consequently undertake and maintain works which have the effect of conserving water. They abstract water from surface and ground sources (including their own reservoirs) for canals, not only for navigation but for supply to industrial and other users, who often could not obtain it from other sources. The requirements of navigation authorities consequently affect river flows and water resources.

(vii) *Industry* requires an ample supply of water (of which a high proportion is, however, returned close to the point of abstraction) for such purposes as heat transfer and transmission, gas cleaning and conditioning, transport of materials (including waste), power generation and various other process purposes including cleansing of plant, vehicles and buildings and for normal domestic uses. It is obtained from a variety of sources including non-tidal rivers and streams, tidal waters (particularly estuaries), canals, boreholes, mine water, treated sewage effluents and public supplies (both potable and non-potable).

(viii) *Public health authorities* are concerned that there shall be a sufficient flow of water for such purposes as the dilution of sewage effluents and the avoidance of pollution, the maintenance of a safe and adequate water supply and of amenities generally, for the protection of the public health.

(ix) *Fishing interests* require the maintenance of water and watercourses in a state to support fish life, provide spawning grounds and permit the passage of migratory fish.

(x) *Agricultural interests* are concerned with land drainage and the availability of water for all agricultural (and horticultural) purposes. The comparatively new technique of spray irrigation has already led to heavy new demands for water in some areas. Much of the water required is taken privately from rivers and streams or from boreholes.

(xi) *Riparian interests* are concerned with their rights to take water and to receive a flow of water past their property not sensibly diminished in quantity or quality by the activities of other riparian occupiers and with such other rights as they may have acquired by grant or prescription. (A brief description of these rights is given in Appendix II).

(xii) *The general public* is concerned with the maintenance of rivers and streams in a wholesome state for the protection of health, recreation and amenities, and as users of the various services.

11. The situation, in short, is that numerous interests are engaged in activities which affect the quantity or the quality of water, or both, and many undertake works for their own purposes: but no single authority is responsible locally for co-ordinating the use and development of the water resources of a river basin as a whole and there is no machinery for planning and executing positive measures locally or centrally to conserve water resources in the general interest.

DROUGHT AND FLOOD 1959-1960

12. Attention has been focussed upon the need for comprehensive management of water resources by the extremes of weather which the country experienced in 1959 and 1960.

¹ See glossary.

13. An account of the drought of 1959, and in particular its impact on water undertakers, is to be found in the Annual Report of the Ministry of Housing and Local Government for the year 1959¹. 1959 was remarkable for the driest summer for nearly 250 years and, coinciding as it did with the time of maximum demand, this put a heavy strain on water undertakers, particularly in the north and west where reliance is placed principally on surface waters more quickly responsive to weather fluctuations than natural ground storage. Although most undertakers were able to meet the situation without imposing restrictions on consumers a number found their resources strained and had to impose restrictions on water supply. Industry suffered considerable inconvenience which would have become serious, leading to closing of works and unemployment, if the dry weather had continued much longer. In a circular dated 10th December, 1959², the Minister drew the attention of water undertakers to the weaknesses which the drought had revealed and to the steps they should take to ensure adequate supplies in future: and in the Annual Report the view was expressed that a properly organised water undertaking ought to have resources adequate to meet all the demands made upon it in a year such as 1959, since the deficiency over the year as a whole was within the range which might be expected to occur every few years in this country.

14. The fall in river levels caused by the drought also affected navigation (necessitating lightening of loads with consequent financial loss), fishing and the passage of migratory fish, agriculture generally and the dilution of effluents, making it difficult to maintain satisfactory conditions.

15. By contrast 1960 was the third wettest year for nearly 250 years and the rainfall during the late summer and autumn was the heaviest on record for England and Wales. This was the cause of widespread flooding in southern England and south Wales.

16. These experiences emphasise the need for developing and controlling the resources of river basins as a whole so as to mitigate the more extreme consequences of drought and flood.

THE DEMAND FOR WATER

17. Conservation is necessary to meet the rising demand for water. In our first report³ we pointed out that statistical information on water consumption and resources was incomplete, particularly as regards uncontrolled abstractions⁴, and we recommended that comprehensive hydrological surveys⁴ should be put in hand. At that time we were informed that several such surveys were already being planned by the Surface Water Survey Centre of the Ministry of Housing and Local Government. Reports have now been published of surveys of the River Great Ouse Basin⁵, the River Severn Basin⁶ and the Essex rivers and Stour⁷. Surveys of several other river basins are in hand and the Minister has stated that more surveys will be made in order of the urgency of the need for them.

¹ Report of the Ministry of Housing and Local Government, 1959. H.M.S.O.

² Drought 1959. Short-term measures. Ministry of Housing and Local Government Circular No. 65/59. H.M.S.O.

³ Central Advisory Water Committee. Sub-Committee on the Growing Demand for Water. First report, 1959. H.M.S.O.

⁴ See glossary.

⁵ River Great Ouse Basin. Hydrological Survey, 1960. H.M.S.O.

⁶ River Severn Basin. Hydrological Survey, 1960. H.M.S.O.

⁷ Essex Rivers and Stour. Hydrological Survey, 1961. H.M.S.O.

18. In September, 1960, the Minister of Housing and Local Government sent a circular¹ to all statutory water undertakers in England and Wales asking them to complete an annual statistical return of the reliable yield of their sources and the amounts actually supplied to consumers.

19. Since information was in process of systematic collection in these ways we have not thought it necessary or desirable to seek to collect further statistical information ourselves.

20. Information bearing on the demand for water is also to be found in the report on Welsh water resources² published in April, 1961, and the report of the Committee on Agriculture of the Natural Resources (Technical) Committee appointed to advise the Minister for Science which is to be published shortly.

IRRIGATION

21. We refer first to irrigation since the increase in abstractions for this purpose was the chief reason for the recommendation in our second report in 1960 that abstractions such as these, where the water was substantially consumed without return, should be brought under control.

22. The Committee on Agriculture have prepared a comprehensive report on irrigation in Great Britain dealing with such matters as methods and costs of irrigating, the response of different crops to irrigation, the economics of irrigation and the water situation. The report concludes that the judicious use of irrigation in agriculture and horticulture should be encouraged because of the major increases in productivity which result and that the main problem is how to make sufficient water available where it is needed. The hydrological surveys included estimates of the demand for water based on the present rate of increase in the acreage of land irrigated allowing for the full amount of irrigation in the driest years. Estimates of the limit of irrigation development were also given assuming that all the crops most likely to benefit were irrigated to the maximum extent. The irrigation report gives estimates of the practical limit of development assuming that water can be provided at low cost and that it would never be economic to provide water to meet the total demand in the driest years in the driest areas. Even this reduced estimate suggests that the acreage of land irrigated in England and Wales may rise ultimately from the present 130,000 acres to about 1½ million acres, the possible peak daily demand for water ranging from about 2,000 m.g.d. in April and September to about 3,000 m.g.d. from mid-June to early August. The peak daily demand could thus exceed the total amount of water at present supplied by statutory water undertakers (see paragraph 25); and it arises, of course, when the greatest strain on water resources occurs.

23. Estimates have also been made in the irrigation report of the practical limits of development in the river Great Ouse basin and the river Severn basin. For the Great Ouse basin these suggest that the eightfold expansion envisaged would far outstrip the resources available. Some increase could possibly be met in parts of the river Severn basin but this would need to be considered in the light of developments in this area which are described in paragraph 30.

24. The irrigation report stresses that in the areas where irrigation is of most value substantial expansion can only be made possible by increased conservation of water. The most immediate practical solution is the storage of water in

¹ Statistics of water supply. Ministry of Housing and Local Government Circular No. 46/60.

² Report on the Water Resources of Wales, 1961. H.M.S.O.

small units as close as possible to the land to be irrigated: this has already started and is eligible for government grant. In the long term larger measures will be needed and conservation works should be properly planned in relation to each other and in conjunction with the proper development of the water resources of the whole river basin.

STATUTORY WATER UNDERTAKERS

25. From the returns rendered to the Ministry of Housing and Local Government by statutory water undertakers the amount of water taken from public supplies in 1960 is estimated to have been 2,195 m.g.d. This represents an average increase of 2.4% per annum over the period 1955-60 which accords very well with the estimated increase (2.3% per annum) over the period 1955-65 given to us in connection with our first report. The reliable yield of all sources together is put at some 2,486 m.g.d., suggesting that in 1960 there was a certain margin overall from sources already brought into use. Reference to totals is, however, misleading since the position varies considerably as between one undertaking and another.

26. Firm longer-term forecasts are not available but there seems to be no obvious limit to the growth in demand for water from statutory water undertakers, both to meet increased domestic consumption consequent upon rising social standards and to serve the growing demands of industry.

WATER FOR INDUSTRY

27. Metered supplies furnished by statutory water undertakers give an indication of the industrial demand for water. For the country as a whole the increase in metered consumption has been rather less than was expected at the time of our first report: but, as possibly a better indication, figures extracted for selected undertakings where metered consumption is a high proportion of the total show the average annual rate of increase in metered consumption in these areas over the period 1955-60 to have been some 5.2%. Since the quantity of water taken by industry from private sources may well be near in amount to the total supplied for all purposes by statutory water undertakers, this is evidence that at least in some areas steps are needed to co-ordinate demands and the development of resources so as to assure the adequate supplies of water which are of vital importance to industry.

ELECTRICITY GENERATION

28. The Central Electricity Generating Board, as particularly large abstractors of water for cooling purposes, gave evidence of great interest because of the effect on the expansion of their industry of the inadequacy of river flows. We were told that water requirements for direct cooling for a coal-fired power station of 2,000 megawatts output, such as is now being planned, were of the order of 1,000 m.g.d., all of which would be returned. These requirements could only be met by siting on the coast or on a large tidal estuary. Alternatively, by using cooling towers the requirements could be reduced to some 40 m.g.d., of which up to 10 m.g.d. would not be returned. (To give an idea of the magnitude of these requirements we think it worth quoting for comparison the paper industry, whose total water consumption for all purposes amounts to some 630 m.g.d.). The Board stated that the selection of sites for power stations was always a compromise between many factors, such as the availability of water, the supply of fuel and proximity to the electrical load, but because of the difficulty in

finding inland water in sufficient quantities new power stations were to an increasing extent being sited on the sea coast or on tidal estuaries. Accordingly by far the greatest amount of water at present used for cooling was saline water and the proportion was growing: indeed, in absolute terms the amount of fresh water taken was not increasing. Nuclear power stations as at present designed used substantially more water per kilowatt of electricity generated than coal or oil-fired stations and it would probably be a long time before this situation changed. In the light of the present availability of water there was a case for siting most of the nuclear stations on the coast and using available inland water for stations which were more economical in their use of water. On the other hand nuclear technology was constantly evolving and there might be developments which would make it possible to bring such stations inland.

29. The Central Electricity Generating Board saw considerable advantage in being able to deal with comprehensive river authorities working under energetic central direction, since such authorities would be in a position to undertake works designed to regulate the flows in rivers, particularly to increase minimum flows. This could influence the siting of power stations. With such authorities the Board could also explore the possibilities of joint construction of reservoirs useful for hydro-electric or pumped storage generation as well as water conservation.

EXAMPLES OF THE NEED FOR OVERALL PLANNING FOR RIVER BASINS

30. Two examples may be given here of the situation which arises when the resources of a river basin are no longer adequate, without co-ordination, to meet all demands and an overall plan becomes necessary. The River Dee was the first example in this country in which this problem was tackled in a comprehensive way, as long ago as 1951. The problem of the River Severn has arisen more recently.

(i) *River Dee.* The Dee and Clwyd River Board succeeded the River Dee and River Clwyd Catchment Boards in 1950. At that time the British Transport Commission were responsible for works constructed at the natural lake Bala to compensate the River Dee for water taken into the Ellesmere and Chester canal downstream. A number of statutory water undertakers were empowered to extract water from the river, several others wished to do likewise and industry and other abstractors also wished to increase their takes, but the flow in the river was not sufficient at all times to meet the total demands. The River Board decided that the situation called for additional storage and the regulation of the river flow and they accordingly took over existing sluices and other works on Lake Bala and carried out further extensive works costing some £650,000. The cost of these works was shared by agreement between the River Board and the water undertakers, who were as a result enabled to take water amounting to some 40 m.g.d.

The Dee and Clwyd River Board Act, 1951, provided for the establishment of a Consultative Committee consisting of representatives of the River Board and the British Transport Commission and of any water undertaker for the time being authorised to take water from the river. This Committee assists the River Board in making general directions for the operation of the Bala works and these general directions are subject to the reasonable approval of each body represented, any differences to be referred to arbitration.

When later Liverpool Corporation, in 1957, promoted a scheme for an impounding reservoir in the Tryweryn Valley and abstraction from the River

Dee near Chester for Liverpool and other areas in south-west Lancashire and Cheshire, provision was made for the reservoir to be operated under the direction of the River Board assisted by the Consultative Committee, on which Liverpool were accorded representation. This means in effect that the total storage at Bala and Tryweryn will be available for regulating the flow of the River Dee to provide for abstractions amounting to some 100 m.g.d.

(ii) *River Severn*. In this area proposals for new or increased abstractions had by 1958 begun to reach proportions beyond the resources of the river to meet them if they were allowed to proceed individually. This led to the commissioning of the Hydrological Survey to ascertain the extent of likely demands and the capability of the river system to meet them, given the necessary works to provide storage and to regulate the river flow. The report on the survey showed that if estimates were correct and abstractions continued unchecked serious difficulties would develop within a comparatively few years. The solution lay in storage and the report showed how, by progressive development of catchments and construction of regulating reservoirs, it would be possible to meet demands, to provide for irrigation, to maintain an adequate flow in the river at all times and to afford some protection against flooding.

In the absence of an overall authority for the whole river basin the River Board, the water undertakers principally concerned and the British Transport Commission were brought together in an informal working party to carry out a preliminary investigation of potential reservoir sites. The works involved concern a variety of interests, however, none of which is itself empowered to undertake them and we understand that when actual construction is in question there may be legal difficulties in empowering a particular authority or group of authorities to carry them out which, unless there is an amendment of the general law, are likely to be satisfactorily overcome only by private legislation.

31. It has thus already been shown by experience that where competitive demands arise the best way of reconciling and providing for them is the establishment of a single body responsible for the development of the river basin as a whole. In the absence of this it was found necessary to bring together the river boards and water undertakers in the two areas quoted, the Dee and Severn river basins, and the British Transport Commission, in ad hoc committees in order to ensure the necessary consultation and co-operation. We think it a shortcoming in these two cases, however, that other major users, notably industry, are not represented and we indicate in Part IX that for the successful working of the new river authorities we consider it essential that the controlling body should be so constituted as to take account of the wide range of interests concerned with conservation.

VIEWES OF REPRESENTATIVE BODIES

32. The representative bodies from which we took evidence were generally agreed that the need had been established for a positive policy of water conservation.

33. *The British Waterworks Association* and the *Dock and Harbour Authorities' Association*, however, saw no need for river basin authorities and considered that the need would be met by setting up an independent central authority. The *British Waterworks Association* envisaged a Central Water Authority with full powers to control, plan and allocate water resources and co-ordinate the activities of existing bodies, assisted if necessary by Regional Co-ordinating Committees: the *Dock and Harbour Authorities' Association* envisaged a central

authority to collect information and prepare a complete picture of needs and requirements from which to advise the Minister when proposals were before him. The remaining organisations considered that conservation should in the first instance be a local function but expressed different views as to the type of authority to be made responsible. *The Country Landowners' Association* and the *Association of Drainage Authorities* considered that river boards and other existing bodies should retain their present functions and that the new function of conservation should be the responsibility of new regional conservation authorities (which could be branches of, or committees working under, the central authority) set up to co-ordinate existing activities and to put into practice the policy and plans of the central authority. *The Institution of Water Engineers*, the *Federation of British Industries* and the *Central Electricity Generating Board* considered that new authorities were needed to discharge conservation functions, that it would not be practicable for these authorities to operate alongside the existing river boards and that they should therefore also take over the functions of, and supersede, the river boards. *The River Boards' Association*, the *National Farmers' Union*, the *County Councils Association*, the *National Federation of Anglers* and the *Salmon and Trout Association* considered that conservation should be the responsibility of authorities based on the existing river boards or combinations of river boards, provision being made for interests not at present covered to be represented. *The National Farmers' Union* also saw the need for conservation as developing gradually, the new function being conferred as the need became apparent. *The British Transport Commission* considered that the situation called for the establishment of not more than five area boards (four for England and one for Wales) based on aggregations of river basin areas.

GENERAL APPRECIATION

34. We said in our first report that "the rainfall in England and Wales is sufficient to ensure an adequate supply of water to all parts of the country provided that proper means of conservation and distribution are developed to keep pace with the growing demand". The evidence has underlined the importance of the proviso about conservation. We have described the situation which has developed in which numerous interests are engaged in activities affecting the quantity or the quality of water, or both, without any overall co-ordination, and in which demands have arisen which can only be met if steps are taken to regulate river flows and provide storage. The years 1959 and 1960 have also afforded examples of the effects of extremes of drought and flood.

35. We consider that it should no longer be left to independent initiatives to develop the country's water resources according to their separate needs but that the situation now calls for new authorities to review the various requirements and plan the ordered development of resources to meet them.

36. Although the resources of river catchments may have developed to differing degrees and major conservation works may not immediately be required in all river basins, there is an important need everywhere for fact-finding and for preparation of co-ordinated plans against which to consider the proposals of water users. Moreover, as we point out in the next section of this report in discussing the physical side of water conservation, arrangements may be needed to transfer water from areas where resources are ample to those less well endowed. Accordingly we consider that river authorities should be set up at the outset for the whole of England and Wales.

IV. PHYSICAL DEVELOPMENT OF RESOURCES

37. Conservation involves both the construction of physical works and control over the use of water. In this part of the report we consider engineering aspects of the development of water resources. In Part V we discuss the control arrangements which will in our view be necessary to ensure that these resources are not squandered to general disadvantage.

GENERAL

38. The water resources of a river basin comprise all the water flowing in rivers or streams or held in man-made or natural storage above or below ground. The boundaries of water-bearing strata do not necessarily coincide with surface watersheds but surface and ground resources of water are interdependent. The proper management and development of these resources involve physical works of different sorts and also control of abstractions and of the quantity and quality of water returned. At the same time land drainage and flood control works need to be designed as far as practicable to complement the operation of conservation measures.

39. While in the early stages of development of a river basin direct abstractions of water without storage may be permissible, in general the prime need is the provision of storage to hold back water in times of plenty to meet requirements in dry periods. The steps to be taken will be determined by the nature of the river system but we were advised that from the engineering point of view there should be no insuperable difficulty in preparing schemes which (with reservations as to flooding to which we refer in paragraphs 49-57) would cater for all the interests concerned. Separate schemes for limited purposes are likely to be wasteful of resources and should therefore no longer be permitted except where they accord fully with the development of the river basin as a whole. Cases have arisen in the past where partial development of a catchment for a single limited purpose has curtailed or even prevented any future development of the remaining resources and care should therefore be taken in future to see that reservoir catchments are developed in accordance with schemes which will eventually yield their full potentialities.

40. When planning new conservation works it will also be necessary to take account of the contribution which existing works can make to the overall control of the catchment and this implies the ability to co-ordinate the operation of all water control works in the area, including navigation works where appropriate and the works of statutory water undertakers. In this connection the requirements as to "compensation water"¹ need review. Ministerial Orders, by virtue of the provisions of the Water Act, 1945, under which they are made, and private Acts, empowering statutory water undertakers to construct impounding reservoirs, have required the undertakers to observe conditions as to the "compensation water" to be returned to the river. In the case of private Acts especially, the quantities prescribed are often the result of bargaining between the promoters and the opposers of the schemes concerned. Engineering evidence suggested to us that this frequently led to waste of water and that such provisions should be reviewed in the light of needs and conditions in the river basin as a whole and in relation to the control of river flows.

¹ See glossary.

ARTIFICIAL RECHARGE OF AQUIFERS

41. The artificial recharging of aquifers is a technique which has not yet been fully explored in this country but which may provide a means of maintaining the quantity of water stored underground and hastening the replenishment of such storage. We have not considered it our task to investigate this technically but we are clear that the arrangement of appropriate schemes of this sort is a matter which should be within the scope of river authorities, under the general guidance of a central authority. This is one of the subjects calling for investigation as part of a comprehensive hydrological research programme.

WATER FROM THE SEA

42. The scheme inaugurated by the States of Guernsey Water Board has demonstrated the feasibility of producing potable water from sea water on a commercial scale: but in the present state of technology the cost would still be high even if steam from a specially-designed coastal power station could be used as the source of heat for distillation. This method may find some application in coastal areas of low rainfall but in general it is likely to be more economical to transfer water from other catchments to the extent to which it is available.

TRANSFERS OF WATER BETWEEN THE AREAS OF DIFFERENT RIVER AUTHORITIES

43. A specific question on which we sought information from the engineering witnesses was the extent to which river basins were self-supporting in terms of water resources. It was pointed out to us that examples already existed of the transfer of large quantities of water between river basins but the problem of insufficient resources within particular basins was arising in the eastern half of England: it would undoubtedly be necessary on occasion to provide for the movement of water between the areas of river authorities. The hydrological survey of the Essex rivers and the Stour¹ has confirmed this to be an area where water resources have been developed almost to the limit and which will have to look to the importation of water from outside to meet future needs. We were also advised that although cost was the chief objection to transporting water over long distances, this might nevertheless be a lesser difficulty than finding additional sites for reservoirs in some areas. The British Transport Commission pointed out that existing canals could sometimes be used to help to provide inter-connections between catchments. Clearly the measures adopted for any transfer of water will depend on circumstances. We do not regard the fact that such transfers may be necessary as detracting from the general principle that water resources should be managed on a basis of river basins. It should be well within the scope of a river authority foreseeing a need to import water to initiate inquiries of other river authorities, subject to guidance and, if necessary, direction from the central authority.

NATIONAL WATER GRID

44. The common conception of a national water grid is probably that of a network of trunk mains carrying water throughout the length and breadth of the country in the manner of the electricity grid. The distribution of water and electricity raise quite different problems, however. Water has to be sought where nature places it, while electricity can be manufactured where most convenient. The transmission of electricity is not affected by the levels of the ground passed

¹ Essex Rivers and Stour. Hydrological Survey, 1961. H.M.S.O.

over. It is not practicable to store electricity, so that it has to be generated for immediate consumption to meet demands which may vary considerably between low and peak periods. On the other hand water is easily stored but expensive to distribute because of the cost of mains and the cost of distribution is considerably enhanced when flow by gravity is impracticable by reason of ground levels and pumping has to be introduced.

45. The principle justification of the electricity grid system was the interconnection of power stations which made possible the pooling of spare plant capacity to meet peak demands and cover breakdowns and other contingencies. Hitherto, each independent power station or group of stations had been obliged to provide spare capacity sufficient to exceed the peak demand (which occurs in winter and is roughly double the average demand for the whole year) by a margin sufficient to cover any losses due to breakdowns or other causes. The pooling of spare capacity has made it possible to meet growing demands with substantially less capital investment in new generating plant than would otherwise have been required. Another advantage of interconnection has been the ability, at times of less than peak load, to concentrate the maximum production of electricity in the generating stations which are cheapest to run, using the most expensive stations only for short-period peak load generation. This has led to major operating economies.

46. Water supply has over the years been built up from local sources but because of increasing demands or excessive pollution many large cities have exhausted nearby sources and have had recourse to places further afield where the development of major sources was possible. The aqueducts bringing this water to the cities have been used to supply water to places along their routes. Major sources have also been developed jointly on occasion by two or more water undertakers. The regrouping of water undertakings into a much smaller number of larger units which is now in process will help to reduce competition for sources between water undertakers. Considerable elasticity in the public water supply has thus been achieved over very wide areas and its extent and worth were amply proved by the aid which some statutory water undertakers were able to afford to others during the drought of 1959. It can therefore be said that within the limits of what is economical and practical "regional grids" have been established and encouraged.

47. It would be a different matter to seek to transform these regional arrangements into a national network of trunk mains or canals. The cost of the main arteries would in itself be excessive and at whatever level these were laid there would be difficulties in lifting water from lower levels into a grid system and drawing out supplies at higher levels.

48. We therefore consider it impracticable to contemplate for water anything in the nature of a national network of mains or "national water grid" into which water could be passed from sources in various parts of the country and from which supplies could be drawn at any point where they were needed. On the other hand we are agreed about the potentialities of regional distribution arrangements and the uses which can be made of special-purpose mains schemes which involve transporting water over considerable distances and we are glad to note the extent to which mutual aid is already a feature of the public water supply. If river authorities such as we recommend are set up to plan and co-ordinate the development of river basins as a whole, they will, in conjunction with statutory water undertakers, be in a position to promote any transfers of water which may be desirable.

FLOOD CONTROL AND WATER CONSERVATION

49. Public interest in the control of flooding has been intensified following the extremes of weather which the country suffered in 1959 and 1960. It is often asked why flood waters should not be stored against times of shortage rather than be allowed to flow unchecked downstream, causing damage and dislocation. It is true that there can be a link between water conservation and flood control but the practical difficulties are formidable. If flood waters are to be taken into storage there must be capacity available at the right time and place to hold them.

50. In general the engineering works required for water conservation and for flood control are only partially compatible in time and place. It is usually desirable for reservoirs used for conservation purposes to be sited in the head-waters of the river system and therefore they will only be able to intercept a comparatively small part of the total flood run-off of a river catchment. Storage for flood control purposes is generally best sited at strategic points throughout the river system.

51. Major floods generally occur during the early part of the year, when reservoirs operated in the interests of abstractors and other river users should be as full as is necessary to maintain river flows in the drier months of the ensuing summer. The time between the actual fall of rain and its discharge into most reservoir sites is not sufficiently great to enable the reservoir to be drawn down specifically to receive it. It is not at present possible in this country to forecast weather sufficiently far ahead to be able safely to lower reservoirs in anticipation of rain to come.

52. There are situations in which a reservoir designed for conservation purposes can delay the passage of a spate down river. Spare capacity may be available in such a reservoir in the initial period of its use before its full capacity is required for conservation purposes. When a reservoir is full there is some additional storage effect to be gained due to the rise of water above the level of the spill-way.

53. The operation of a regulating reservoir in the head-waters of a river would modify peak discharges in the stream on which it was built and possibly for some distance downstream of the confluence of this stream with others. Certainly it would be advantageous for the operation of regulating reservoirs and responsibility for flood control to be in the same hands. Nevertheless regulating reservoirs built for conservation purposes do not present more than a partial solution to the problem of flood control, although every opportunity should be taken to use surplus storage capacity to mitigate flooding.

54. Use is already being made of relatively small flood detention reservoirs on small rivers to balance flood discharges from new towns, while very large flood reservoirs are used in the Fen country. Storage on the flood plains of larger rivers also has a material effect in reducing flood peaks.

55. In some countries, particularly where rainfall is more predictable, storage capacity is used extensively to mitigate the effects of floods and such storage is specifically provided for flood control purposes.

56. Members of the Sub-Committee have seen an example of combining flood control and regulating reservoirs on a river system in Western Germany. In this system the newest regulating reservoir is being constructed large enough to allow some capacity to be used exclusively for flood control purposes and the flood peaks are expected to be reduced by 17% at a point half-way down the river. The only example of a similar dual-purpose control reservoir in this

country is the control works at Bala Lake which regulate the River Dee. (See paragraph 30).

57. There is scope for a good deal of expert study and consideration of this problem to see whether means cannot in time be developed for combining measures for the conservation of water with those for mitigation of floods. In this connection improved knowledge of the hydrological characteristics of a river basin will be essential.

V. CONTROL OF ABSTRACTIONS

SURFACE WATER

58. Some abstractions are specifically authorised by or under statute. This applies to statutory water undertakers, all of whose operations are governed by statute, and in varying degree to abstractions by the nationalised industries and to the use of water for navigation. Otherwise there is in general no control over abstractions of surface water (other than actions which may be brought to protect the private rights described in Appendix II). Information about the extent of uncontrolled abstractions¹ is imperfect but very large abstractions are known to be made for industrial and other purposes as well as numerous smaller abstractions, notably for irrigation, and it is highly probable that their total exceeds the total of those made in the exercise of statutory powers.

59. In order that conservation works may be designed and operated to afford maximum benefit to all concerned, knowledge of present and proposed abstractions will be needed and it will be necessary to apply control to ensure that abstractions do not overstrain the river system at any time and that the benefit of conservation works is enjoyed by those whose needs they are intended to serve. We consider that to this end river authorities should be empowered to operate a system of licensing abstractions.

60. This does not mean that we abandon the view expressed in our second report, that the object of conservation should be the positive one of making water available to meet all legitimate requirements: but conservation works take time to design and execute and in the interim the available resources may have to be utilised with care. Moreover, water resources can only be successfully managed through the years if the controlling authority is thoroughly well informed of the demands being made on those resources. For these reasons a comprehensive system of controlling surface water abstractions is needed: it should extend to the diversion as well as the abstraction of water since this also affects the water resources of the area.

GROUND WATER

61. A larger measure of control of abstractions from ground water already exists but again we believe that the control should be comprehensive. At present the Minister of Housing and Local Government is empowered by Section 14 of the Water Act, 1945, to define areas within which works for the abstraction of ground water are to be subject to licensing, provided that he is satisfied that this is necessary to conserve water in the public interest, whether for the protection of public water supplies or water supplies used for industrial or other purposes. Most of the main water-bearing strata have been defined in this way. In these areas new abstraction works are required to be licensed but the Act

¹ See glossary.

made exceptions for abstractions from boreholes sunk before the Act came into operation and for abstractions solely for the domestic purposes of a household. Elsewhere landowners have unfettered rights under the common law in regard to all water under their lands which does not flow in defined channels. They can abstract unlimited quantities for their own use or for sale without regard to other abstractors.

62. We are satisfied from the advice we have received that the limitations in existing legislation should be removed and that ground water abstractions should be controlled throughout England and Wales, not only in the present defined areas. This should extend to such abstractions from boreholes sunk before the 1945 Act came into operation as can at present be made without licence. "Domestic" abstractions should, however, be exempt (see paragraph 65).

63. We think it important that the control of abstraction both of surface and of ground water should be exercised by the same authority. This would involve transferring the power of controlling abstractions of ground water, broadened as we have suggested, from the Minister of Housing and Local Government to the river authorities, to be exercised as one of their conservation functions.

64. The fact that surface watersheds and the limits of ground aquifers do not correspond is not an obstacle to unified control of surface and ground water. We are quite sure that unified control is essential in order to ensure the best use of both surface and ground water.

EXEMPTION OF "DOMESTIC"¹ ABSTRACTIONS FROM CONTROL

65. A person abstracting ground water for the domestic purposes of his household is exempt from the existing control of ground water abstractions under Section 14 of the Water Act, 1945. We consider that, as the total quantity is not likely to be of great significance, this exemption should for administrative convenience be continued in respect of ground water and should also apply to the "ordinary" use of surface water by riparian owners as defined in Appendix II. All other abstractions should be controlled.

GENERAL

66. The detailed operation of the control of abstractions will need to be very carefully worked out to do justice to all the interests concerned and will be a matter for negotiation. We do not think we can do more in the time at our disposal than draw attention to the following general principles. In Part VIII we refer to the statutory provisions and private rights under which abstractions are made at present and describe the relationships we envisage between the river authorities and other authorities and interests.

(i) *Issue of licences*

67. Priority should be given to established abstractions, since they may be vital to the economies they support, and they should as far as possible be licensed to the full extent to which they have hitherto been made. The extent of statutory abstractions will be known. Establishing uncontrolled abstractions¹ is likely to present difficulties and we think it will be necessary to place the initiative on the abstractors to show that the quantities applied for represent usage over a given period. New or altered abstractions should be licensed at the discretion of the river authority according to the availability of water, with provision for appeals.

¹ See glossary.

68. We see no objection in principle to the granting of licences to abstract surface water to non-riparian interests if wayleaves can be obtained and if the river authority considers that water can be made available.

(ii) Review of licences

69. We think it will be necessary for river authorities to have power, subject to safeguards for the abstractors, to review and to revoke licences. This will enable them to co-ordinate surface and ground water abstractions in the best interests of conservation in the area, to modify decisions taken at the outset in the light of subsequent experience or for other reasons and to deal, among others, with cases where licences are in the event not exercised, or not to their full extent, or where licensed abstractions are abandoned. The inability to review or revoke licences, once issued, has proved to be a serious weakness in the existing control of ground water. A flexible scheme will ensure the best use of resources.

(iii) Surface water abstractions to be related to the discharges or levels of rivers and streams

70. In operating the control of surface water abstractions we think it will be necessary for the river authorities to prescribe minimum acceptable discharges¹ at different points on rivers or streams to which abstractions will be related as a licensing condition. Such restrictions would be imposed on abstractions as might be required when the discharges or levels fell towards these minima, arrangements being made to safeguard essential services to the fullest extent possible. Where abstractions are coupled with storage the licensing system should allow of variations in the quantities abstracted to enable advantage to be taken of high flows to abstract water for storage which would otherwise be lost from the river system.

(iv) Application to works

71. It will be necessary for the river authorities to have general control not only over abstractions but also over new works the operation of which affects the river system and we propose that this control should operate in connection with the licensing system. We also think it will be necessary for existing works of other agencies (including statutory water undertakers) to be operated in accordance with overall control of the river basin by the river authority. So long as this is assured responsibility for administering their own services should remain with the authority or body concerned.

(v) Tidal waters

72. As indicated in Part IX, we have not attempted to designate the areas of river authorities. We think, however, that it should be possible to include in the licensing system those parts of tidal waters where abstractions would have an appreciable effect on water resources or on other abstractions or interests.

(vi) Rights to abstract conferred by licences

73. A licence should confer a statutory right to abstract in accordance with the terms of the licence, to the exclusion of civil rights of action against the abstractor in relation to the abstraction.

(vii) Liabilities and safeguards of river authorities and abstractors

74. In exercising their licensing powers river authorities will have a task of great complexity and responsibility. It has been represented to us that provision

¹ See glossary.

should be made both to protect abstractors against unreasonable acts by river authorities and to protect river authorities against actions by abstractors and others claiming detriment from the activities of the authorities. Statutory water undertakers in particular stressed that as the Water Acts placed on them a duty to maintain a constant supply of water, subject to continuing penalties, except when prevented by frost or drought, unavoidable accident or other unavoidable cause, they should in turn be assured of their own sources of supply.

75. In due course, when any necessary conservation works have been carried out, it may be possible to impose a duty on river authorities not to allow by their default the discharges or levels of rivers and streams to fall below what is needed to provide for all licensed abstractions, and the needs of the rivers themselves, with a saving clause for failure to do so through circumstances against which they could not reasonably be expected to guard. In the meantime probably the most that can be done will be to require them in exercising their licensing powers to act reasonably. Correctives would be provided by appeals to the Minister and by Ministerial default powers.

(viii) *Obstructions to watercourses*

76. The Land Drainage Act, 1930, gave catchment boards and internal drainage boards powers, which were also made available to river boards by the River Boards Act, 1948, to remove mill dams, weirs or other obstructions to watercourses in the exercise of their land drainage functions, on payment of compensation for any injury sustained. (These powers do not apply to works controlled by navigation or harbour authorities.) The Land Drainage Act, 1961, has extended these powers to include alterations as well as removals. We think that river authorities will also need powers of this sort for the exercise of their conservation functions.

APPEALS

77. We assume that provision will be made for appeals to the Minister against decisions of the river authorities.

VI. CONSERVATION AND RIVER BOARDS

78. In defining "conservation" in Part II we said that we regarded it as closely bound up with land drainage and the carrying out of flood control measures. These are at present major functions of the river boards set up under the River Boards Act, 1948, but they are such an important part of water management that they should not be separated from conservation. The activities of a conservation authority will affect the river basin as a whole, governing the flow and use of water throughout its whole area. We are clear that existing river boards and separate new conservation authorities cannot operate successfully side by side. Conservation proposals therefore raise sharply the issue whether existing river boards should have added to them the broader task of conservation of water resources as we have outlined it or be superseded by new authorities designed to discharge the present duties of the boards in association with the new task of conservation.

79. The evidence we received in support of the general principle of conservation of water resources was divided on the desirability of devolving this new function on river boards reconstituted to embody additional interests or of setting up entirely new authorities for the purpose.

80. For the reasons set out in Part IX we consider¹ that the proposals in our report call for the creation of an entirely new type of authority which would be responsible for conservation and also assume the functions of, and supersede, the existing river boards.

VII. DUTIES AND FUNCTIONS OF RIVER AUTHORITIES

81. We now set out briefly the duties and functions which we envisage for river authorities.

(i) In the first place the river authorities should be charged with a positive duty to conserve and ensure the best use of all the water resources of their areas.

The new function of conservation should include the following:

(ii) The assessment of the resources and potentialities of the area (including both surface and ground water); the estimation of future demands for water; the prescribing of minimum acceptable discharges in rivers and streams; the keeping of a continuously up-to-date hydrological survey of the area.

(iii) The control and, where appropriate, the development for all relevant purposes of the water resources of the area (both surface and ground, including the artificial recharge of aquifers where appropriate). This implies power to secure where necessary that the existing works of other agencies are operated in accordance with the needs of the river basin as a whole. Power should also be given to review existing statutory provisions for the discharge of compensation water² and, subject to the consent of the central authority, to secure their amendment.

(iv) The allocation of water, including ground water, between the various users by a system of licensing. The existing control of ground water should be broadened and extended over the whole country and transferred to the river authorities.

(v) The construction and operation of river regulating or other kinds of reservoir (including control of the catchments of such reservoirs) according to the needs of the river basin and the requirements of water users, together with such general control of the construction and operation of new works by other agencies as is necessary to ensure conformity with the management of the river basin as a whole.

(vi) Where appropriate, the transfer of water between the areas of different river authorities, subject to the approval or direction of the central authority.

(vii) The protection of ground water from pollution.

(viii) An extension of the present control of pollution of surface water to include power to carry out river purification where this cannot be done by another authority or individual.

(ix) Where appropriate, the preservation, control and development of amenities. The amenities we have in mind here are the use of reservoirs and rivers for boating, swimming and fishing and similar purposes incidental to the management of water resources. The proposal is not intended in any way to infringe the powers and duties of Planning and other authorities (including statutory water undertakers).

82. In addition all the existing functions of river boards should be transferred to the river authorities. Of these the most important are:

¹ See reservation on pages 33-36.

² See glossary.

(x) The control of pollution of surface water under the Rivers (Prevention of Pollution) Acts, 1951 to 1961.

(xi) The administration of land drainage, flood control and sea defence under the Land Drainage Acts, 1930 and 1961.

(xii) The administration of fisheries under the Salmon and Freshwater Fisheries Acts, 1923 to 1935.

(xiii) Where appropriate, the functions of navigation authorities as provided for in the River Boards Act, 1948,

and finally the river authorities should have:

(xiv) Power to undertake or contribute to investigations relating to any of their functions, subject to the approval or direction of the central authority.

83. We assume that any legislation will provide for the river authorities to obtain powers to construct works and other necessary powers in normal circumstances by the simpler procedures, such as Ministerial Order, now common, rather than requiring invariable recourse to private Bills.

VIII. RELATIONSHIP OF RIVER AUTHORITIES TO EXISTING AUTHORITIES AND INTERESTS

84. The development and use of water resources in orderly fashion unavoidably implies co-ordination and control of the activities of public organisations and private concerns and individuals using water and will call for a close and harmonious working relationship between these and the river authorities. We set out below the way in which we think this would work.

(i) *River boards*

85. As explained in Part VI we consider that it would be impracticable to have separate authorities administering conservation on the one hand and the existing functions of river boards on the other, since these are interdependent. We therefore consider that these functions should be administered by the same authorities. We also consider¹ that a new sort of authority should be created to which the present powers and duties of river boards would be transferred, river boards as now known ceasing to exist.

(ii) *Thames and Lee catchments and the greater London area*

86. In these areas the responsible authorities are at present the Conservators of the River Thames and the Lee Conservancy Catchment Board and for the greater London area a number of different authorities. The situation is complex and we have not considered it in detail but we consider that our proposals for conservation should apply to the whole of England and Wales and that the position in these areas should be reviewed with the object of bringing them within the general system.

(iii) *Internal drainage boards*

87. We do not envisage any change in the powers and duties of internal drainage boards, which in these respects would be placed in the same relationship with the river authorities as now subsists with the river boards.

(iv) *Statutory water undertakers*

88. At present (unless they choose to resort to the promotion of private Bills) abstractions of surface water and the provision of related works by statutory

¹ See reservation.

water undertakers¹ are subject to Ministerial control under public general legislation. The acquisition by agreement of rights of abstraction is subject to the approval of the Minister of Housing and Local Government and the compulsory acquisition of such rights must be authorised by the Minister. The acquisition of such rights under the Water Act, 1945, is subject to a statutory procedure which ensures publicity and the proper consideration of objections, and, in certain circumstances, gives objectors access to Parliament under the Statutory Orders (Special Procedure) Act, 1945. The Minister also has certain statutory duties under Section 26 of the Water Act, 1945, where the acquisition of rights to abstract involves the impounding¹ of any stream or will substantially reduce the flow of any stream. He must in the case of both agreed and compulsory acquisition of such rights satisfy himself that the extent to which and the circumstances in which water may be taken are satisfactorily defined and must see that the appropriate provisions of Part III of the Third Schedule to the Water Act, 1945, (which relate to compensation water¹ and other matters) are incorporated in the agreement or order. Section 26 also lays down the considerations to which the Minister must have regard when reaching his decision.

89. We are sure it is right in principle that future abstractions and related abstraction and impounding works of statutory water undertakers should, in common with those of other abstractors, in the first instance be subject to the consent of the river authorities. The earmarking of resources for meeting this particular demand will be a vital part of the work of the river authorities. The question whether storage for public water supply should be provided by, or jointly with, the river authorities, or by the statutory water undertakers alone, will be a matter for agreement. Once this has been determined and the quantity, point and method of abstraction, including the building of reservoirs, have been settled, the impounding, abstraction, treatment and distribution of the water for the public water supply should remain entirely the responsibility of the statutory water undertakers. River authorities should, however, also be able to ensure that existing works of statutory water undertakers are operated in accordance with the good management of the river as a whole. This should include the adjustment of compensation water requirements, which frequently are unnecessarily inflexible.

90. Abstractions of ground water and related works should similarly be controlled by the river authorities.

91. Our proposals involve alterations in the existing statutory provisions and we assume that the necessary legislative provisions will be a matter for consideration by the Government.

(v) *Nationalised industries*

92. We include under this heading electricity, gas, coal and transport (other than inland waterways, which are dealt with separately in paragraphs 96-99).

93. Under the Electricity (Supply) Act, 1919, as amended by the Act of 1926 and the Electricity Act, 1947, the Minister of Power may, by order and subject to conditions, authorise the abstraction of water from any source for electricity generation. We understand, however, that historically the industry when abstracting water has relied upon its rights as riparian owners, in recent years discussing the proposed use of river water for new generating stations with the appropriate river board. We have referred in Part III to the industry's immense

¹ See glossary.

flow requirements of water for cooling, which are vital to the operation of power stations, and the resulting problem of siting.

94. As far as we know abstractions by the other nationalised industries we have mentioned are also made in reliance upon riparian or acquired rights rather than under statutory powers. As we said in our first report, the water requirements of these industries are not great.

95. We think that in principle new abstractions should, in common with those of other abstractors, be subject to the consent of the river authorities. This implies amendment or repeal of the relevant provisions of the Electricity Acts and other relevant provisions, if any. Licences should as far as possible be granted automatically for established abstractions: but as operating methods and cooling and other requirements may alter we think that the river authorities must be able to review licences from time to time with a view to any appropriate amendment.

(vi) *Inland waterways*

96. Inland waterways include navigable rivers, rivers improved for purposes of navigation, waterways partly natural and partly artificial, and wholly artificial canals. They derive their water from rivers, minor watercourses, reservoirs, springs and underground sources according to local circumstances. Because of their obligations to maintain navigable water levels, navigation authorities¹ may undertake and maintain works which affect the conservation of water.

97. The construction of inland navigations (whether artificial or improved natural navigations) and ancillary works such as reservoirs, and the impounding or abstracting of water where necessary, was normally authorised by means of private legislation, and the obligations on and powers belonging to canal owners are normally defined, in respect of particular waterways, in the private legislation relating to those waterways. There has been no general legislation on inland waterways governing the abstraction of water for inland waterways.

98. We have taken note of the report of the Committee of Inquiry into Inland Waterways² and the interim proposals outlined in the White Paper³ issued by the Government in February, 1959, following the report, and also of the proposals on inland waterways included in the White Paper on reorganisation of the nationalised transport undertakings⁴. The White Paper of 1959 referred to the variety and complexity of the problems which inland waterways present and the multiplicity of their uses: and we accept that any recommendations we may make may need to be qualified when proposals for the future of inland waterways in general are worked out.

99. Nevertheless this should not in our view affect the basic principle that the resources of a river system should be managed as a whole by a unified authority. Some inland waterways now redundant for navigation purposes are used for other purposes and such possibilities have not been exhausted: we consider that there should be an arrangement whereby river authorities could seek power to take over such installations as they consider useful for the discharge of their conservation functions. In other cases it would probably be sufficient for the

¹ See glossary.

² Report of the Committee of Inquiry into Inland Waterways, 1958. Cmnd. 486. Reprinted 1960. H.M.S.O.

³ Government proposals following the report of the Committee of Inquiry into Inland Waterways. Cmnd. 676 1959. H.M.S.O.

⁴ Reorganisation of the nationalised transport undertakings. Cmnd. 1248 1960. H.M.S.O.

river authorities to control or co-ordinate the flow of water into, and return from, the canal system and the construction or operation of works affecting the river system, rather on the lines of the arrangements we envisage for statutory water undertakers, control within the canal system (including control of abstractions from the canals) remaining with the canal authority. More complex problems arise in the case of navigable waters where navigation authorities and river boards exercise their respective functions but we consider that responsibility for works constructed to maintain the river system for purposes of water conservation, land drainage and flood control, as well as responsibility for the control of abstractions, should be that of the river authority, while responsibility for works constructed to maintain navigation should be that of the navigation authority. The closest co-operation will be necessary between river authorities and navigation authorities.

(vii) *Dock and harbour authorities*

100. As indicated in paragraph 85, existing powers of river boards should be transferred to the river authorities. We think it unlikely that anything more will be required with regard to dock and harbour authorities since the activities of these authorities chiefly concern the tidal portions of rivers and below. Arrangements should, however, be made for consultation between dock and harbour authorities and the river authorities, for certain operations of either may affect the other.

(viii) *Private abstractors*

101. Private abstractions of *surface* water are made in the exercise of riparian rights or of rights acquired by grant or prescription. (A brief description of these rights is given in Appendix II.) Many private abstractions of *ground* water are already subject to control but where they are not the landowners have unfettered rights in regard to water under their lands not flowing in defined channels.

102. Private abstractions include the very large ones made for industrial and other purposes as well as the numerous small abstractions being made all over the country. We have already suggested (Part V) that all abstractions except those for "domestic" purposes should be brought within the system of licensing we have proposed.

IX. CONSTITUTION AND ORGANISATION OF RIVER AUTHORITIES

103. As we see it the interests to be taken account of in the constitution of the river authorities are the following (although not all would necessarily call for consideration in every case):

| | |
|--|---|
| local authorities | } already represented on river boards. |
| land drainage | |
| fisheries | |
| National Coal Board (in two instances) | |
| statutory water undertakers | |
| industry (including fuel and power) | |
| agriculture | |
| navigation | |

Amenities are not mentioned as such because they are effectively covered by local authorities and fishery interests.

104. We do not consider ourselves equipped to designate the areas of river authorities. Not every existing river board area need, we think, be administered as a separate conservation area but for the purpose of river authorities some review of river board areas is likely to be the sensible course. (The legislative framework should, we suggest, allow of this at the outset, bearing in mind geological as well as topographical considerations, and permit of subsequent modification.) It seems to us that the criteria to be kept in mind are that the burden of work of each river authority should be such as to justify full-time expert staff with proper facilities at their disposal and that the authority's financial resources should be sufficient to support them. The work of the river authorities which we envisage will demand a wide degree of professional and technical ability and experience in their staff.

105. We see strong objections¹ to securing representation of the numerous and diverse interests affected by conservation by adding to or modifying the membership of the existing river boards, as we think this would be bound to result in bodies too cumbrous for efficient working. Eight river boards and the Thames Conservancy already have a membership of 40 or 41 (Appendix V): and the amalgamation of areas which we envisage would doubtless increase the claims for representation. We therefore consider that the situation requires, and offers the opportunity for, an entirely new approach.

106. In this connection we think it is important to stress the magnitude of the new task of conservation. We think it likely that in some areas at any rate the physical works and control measures involved in conservation will equal if not outstrip in importance the functions of existing river boards. Conservation also brings to the fore quite different aspects of surface and ground water use affecting interests not so far represented and requiring a positive and far-sighted approach by the new river authorities if growing water demands are to be efficiently met.

107. We therefore recommend the creation of an entirely new type of authority.¹ We attach less importance to representation as such than to the efficient and expeditious discharge of the wide range of functions involved. We think this calls for small and compact authorities with a membership of, say, 10-15, the pattern being varied if necessary to take account of local circumstances. These members could be elected by the interests concerned or appointed by Ministers in consultation with those interests, or a combination of these methods could be adopted, and we do not rule out the possibility of appointing some members able to devote their full time to the business of the river authority. The detailed constitution of river authorities is, however, outside our terms of reference and will we assume be a matter for negotiation.

108. We realise that our recommendation involves a departure from a principle underlying the present constitution of river boards, that representation is partly related to the provision of finance. We think this is unavoidable. The present functions of river boards are financed largely by precepts on rating authorities. Conservation will be financed by charges or licence fees levied on a wide range of new interests, the water users, who will expect fair consideration in the conduct of the affairs of the river authorities. We have concluded that to add representatives of these interests to the existing river boards would not be a practicable or

¹ See reservation.

business-like way of handling these affairs. We therefore feel justified in our recommendation even if it involves the levying of precepts by bodies whose constitution is not based on comprehensive representation of the authorities meeting the precept.

X. FINANCING OF WATER CONSERVATION

GENERAL

109. The evidence we received included a variety of suggestions for ways in which water conservation might be financed but not many organisations dealt with this aspect of conservation at any length and the field of agreement was not wide enough to yield any comprehensive scheme. Several organisations, however, including the Federation of British Industries, the National Farmers' Union, the River Boards' Association and the Institution of Water Engineers, stressed that the basic principle ought to be that the cost of conservation should be met by those who benefitted, in proportion to the degree of benefit received. Some organisations considered that conservation should be financially self-supporting: others felt there was a case for government assistance. Suggestions were made for financing conservation by methods of charging, either entirely or together with precepts on rating authorities in the area to meet any deficiencies: or for meeting the whole cost by precepting on rating authorities in the area, (suggested by the Central Electricity Generating Board and others), or for a national water rate (suggested by the River Boards' Association). Some organisations expressed strong views as to the method of dealing with existing uses of water. The National Farmers' Union and the Federation of British Industries considered that contributions should be levied only for "new" uses, while the Institution of Water Engineers and the County Councils Association thought that anyone using water should make some payment. The Institution of Water Engineers and the River Boards' Association provided detailed suggestions for methods of charging related to different categories of water use.

110. Dealing first with the points of principle raised in the evidence, we agree that expenditure on water conservation should be met by those benefitting according to the degree of benefit received and we think that special consideration should be given to existing users for some years. We also consider that the conservation activities of river authorities should in general be financially self-supporting, but with reservations as to financing in the early years and as to Exchequer assistance in certain circumstances which we set out in paragraphs 119-120 and 122.

111. We set out below the conclusions we have reached after carefully considering the evidence we received.

PRESENT FUNCTIONS OF RIVER BOARDS

112. In the first place we have assumed that the established methods of financing the present functions of river boards will continue and that the river authorities will simply inherit these sources of income when taking over these functions from the river boards. These sources of income are mainly precepts on County Councils and County Borough Councils and on internal drainage boards, the income from fishing licences and government grants. The Land Drainage Act, 1961, has added powers to levy general and special drainage charges. We assume that the arrangements for financing internal drainage boards will also continue as before.

CONSERVATION

113. The new function of conservation will call for expenditure on administration and control, on research and on the construction and maintenance of capital works. We have recommended in Part V that all abstractions from both surface and ground water except abstractions for "domestic" purposes should be brought within a system of licensing. We think that the most practical method of financing conservation would be by way of fees or charges linked with the licences and scaled where appropriate to take account of the degree of benefit received and other relevant factors. Such a method would be flexible enough to include flat rate licence fees in suitable circumstances as well as charges calculated in different ways, for example on the gallonage of water used or the share of storage provided, with allowances for water returned. The choice of method would depend upon the nature, extent and cost of the measures required to control the use of water and the works needed to maintain and develop water supplies. Fees would also be payable for such facilities as boating.

NEW WORKS

114. The cost of new capital works should in our view be charged to all those who benefit: on this basis it may on occasion be right to limit it to a particular section of the area of a river authority or to a particular group of users. The conservation works required will vary in size and scope according to the needs and conditions in different river basins but there is little doubt that in some river basins major capital works will be needed at an early date. We assume that capital expenditure will normally be met by borrowing from the sources available to local authorities and bodies of similar standing (although capital contributions by water users need not be ruled out). The river authorities must be assured of a sufficient income to meet the loan charges from the time they arise: the main source of this income will be those benefitting from the works in question, who in some cases therefore will be called upon to meet fairly substantial charges. We think this must be accepted and that it is right in principle that users should pay an economic price for water related to the cost of providing it.

EXISTING ABSTRACTIONS

115. We consider that established abstractors (e.g. statutory water undertakers) may have a claim to being exempt for a period of years from making contributions towards new capital works, unless there was plainly an immediate need for such works related to existing requirements. The administrative expenses of the river authorities are a different matter and we think that these might reasonably be spread over all water users from the start.

APPLICATION TO STATUTORY WATER UNDERTAKERS AND OTHER STATUTORY ABSTRACTORS

116. Following this principle, apart from a licence fee towards the administrative expenses of the river authorities statutory water undertakers should in the absence of materially changed circumstances be enabled to enjoy without charge the existing benefit of their conservation works and of statutory rights to take water up to the statutory limit or, where such rights are unlimited, to an extent to be determined. The terms on which new abstractions could be made would be a matter for negotiation with the river authorities and contributions would we assume be related to the cost of conservation works needing to be provided and the benefit derived: one such benefit could be an alteration in the quantity or

method of discharge of compensation water from existing works as a result of the activities of the river authorities. The foregoing principles should apply to other statutory abstractors.

TRANSFER OF WATER

117. Where water is transferred by one river authority to the area of another the receiving river authority would be expected to make the appropriate payment and recover this from users in its area.

SCHEMES OF CHARGING

118. The river authorities should prepare charging schemes appropriate to the circumstances of their areas, the object being to make these readily understood and as simple and economical as possible to operate. These schemes would be advertised and be the subject of local inquiry if there were objections: and if approved by the Minister would be operative.

INTERIM ARRANGEMENTS

119. When they are first set up the river authorities will be faced with an immediate problem of financing their operations while lacking adequate information about abstractions and returns of water on which to base their detailed charging schemes. To overcome this initial difficulty we think that for, say, the first three years of their existence, while they are collecting this information, they may find it necessary to devise interim charging schemes. Any inequalities could be adjusted at the end of the interim period to bring the charges into line with the permanent scheme. As an alternative method we considered a flat rate licence fee charged on every user but we think this would be difficult to operate fairly having regard to the very wide variations in the amounts of water used by different consumers, while calculations based on the river Severn hydrological survey also suggest that even a considerable uniform licence fee would not produce an adequate income.

120. Even so, some river authorities may be faced with revenue deficiencies in the first year or so of their existence before income can be built up from the various sources. To overcome any initial financial difficulties we suggest that the river authorities might be given power to levy new precepts on County Councils and County Borough Councils. These should be limited to the product of 1d. rate and the power should expire after a short time, say, three years. This precept is intended to meet exceptional contingencies only, when the revenue from other sources unavoidably falls short. We do not favour precepts as a permanent source of income for water conservation.

GROUND WATER

121. What we have said applies in principle to ground water as well as to surface water but the somewhat different circumstances in which ground water abstractions are made may call for special consideration in the detailed application of charging arrangements.

EXCHEQUER GRANTS

122. We have expressed the view that conservation should in general be financially self-supporting. Nevertheless, in view of the importance of water in the national economy, we think that circumstances may arise in which it would be in the national interest to make financial assistance available from Exchequer funds.

XI. CENTRAL AUTHORITY

123. Much of the evidence we received stressed the need for a central body to promote an active policy for water and to co-ordinate the activities of the river authorities. Some evidence envisaged merely an advisory body but most considered that strong direction should be available as necessary from the centre. Various suggestions were made as to the form the central authority might take. Several organisations pressed for the establishment of a separate Central Water Authority, made up of persons experienced in water problems, possibly of the Chairmen of the river authorities together with representatives of government departments, and chaired possibly by a Minister, possibly by a full-time independent Chairman. Others considered that it would be a mistake to interpose an additional authority between the proposed river authorities and the responsible Ministers, to whom certain functions would in any event have to be reserved. Of these some favoured a separate Minister for Water, while others had in mind the present responsibilities of the Minister of Housing and Local Government under the Water Acts with regard to the conservation and proper use of water resources and considered that little more was required than some strengthening of these powers, with continuing consultation with the Minister of Agriculture, Fisheries and Food and other Ministers as appropriate. Proposals of this sort have repeatedly been put forward from time to time over the years.

124. Although our terms of reference do not extend to the making of detailed recommendations about the nature and constitution of the central authority, which are matters of government organisation, we are emphatic in recommending that a separate central authority, accountable to the Minister, should be set up to deal with water conservation. Its principal functions should in our view be as follows:

(i) To promote an active policy for the conservation and proper use of the country's water resources, ensuring its efficient execution by the river authorities.

(ii) As the essential foundation of such a policy, to collate and co-ordinate assessments by river authorities and others of water requirements and water resources, together with the central authority's own assessments, into a national appraisal on which to base forward planning; and to keep it under constant review. This would among other things involve promulgating a national pattern for the collection and publication of hydrological information.

(iii) On the basis of this national assessment to integrate the proposals of river authorities for the development of water resources, itself initiating conservation schemes and works if necessary.

(iv) To allocate water resources where necessary between the areas of river authorities and to co-ordinate, authorise and where necessary initiate proposals for transfers of water between those areas in the light of the national assessment of water requirements and the availability of resources.

(v) To approve and review the general conservation schemes of the river authorities.

(vi) To consider, co-ordinate and sponsor programmes of capital investment relative to water conservation.

(vii) Where desirable, to commission research into questions related to water conservation.

125. We assume that appellate functions arising from decisions of the central authority or the river authorities on conservation matters would be reserved to

the Minister. This would achieve a desirable separation of promotional from appellate functions.

126. The functions listed are related to water conservation and are consequential upon our proposals for the establishment of river authorities with the new function of water conservation. Our terms of reference do not extend to the consideration of such existing functions of Ministers as land drainage and the control of pollution.

XII. INDUSTRIAL USE OF WATER

127. At the time of our first report we estimated that in 1955 major industrial users (including the nationalised industries) took some 1,668 m.g.d. from private sources (excluding cooling water for the nationalised industries) while metered supplies from statutory water undertakers, a large proportion of which would relate to industry, amounted to 730 m.g.d. (out of the total public supply of 1,958 m.g.d.). These figures indicate the magnitude of industrial water requirements, even when an allowance is made for re-use. We have also shown in Part III (when dealing with the demand for water) that there are indications that in industrial areas industry is increasing its demands on the public supply—a trend which is likely to increase as greater control is exerted over direct abstractions from rivers and streams.

128. A feature of the industrial demand for water is the attention given to the quality of water. Potability is not always important. The cardinal points of interest are suspended and dissolved solids, hardness, bio-chemical oxygen demand, permanganate value and metals. The treatment of unsuitable water to make it suitable for industrial purposes can be very costly, often more so than treatment for potability.

129. In our first report we referred to a lack of information about the use of water in industry and the possibilities of economies and to an inquiry into these matters which was put in hand with the co-operation of the Federation of British Industries. This inquiry took the form of a questionnaire designed to produce information about the relative importance of water in manufacturing processes and the economies in the use of fresh water which could be effected by re-use or the use of saline water.

130. At the same time, at the suggestion of the Federation of British Industries, arrangements were being made for officers of the engineering staff of the Ministry of Housing and Local Government to visit certain firms in order that the Ministry might be more fully informed about industrial uses of water.

131. The reports on visits to firms in two industries, paper-making and brewing, selected as being heavy consumers of water in relation to their size, have been made available to us and we have examined them together with the replies to the questionnaire for these industries. There is an important difference in the water requirements of the two industries. The evidence from the questionnaire was that less than 1% of water for the paper industry is taken from statutory water undertakers, the remainder being taken from rivers and streams, canals or ground water. Potability is not a factor but approximately constant quality usually is. On the other hand, for most purposes the water used by the brewing industry must be potable and according to the replies to the questionnaire a substantial percentage of it is frequently taken from statutory water undertakers.

132. The evidence from this sample is that many firms in these two industries have already taken steps to secure some re-use of water, thereby reducing their demands for additional supplies; the estimated savings by re-use varied widely but in some cases the proportion of re-used water in the total consumption (including cooling water) was as high as 80%. In other cases no re-use is practised. In few cases was the cost of water as high as 5% of the total manufacturing cost of the products and frequently it was less than 1%.

133. We also referred in our first report to suggestions that advice on water economy might be made available to industrialists in booklet form or through advisory channels. We are informed that Birmingham Corporation have launched a campaign to emphasise the need to re-use and recirculate water and we have seen a leaflet distributed by the Corporation to their larger industrial consumers stressing the advantages of economy both to them and to the water undertakers. Recirculation brings in its train problems of corrosion and scaling which may involve additional treatment and careful control of the circulating water: it will therefore be interesting to observe the results of the Birmingham campaign which, we understand, has stimulated inquiries from other parts of the country.

134. We have described elsewhere in this report the effect of our conservation proposals on industrial water requirements, whether taken from public water supplies or direct from surface or ground water resources. We are sure that they will call for a good understanding by the central and river authorities, water undertakers and industry of each other's problems and close co-operation between all of them, so that the best use may be made of the available water resources.

XIII. PRINCIPAL CONCLUSIONS AND RECOMMENDATIONS

135. We said in our first report, presented in December, 1958, that an adequate supply of water to all parts of the country depended on the development of proper means of water conservation and distribution to keep pace with the growing demand: and in our second report, presented in March, 1960, we said that the time had come when abstractions of surface water where the water was substantially consumed without return should be brought under control where the situation called for such a step. The evidence we have since received has shown that numerous interests are engaged in activities affecting the quantity or quality of water, or both, without any overall co-ordination and that demands have arisen which can only be met if steps are taken to regulate river flows and provide storage. The years 1959 and 1960 have also afforded examples of the effects of extremes of drought and flood. (Paragraph 34).

136. We consider that it should no longer be left to independent initiatives to develop the country's water resources according to their separate needs but that the situation calls for new authorities to review the various requirements and plan the ordered development of resources to meet them. (Paragraph 35).

137. We therefore recommend a major change in the administration of the water resources of England and Wales. This involves the creation of comprehensive new authorities, which we have called "river authorities", to manage the water resources of river basins as a whole and to be charged with a positive duty of water conservation. (Paragraph 8).

138. By "conservation" we mean the preservation, control and development of water resources (both surface and ground) to ensure that the largest possible

amount of water is made available for all purposes in the most suitable and economical way. (Paragraph 6).

139. Although conditions vary from one river basin to another, we consider that river authorities should be set up at the outset for the whole of England and Wales. We have not attempted to define the areas of these authorities but we envisage some amalgamation of present river board areas. The position in the Thames and Lee catchments and the greater London area should be reviewed with the object of bringing them within the general system. (Paragraphs 36, 86 and 104).

140. We consider that conservation and land drainage and flood control are all so much a part of water management that it is essential for them to be the responsibility of the same authorities. River boards are at present responsible for land drainage and flood control. Conservation brings to the fore quite different aspects of water use affecting interests not so far represented and requiring a positive and far-sighted approach by the river authorities if growing water demands are to be efficiently met. We are strongly of the view that representation of the numerous and diverse interests affected by conservation could not suitably be arranged by adding to or modifying the membership of the existing river boards as this would result in bodies too cumbersome for efficient working. We therefore recommend the creation of an entirely new type of authority which would be responsible for conservation and also assume the functions of, and supersede, the existing river boards. Details of constitution are outside our terms of reference but we think the situation calls for small and compact authorities with a membership of, say, 10-15, the pattern being varied if necessary to take account of local circumstances. (Paragraphs 78 and 105-107).

141. Six members are unable to agree with this conclusion and consider that the co-ordination of river use should be effected by re-constituting river boards as integrated river authorities. Their views on this point are set out in the Reservation.

142. The river authorities should be charged with a positive duty to conserve and ensure the best use of all the water resources of their areas. This should include the variety of functions set out in Part VII. The authorities should also assume the existing functions of river boards with relation to land drainage, flood control, fisheries and the control of pollution. (Paragraphs 81 and 82).

143. While the object should be the positive one of making water available to meet all legitimate requirements, control of abstractions is needed to ensure that they do not overstrain the river system at any time and that the benefit of conservation works is enjoyed by those whose needs they are intended to serve. We therefore recommend that, except for abstractions for "domestic" purposes, which for administrative convenience should be exempt, river authorities should be empowered to operate a system of licensing for all abstractions from both surface and ground water. This would involve widening and improving the existing control of abstractions from ground water and transferring it from the Minister of Housing and Local Government to the river authorities. (Paragraphs 58-66).

144. Both existing and new abstractions should be brought within the licensing control. Priority should be given to established abstractions which as far as possible should be licensed to the full extent to which they have hitherto been made. (Paragraph 67).

145. We assume that provision will be made for appeals to the Minister against decisions of the river authorities on conservation matters. (Paragraphs 67 and 77).

146. Conservation should be financed by means of fees or charges linked with the licences to abstract water. Expenditure on new capital works should be met by those benefitting according to the degree of benefit received: established abstractors may have a claim to being exempt from making contributions for a period of years. The administrative expenses of river authorities should be spread over all water users from the start. Schemes of charging should be prepared by the river authorities for approval by the Minister. (Paragraphs 113, 114 and 118).

147. In general the conservation activities of river authorities should be financially self-supporting but we think that special interim arrangements, including new precepts (limited to the product of 1d. rate) on County Councils and County Borough Councils, may be needed for, say, the first three years. We also think that, in view of the importance of water in the national economy, circumstances may arise in which it would be in the national interest to make financial assistance available from Exchequer funds. (Paragraphs 110, 120 and 122).

148. We consider that a separate central authority, accountable to the Minister, should be set up to promote an active policy for the conservation and proper use of the country's water resources. Our terms of reference do not extend to consideration of such existing functions of Ministers as land drainage and the control of pollution. Appellate functions arising from decisions of the central authority or the river authorities on conservation matters would we assume be reserved to the Minister, thus achieving a desirable separation of promotional from appellate functions. (Paragraphs 124-126).

149. The use of water in industry was a matter left over from our first report. We refer to this in Part XII. (Paragraphs 127-134).

150. Finally, we wish to place on record our appreciation of the way in which our work has been facilitated by the assessors and secretaries. The assessors have provided much information, some of it by memoranda. The volume of evidence which we have taken is very considerable and this Miss Petzsche has always handled in a masterly manner. Her services to the delegation which went to Western Germany were most noteworthy. The writing of the drafts of this report has been a task involving many difficulties but Miss Petzsche, assisted by Miss Prior, has always surmounted these difficulties.

J. PROUDMAN.
D. CLARK.
RUSSELL H. R. DAVEY.
E. DUNNETT.
W. ETHERIDGE.
NORMAN R. HOOD.
H. E. HOPTHROW.
W. K. LEWIS.
MALMESBURY.
A. G. McLELLAN.
W. A. MUDDALL.
N. A. F. ROWNTREE.
J. I. TAYLOR.
EDWIN T. WADMAN.
JOHN R. WARDELL.
R. C. YATES.

M. E. PETZSCHE, *Secretary*.

D. M. PRIOR, *Assistant Secretary*.

December, 1961.

RESERVATION

by Messrs. R. H. R. Davey, E. Dunnett, the Earl of Malmesbury,
Messrs. W. A. Muddell, J. I. Taylor and E. T. Wadman.

1. We are unable to agree with the conclusions of our colleagues with regard to the constitution of the new river authorities as set out in Part IX of the report.
2. We acknowledge that the main task of the Sub-Committee has been concerned with water conservation and we wholeheartedly agree with the great importance of the proposals outlined in the report, but once it had been decided that there should be an all-purpose authority for each river basin, to which the existing functions of river boards should be transferred, then the extent and importance of the transferred functions and the manner in which they are at present organised should have received the degree of prominence which they merit. We consider this has been overlooked.
3. We agree with our colleagues that there should be a new composite authority for each river basin (or group of basins); but we find ourselves utterly at variance with their view as to the form and make-up of such an authority. Consequently we state the reasons for our differences and submit an alternative recommendation.
4. The kind of authority, small and non-representative in character, which our colleagues favour would be an exclusive body akin to a commercial undertaking or one of the boards of a nationalised industry. River boards are not a trading organisation although they do need to take into account the economic results of their expenditure. They are a form of local authority providing a public service involving local knowledge and understanding and neighbourly associations not only with similar authorities but with all sorts of people who live and work in their areas. The main recommendations would mean a complete and radical departure from this kind of authority, which has proved successful over many years and which has measured up to a number of national emergencies including the tidal disaster of 1953.
5. We do not consider that the success of the new river authorities requires such a complete change of administration, which would entail the elimination of the present system. We are not opposed to change provided it means progress and we think that progress is more likely to be achieved by building on a proved foundation than by substituting an untried and controversial kind of authority.
6. The summary of evidence in paragraph 33 makes it quite plain that only three bodies advocated the kind of authority favoured by our colleagues, whereas we are supported in our view by a much greater number of witnesses who were fervently opposed to the complete disruption of river boards.

FUNCTIONS

7. Naturally we agree with the majority opinion that the wide range of functions devolving upon a comprehensive river authority must be efficiently administered, but it must be emphasised that river boards at present carry out all these functions with the single exception of conservation in the very wide sense in which it is defined in the report. Nevertheless river boards already have a duty in exercising their functions "to conserve as far as practicable the water resources of their area" and although only supported by incidental powers this has been done in a number of ways—on a large scale in connection with land drainage works—by close attention to proposals for abstraction of water (both surface and ground) by water undertakers and others and in particular by the regulation of abstrac-

tions for spray irrigation. Consequently river boards are accustomed to considering the availability of surface water resources from the point of view of river interests as a whole. The experience thus gained has already given them a knowledge of the developing demands upon the supplies of their river systems and the arrangements that should be made for the future and this experience would be valuable in facilitating the change from negotiated arrangements for abstractions to those of statutory control.

8. There is general agreement that water conservation is inseparable from land drainage, flood control and pollution prevention. Following the recommendations of the "Milne" Report¹ integrated river management was substantially effected in 1948 when river boards were formed to take over the functions of land drainage, flood control, coastal defence, fisheries, pollution prevention, river gauging and certain other matters (transferred to them from catchment boards, fishery boards and local authorities). It seems sensible and logical that the final stage of co-ordinated river management, that of water conservation in the widest sense, should be completed by improving and further extending the powers of river boards in this respect and at the same time reconstituting them as fully comprehensive river authorities.

FINANCE

9. Although the Sub-Committee's terms of reference preclude consideration of the manner in which land drainage and flood control works are financed we understand the present method will be continued. Accordingly, the new river authorities will succeed to the present financial arrangements of river boards.

10. They will have power therefore to precept upon County Councils, County Borough Councils and internal drainage boards, to levy general and special drainage charges on all agricultural land outside internal drainage districts and (where a river board is acting as an internal drainage board—80 instances) to levy land drainage rates. To give these sweeping financial powers to a small non-representative body such as our colleagues recommend is without precedent. A precept made by a river board on a local authority is mandatory without any right of appeal. Thus the authorities called upon to pay would have no control—other than that provided by the River Boards Act—over the amount demanded and no voice as to how the money was spent. A right of appeal against water charges demanded by a river authority (with which we agree) will ensure that users of water are fairly treated. We think it quite wrong and entirely inconsistent, having provided justice for abstractors, to deny it, by non-representation, to local authorities and others who will be required to find large sums to finance all the other activities of river authorities. We also point out that Parliament has, as recently as the passing of the Land Drainage Act, 1961, reaffirmed the principle that a liability for contributions carries with it an entitlement to representation. We believe that the dissatisfaction which would be provoked by such a plenitude of arbitrary power would make further progress in land drainage and fishery management difficult and slow. We feel too it to be contrary to normal constitutional arrangements and that it would be inequitable and unworkable in practice.

REPRESENTATION

11. If the new river authorities are given comprehensive conservation powers we think it is desirable that the constitution should provide for the inclusion of

¹ Third report of the Central Advisory Water Committee. River Boards. Cmd. 6465. 1943. H.M.S.O.

some interests concerned with water use not at present represented on river boards. At the same time this departure from the principle that representation is dependent on contributions should be approached with caution and should not be looked upon as an open invitation to all.

12. The relative importance of the interests at present unrepresented, and consequently their need for membership, will vary according to the nature of each river basin. Desirable as it may be to include outside interests on the new authorities it is only equitable that any revised basis of representation should ensure that those finding the major part of the finances should have their just share of membership.

13. We are sure that the existing functions of river boards, notably of land drainage and coastal defence, will as a whole still be a prominent (and in some areas a dominant) feature of the work of river authorities and it is essential that this important work should continue with the minimum of interference.

14. Although some river boards depend upon internal drainage boards for a large part of their income, land drainage administration is not only a matter of money. River boards have extensive supervisory powers over drainage boards and relationships are complicated and intimate.

15. Further, the knowledge, experience and local approach provided by lowland members of river boards are essential to the successful continuation of land drainage and flood control measures and the additional powers provided by the Land Drainage Act, 1961, will make this close association in the field even more important.

16. It must also be remembered that in parts of the country major conservation works may not be required and that in such cases the new conservation functions would be confined to regulation and control of water use.

SIZE OF THE NEW AUTHORITIES

17. The present membership of river boards varies between 16 and 41, the average size being about 28. Experience over the last ten years has shown that these numbers have been suitable to embrace in the areas concerned those interests at present affected, without being unduly large. Some witnesses said they thought river boards were unwieldy but they were not able to explain to us why they held this opinion.

18. The total membership of a new kind of river authority must depend on the size and circumstances of the area over which it will have jurisdiction. We do not consider that the interests to be included are so numerous that the kind of authority we recommend would be cumbersome. Of the nine largest river and catchment boards (some of which have jurisdiction over 4,000 square miles), the Thames Conservancy and two river boards each have 41 members—the other six river boards each have 40. We think it would be feasible to constitute a new kind of authority without exceeding such numbers.

RECOMMENDED KIND OF AUTHORITY

19. We have carefully considered all the evidence and having given due weight to our colleagues' views we recommend, for the reasons we have stated, as follows:

That the co-ordination of river use should be effected by reconstituting river boards as integrated river authorities, with the powers and duties recommended in the report and making provision for the principal interests

not at present represented to be part of the new authority; but we stress that a proper balance of representation is important and in particular that it is right that an effective majority of members should come from those bodies providing the major portion of the revenue.

RUSSELL H. R. DAVEY.

E. DUNNETT.

MALMESBURY.

W. A. MUDDALL.

J. I. TAYLOR.

EDWIN T. WADMAN.

APPENDIX I

GLOSSARY

Note. The various terms are defined to accord with the concepts in the report.
Compensation water. Water required to be discharged into a river or stream (usually in a regular and continuous flow throughout the 24 hours of each day) in consequence of the impounding of the waters of the river or stream and in compensation for the waters so impounded. The term is not defined in the Water Act, 1945, but an indication of its meaning is given in Section 26 of the Act and in Part III of the Third Schedule.

Domestic abstraction. (a) Surface water: abstraction by a riparian owner in the exercise of the "ordinary" common law rights described in Appendix II. (b) Ground water: abstraction by an individual solely for the domestic purposes of his household.

Ground water. Now the generally accepted term for underground water.

Hydrological survey. The comprehensive survey in a river basin of rainfall, runoff, evaporation, ground water, public and private sources of supply, effluent discharges, re-use of water, and the yield from controlled catchments (existing and potential) to produce a balance-sheet of resources and requirements.

Impounding. The collection of water in the conventional type of reservoir, generally sited in the upper reaches of a river. Water is impounded by means of a dam and taken by aqueduct to the area to be supplied, compensation water (see above) being fed into the river at the prescribed rates and times.

M.g.d. Million gallons per day.

Minimum acceptable discharge. The minimum discharge, or level corresponding thereto (defined from time to time by the river authority having regard to the needs of all interests downstream) below which the flow in the river or stream at the point of reference should not be diminished by abstractions.

Navigation authority. This includes a variety of interests. Nationalised waterways are owned or managed by the British Transport Commission. Other waterways may be owned or managed by navigation companies, commissioners or trustees, local authorities, river boards or private interests. Port, conservancy or drainage authorities may have jurisdiction over certain stretches of rivers, including tidal stretches. A full description is given in the Report of the Committee of Inquiry into Inland Waterways.¹

River Authority. An authority responsible for the management of the water resources of a river basin, or group of river basins, as a whole, including both surface and ground water.

River regulation. The regulation of a river by means of a reservoir or reservoirs designed to regulate the flow of water in the river in order to provide more reliably for abstractions and other uses of water at points downstream.

Statutory water undertakers. Any company, local authority, board, committee or other person authorised by a local enactment to supply water and any local authority, or board supplying water under the Public Health Act, 1936. (Section 1 of the Water Act, 1948).

Uncontrolled abstraction. An abstraction of water not specifically authorised by or under statute. This is not intended to imply that it is unlawful.

¹ Report of the Committee of Inquiry into Inland Waterways, 1958. Cmnd. 486. Reprinted 1960. H.M.S.O.

APPENDIX II

PRESENT RIGHTS IN RELATION TO SURFACE WATER

Note provided by the Ministry of Housing and Local Government

I. NATURAL STREAMS

1. Apart from statutory powers granted to public authorities, and on occasion to private persons or interests, rights to use water flowing in a natural stream (the expression "natural stream" is used to include any water flowing naturally in a defined channel) are founded in the common law as an incident of the ownership of riparian land, or are acquired by grant or prescription.

(a) *Absolute rights*

2. An absolute right to abstract surface water may arise from ownership of the land on which it stands or over which it flows, but as a rule this right can be claimed in respect of running water only where the water rises and remains for the whole of its course on the land of a single owner. In such a case, apart from grant or prescription, there is no person entitled to a share in the use of the water. In some exceptional cases there may exist an absolute right to the whole of the water in a natural stream notwithstanding that the right is not based on ownership of the whole of the land through which the stream flows¹.

(b) *Riparian rights in general*

3. The rights of riparian owners to use water flowing in a natural stream arise from the right of access which riparian owners have to the water in the stream. Whether a particular piece of land has the character of a riparian tenement depends on the circumstances of the case; generally speaking the land must be in reasonable proximity to the stream and have actual contact with it.² For a statement of the general nature of riparian rights reference may be made to the judgement of Lord Macnaghten in *John Young and Co. v. Bankier Distillery Co.* [1893] A.C.691:

"The law relating to the rights of riparian proprietors is well settled. A riparian proprietor is entitled to have the water of the stream, on the banks of which his property lies, flow down as it has been accustomed to flow down to his property, subject to the ordinary use of the flowing water by upper proprietors, and to such further use, if any, on their part in connection with their property as may be reasonable under the circumstances. Every riparian proprietor is thus entitled to the water of his stream, in its natural flow, without sensible diminution or increase and without sensible alteration in its character or quality. Any invasion of this right causing actual damage or calculated to found a claim which may ripen into an adverse right entitles the party injured to the intervention of the court".

4. By the general law applicable to natural streams every riparian owner has a right to the ordinary use of the water flowing past his land, without regard to the effect of a deficiency on a lower riparian owner. The ordinary use of water includes the use of water for ordinary household use, for supplying an ordinary number of cattle, and other minor purposes. What further or "extraordinary" use of water can be made by a riparian owner is less easy to determine. The right

¹ *Holker v. Porrit* [1875] L.R. 10 Ex. 59.

² *Swindon Waterworks Co. v. Wilts. and Berks. Canal Navigation Co.* [1875] L.R. 7 H.L. 697; *McCartney v. Londonderry and Lough Swilly Ry. Co. Ltd.* [1904] A.C. 301; *Attwood v. Llay Main Collieries* [1926] 1 Ch. 444.

to take water for other than ordinary purposes is however subject to the general limitation that the use must be reasonable (taking account of the rights of other riparian owners) and that it must be for the use of the riparian tenement. "In the exercise of rights extraordinary but permissible, the limit of which has never been accurately defined and probably is incapable of accurate definition, a riparian owner is under considerable restrictions. The use must be reasonable. The purposes for which the water is taken must be connected with his tenement, and he is bound to restore the water which he takes and uses for those purposes substantially undiminished in volume and unaltered in character" (per Lord Macnaghten, *McCartney v. Londonderry and Lough Swilly Ry. Co. Ltd.* [1904] A.C. at p. 307). An unreasonable use can be restrained by injunction, even without proof of actual damage, since unless restrained it would in course of time result in a prescriptive right.

5. Riparian rights may be altered by grant or prescription or by or under an Act of Parliament. Rights to a watercourse or to the use of water may be claimed by custom.

(c) The use of water from streams for irrigation

6. Whether water may lawfully be used by a riparian owner for irrigation if the water is returned to the stream with no other diminution than that inevitably occasioned by evaporation and absorption, appears to depend on the circumstances of each case. In one case¹, where the diversion of water for irrigation was not continuous and caused no material diminution in the flow of the stream, it was held not to be so unreasonable a use as to be prohibited by law. On the other hand, where a mill-owner diverted water for the purpose of irrigating his adjacent land, it appears that the diversion of water, though it did not seriously diminish the quantity ultimately flowing in the stream below the mill-owner's land, postponed the normal flow so that it arrived at the land of a lower riparian owner too late in the day for him to use it fully for irrigation purposes. The prior detention of the water was held actionable.² No decision concerning spray irrigation has (so far as has been ascertained) been given by the Courts, but it seems possible that such a use of water could be held to be unreasonable since the amount of water used in modern spray systems can be very great and none of it finds its way back to the stream.

(d) Rights acquired by grant or prescription

7. Rights in a natural stream may be acquired by express or implied grant, in which case their extent depends on the terms (express or implied) of the grant. (But it seems that a riparian owner cannot grant away in gross, that is, apart from his estate, the right to take water from a stream so as to place the grantee in the same position as the grantor vis-à-vis other riparian owners.) Rights may also be acquired by prescription, that is, through actual and uninterrupted user or enjoyment, generally for a long period, with the acquiescence of the person against whom the rights are acquired. At common law the acquisition of prescriptive rights depends on proof of immemorial user from which a grant is presumed (strictly, user from the reign of Richard I, but in practice user during living memory, or perhaps even for a shorter period, may establish a presumption of user beyond the time of legal memory) or from evidence of user "as of right" for a reasonable length of time, usually twenty years or more, from which,

¹ *Embrey v. Owen* [1851] 6 Ex. 353.

² *Sampson v. Hoddinott* [1875] 1 C.B. (N.S.) 590.

in legal phraseology, a "lost modern grant" may be presumed. Under the Prescription Act, 1832 (which supplements, without superseding, common law prescription) the time of legal memory is, in effect, shortened. Under that Act rights in respect of water which could lawfully be claimed at common law by custom, prescription or grant may be founded on actual and uninterrupted enjoyment for twenty years and are then defeasible only on grounds (other than proof that the rights were first enjoyed at any time prior to that period of twenty years) on which a common law claim could have been defeated as, for instance, on the ground that they were not the possible subject matter of a grant or that enjoyment of them was by force, or was secret or by licence. After forty years uninterrupted enjoyment as of right the Prescription Act affords an absolute and indefeasible title to prescriptive rights, if they could have been the subject of a grant, unless it appears that the user was enjoyed by some consent or agreement expressly given or made for that purpose by deed or writing.

II. ARTIFICIAL STREAMS

8. The more important artificial streams, such as water-courses artificially created by statutory water undertakers and canals, are made in the exercise of statutory powers. The nature and extent of the rights enjoyed in them, whether by the statutory undertakers concerned or by other persons, depend on the enactments relating to the construction and maintenance of the works in question. Rights in other artificial streams may exist by virtue of ownership of the land on which the stream is created or by virtue of grant or prescription. It appears that there are no natural (riparian) rights in the flow of water in an artificial stream—as there are in the flow of water in a natural stream—although the equivalent of such rights may, in certain circumstances, be acquired. Where there is an express grant the extent to which rights are acquired depends on the terms of the grant. The extent to which rights can be acquired by prescription depends on the character of the stream, its permanent or temporary nature and on the circumstances in which it was created.

APPENDIX III

SUMMARY OF THE REPORT OF THE DELEGATION FROM THE SUB-COMMITTEE WHICH VISITED WESTERN GERMANY, 10TH-14TH APRIL, 1961

Members of the delegation

Prof. J. Proudman (*Chairman*)
Mr. W. Etheridge
Dr. N. R. Hocd
Mr. H. E. Hopthrow
Mr. W. A. Muddell
Mr. N. A. F. Rowntree
Mr. J. I. Taylor
Mr. E. A. G. Johnson
Mr. A. G. Boulton
Miss M. E. Petzsche (*Secretary*)

Itinerary

1. The delegation first met, separately, the Federal Minister and representatives of the Ministry of Nuclear Energy and Water Economy, and representatives of the Ministry of Agriculture for the state of North Rhine/Westphalia. On the second day discussions were held with representatives of the Federation of German Industry and of the iron and steel and chemical industries. The delegation then met representatives of the Water Associations controlling respectively the rivers Ruhr, Emscher and Lippe, and Wupper, together in the third case with representatives of the municipality of Wuppertal. Finally a visit was paid to the new Bigge regulating reservoir under construction by the Ruhr Dams Association.

Conclusions

2. Because of the different systems of government and the different historical development of local organisations there are various differences between the methods adopted to promote water conservation in Western Germany and in England and Wales. Both countries, however, have at much the same point in time reached a stage where the need for a more positive policy of water conservation has become apparent. The Federal Government have recently passed legislation to this end in the shape of a frame law setting out the principles on which such a policy is to be based and the State Governments have passed, or are in process of passing, their own legislation giving effect to those principles.
3. The basic principle is that any use of water must be authorised and there are no rights to the use of water. State Governments are to formulate programmes for the utilisation of water resources and compliance with these programmes can be enforced.
4. During their short tour the delegation gained the impression that the need for more positive and uniform measures was generally accepted. German industry had earlier criticised the form of the frame law and representatives expressed some anxiety to the delegation about its effects, particularly on the cost of water: but it was agreed that it was too soon to gauge these effects since the frame law only came into operation in 1960 and not all the State Governments (including North Rhine/Westphalia) had yet passed their own implementing laws.
5. The delegation chose to visit North Rhine/Westphalia because of the existence there of large Water Associations understood to operate water conservation in the broadest sense. They found that the physical conditions and the problems to be solved differed both in nature and degree from those facing England and Wales. For example mining subsidence in this highly industrialised area appears to have been the primary reason for the establishment of water control organisations, starting more than 50 years ago, and the emphasis has been on the control of pollution and the provision of treatment works by river authorities. An international waterway, the Rhine, exists to provide an apparently inexhaustible reserve of water as an insurance against extreme drought and to receive effluents (the average flow of the Rhine is some five times as much as the total net resources of North Rhine/Westphalia): and the control of main traffic waterways is reserved to the Federal Government, although plans are co-ordinated with State and local water conservation programmes.
6. Nevertheless the large Water Associations combine the functions of water resources development, drainage and flood control, and prevention of pollution, and have impressive achievements to their credit. While there may be differences

from the pattern for England and Wales in the allocation and exercise of functions, the delegation found ample justification for the general thesis that water conservation in the broad sense as envisaged by the Sub-Committee can and should be administered by all-purpose authorities.

7. The arrangements for dealing with flooding in Western Germany are of special interest. Flooding is a government responsibility and compensation is payable for any damage caused. The State Governments therefore have a direct interest in the control of flooding and subsidise the reservation of reservoir capacity for this purpose.

8. The arrangements for financing water conservation appear to have been designed with great care to give full weight to all possible factors. State subsidies are payable and the Water Associations are not therefore entirely self-supporting: but apart from this no difficulty appears to be met in operating acceptable methods of levying charges to meet the expenses of the Associations under the various heads.

9. Compensation is contemplated when established rights are abrogated or curtailed in the interests of water conservation.

10. Water Associations in Western Germany are the result of historical development and are not necessarily the pattern for England and Wales, which are perhaps fortunate in having the opportunity of making a fresh start, profiting at the same time from experience gained elsewhere. It is of interest, however, that a form of organisation has developed for the authorities responsible for conservation measures which includes a large representative body covering the various interests concerned (industry, municipalities, landowners, and others) together with a small executive committee which is responsible for day-to-day administration.

11. The delegation are deeply grateful to the Federal and State Governments and to the various authorities concerned for the opportunity of inquiring into the arrangements in Western Germany and for the very full information made available to them, which has been of great help in considering the provision to be made for water conservation in England and Wales.

APPENDIX IV
AUTHORITIES AND ORGANISATIONS SUBMITTING
EVIDENCE

(Oral as well as written evidence was given by those marked)*

- * Association of Drainage Authorities.
- * British Transport Commission.
- * British Waterworks Association.
- * Central Electricity Generating Board.
- * Country Landowners' Association.
- * County Councils Association.
- Dock and Harbour Authorities' Association.
- * Federation of British Industries.
- * Institution of Civil Engineers (oral evidence only).
- * Institution of Water Engineers.
- * Kent Joint Advisory Water Committee.
- Lee Conservancy Catchment Board.
- Metropolitan Water Board.
- National Association of Parish Councils.
- * National Farmers' Union.
- National Federation of Anglers.
- * River Boards' Association.
- * Salmon and Trout Association.
- * Thames Conservancy.

APPENDIX V
MEMBERSHIP OF RIVER/CONSERVANCY BOARDS (ENGLAND AND WALES)

| Name of Board | Representing | | | | | | | | | | | Total |
|---------------------------|---|----------------------------|-----------------------|--------------------|-------------------------------|--|---------------------------|-----------------------------|--------------------------------|--|--|------------|
| | Ministers (Agriculture/ Housing and Local Government) | • Drainage Interests | Fishery* Interests | County Councils | County Borough Councils | Borough & Urban District Councils | National Coal Board | Corporation of London | Port of London Authority | Metropolitan Water Board and other water undertakers | Recreational, boating [∅] etc. interests | |
| RIVER BOARDS | | | | | | | | | | | | |
| Avon and Dorset | 1 | 4 | 4 | 7 | 5 | — | — | — | — | — | — | 21 |
| Bristol Avon | 1 | 5 | 2 | 4 | 10 | — | — | — | — | — | — | 22 |
| Cheshire | 1 | 5 | 3 | 9 | 7 | — | — | — | — | — | — | 25 |
| Cornwall | 1 | 2 | 4 | 7 | 5 | — | — | — | — | — | — | 19 |
| Cumberland | 1 | 7 | 8 | 17 | 7 | — | — | — | — | — | — | 40 |
| Dee and Clwyd | 1 | 4 | 5 | 15 | 3 | — | — | — | — | — | — | 28 |
| Devon | 1 | 2 | 5 | 9 | 2 | — | — | — | — | — | — | 19 |
| E. Suffolk and Norfolk | 1 | 10 | 4 | 11 | 11 | — | — | — | — | — | — | 37 |
| East Sussex | 1 | 5 | 2 | 4 | 9 | — | — | — | — | — | — | 21 |
| Essex | 1 | 7 | 2 | 13 | 3 | — | — | — | — | — | — | 26 |
| Glamorgan | 1 | 5 | 4 | 10 | 8 | — | — | — | — | — | — | 28 |
| Great Ouse | 1 | 12 | 3 | 24 | — | — | — | — | — | — | — | 40 |
| Gwynedd | 1 | 5 | 5 | 20 | — | — | — | — | — | — | — | 31 |
| Hampshire | 1 | 4 | 4 | 5 | 7 | — | — | — | — | — | — | 21 |
| Hull and E. Yorkshire | 1 | 6 | 2 | 4 | 8 | — | — | — | — | — | — | 21 |
| Isle of Wight | 1 | 3 | 2 | 10 | — | — | — | — | — | — | — | 16 |
| Kent | 1 | 9 | 3 | 20 | 1 | — | — | — | — | — | — | 34 |
| Lancashire | 1 | 7 | 6 | 13 | 13 | — | — | — | — | — | — | 40 |
| Lincolnshire | 1 | 9 | 3 | 11 | 7 | — | — | — | — | — | — | 31 |
| Mersey | 1 | 9 | 4 | 9 | 17 | — | — | — | — | — | — | 40 |
| Nene | 1 | 9 | 3 | 13 | 6 | — | — | — | — | — | — | 32 |
| N'land and Tyneside | 1 | 5 | 4 | 7 | 9 | — | — | — | — | — | — | 26 |
| Severn | 1 | 8 | 6 | 16 | 9 | — | — | — | — | — | — | 40 |
| Somerset | 1 | 8 | 2 | 15 | — | — | — | — | — | — | — | 26 |
| South West Wales | 1 | 4 | 9 | 15 | 11 | — | — | — | — | — | — | 40 |
| Trent | 1 | 9 | 4 | 11 | 15 | — | 1 | — | — | — | — | 41 |
| Usk | 1 | 4 | 4 | 8 | 5 | — | — | — | — | — | — | 22 |
| Wear and Tees | 1 | 4 | 3 | 8 | 6 | — | — | — | — | — | — | 22 |
| Welland | 1 | 5 | 2 | 11 | — | — | — | — | — | — | — | 19 |
| West Sussex | 1 | 5 | 2 | 13 | — | — | — | — | — | — | — | 21 |
| Wye | 1 | 4 | 6 | 16 | — | — | — | — | — | — | — | 27 |
| Yorkshire Ouse | 1 | 9 | 4 | 11 | 15 | — | 1 | — | — | — | — | 41 |
| CONSERVANCY BOARDS | | | | | | | | | | | | |
| Thames | 1 | 3 | — | 18 | 2 | 4† | — | 1 | 1 | 7** | 4 | 41 |
| Lee | 1 | — | — | 11 | 1 | 4‡ | — | 1 | — | 2 | — | 20 |
| TOTALS | 34 | 197 | 124 | 395 | 202 | 8 | 2 | 2 | 1 | 9 | 4 | 978 |

* Appointed by the Minister of Agriculture, Fisheries and Food

† Appointed by two joint committees of councils.

‡ Elected by groups of specified local authorities, including rural district councils.

∅ { Including barge traffic, boat-building, boat-letting.
Appointed by the Minister of Transport.

** One appointed by the Minister of Housing and Local Government.

© *Crown copyright* 1962

Published by

HER MAJESTY'S STATIONERY OFFICE

To be purchased from

York House, Kingsway, London w.c.2

423 Oxford Street, London w.1

13A Castle Street, Edinburgh 2

109 St. Mary Street, Cardiff

39 King Street, Manchester 2

50 Fairfax Street, Bristol 1

35 Smallbrook, Ringway, Birmingham 5

80 Chichester Street, Belfast 1

or through any bookseller

S.O. Code No. 75-97