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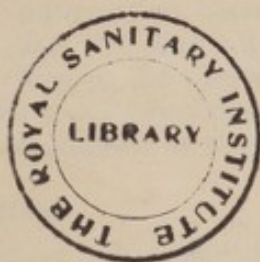
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MINISTRY OF HEALTH
AND SCOTTISH OFFICE

Inland Water Survey Committee

FIFTH ANNUAL
REPORT
1950



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INLAND WATER SURVEY COMMITTEE

Fifth Annual Report, 1950

To the Right Honourable ANEURIN BEVAN, M.P.,
Minister of Health

To the Right Honourable HECTOR McNEIL, M.P.,
Secretary of State for Scotland

GENTLEMEN,

We have the honour to present this, the first report of the Inland Water Survey Committee since the war.

1. War conditions caused our predecessors to cease to meet after 1939. In view of the changed circumstances of the Inland Water Survey, we were appointed to succeed them in January, 1950. The new committee is composed of members, assisted by assessors, whose names are listed in Appendix A. Our chairman is a former Director-General of the Ordnance Survey, and we have requested him on our behalf to sign this report.

2. Our terms of reference are—

“to advise on the Surface Water Survey of Great Britain, on the progress of the measures undertaken and on further measures required, and, in particular, to make an annual report on the subject”.

3. Since our appointment Miss C. E. Barson has succeeded Mr. M. R. P. Gregson as Secretary to the Committee. We are agreed that there should be liaison and interchange of information between ourselves and the Central Advisory Water Committee and the Scottish Water Advisory Committee. Our Secretary is also the Secretary to the Central Advisory Water Committee and we regularly exchange minutes of our meetings and make available any of our papers which may be of interest to the two Advisory Committees.

Previous Committees and Reports

4. The third annual report of the Committee, rendered to you by our predecessors, was published in 1939. They also presented a fourth annual report for 1938—1939, shortly before the outbreak of the World War, which prevented its publication. Since 1939 much has happened that affects the prospects of the Inland Water Survey and defines public requirements as regards the surface water part of that Survey. We have therefore included in this report a summary of events during the period when the committee did not sit.

5. The Inland Water Survey deals with three aspects of British water resources—rainfall, surface water and underground water.

6. The original committee found after wide reconnaissance that there was a widespread lack of information as regards underground and surface waters and occasionally even rainfall. They urged that steps should be taken to provide the agencies, statutory powers and finance necessary for the execution of the Survey. During the following decade a number of Acts of Parliament were promulgated and several reports were published that bore upon the subject of the Survey; they are discussed below in chronological order.

7. Following the Report (published in 1933) of the Committee on Inland Water Survey set up in 1932 as the result of a recommendation by the British Association for the Advancement of Science, the Association together with the Institution of Civil Engineers submitted a memorandum on the subject of the Survey to the Prime Minister in 1934. In 1942 the Institution issued a report that discussed the Survey as an item of post-war national development and made recommendations for measures which have since been largely implemented.

8. In 1943 the Central Advisory Water Committee of the Ministry of Health presented its third report, which recommended the establishment of twenty-nine River Boards for England and Wales. These Boards were to deal with problems of land drainage, fisheries, river pollution and sometimes also navigation and, for the better performance of their task, were to undertake the gauging of their rivers. The two paragraphs most relevant here are reproduced by us in Appendix B. In the same year the Hydro-Electric Development (Scotland) Act became law and strengthened the interest in the national water resources of those concerned with the generation of electricity.

Government papers and enactments

9. In 1944 a White Paper on National Water Policy was presented to Parliament. The text of the section dealing with the Survey is quoted in Appendix C. One of the Government's proposals was—

The work of the Inland Water Survey, to secure the scientific assessment of yield, quality and behaviour of water resources, both surface and underground, and collect and collate records and make them generally available, to be pressed on with vigour.

10. The White Paper was the subject of a further report by the Institution of Civil Engineers, of which no less than two-fifths was devoted to the Survey, especially as to its technical aspects. The continued interest in this matter thus manifested by the senior engineering institution of the country is, we think, significant.

11. The White Paper was followed by a series of Acts of Parliament, viz.: for England and Wales, the Water Acts of 1945 and 1948 and the River Boards Act of 1948, and for Scotland the Water Acts of 1946 and 1949. These Acts made the conservation and proper use of water resources a Ministerial responsibility, whilst the Scottish Act of 1946 specifically called for the collection, preparation, publication and dissemination of information and statistics relating to those resources. Both the 1945 and the 1946 Acts provided powers to require by Regulation from persons who abstract water certain information which was badly needed for the study of underground water resources, and in pursuance of these powers the Water Abstraction Regulations, 1947, for England and Wales were made.

12. The River Boards Act in section 9 makes every Board, also the Conservators of the River Thames and the Lee Conservancy Catchment Board, liable to measure the rainfall and surface water resources of their area and to publish the results. They are also required to collect information about the major abstractions of water from and discharges of effluent into their rivers, as well as about any gaugings of their river system carried out by other interests. The Boards are being set up one by one during the years 1950 and 1951. A map showing the boundaries of their areas is included as Figure 1.

Recent publications affecting the work of the Committee

13. In 1949 the Central Advisory Water Committee published a report of one of its sub-committees, entitled "Prevention of River Pollution". We have noted in it the following statement—

"Para. 43. . . . It is clear that, for the proper exercise of their powers, it will be essential for River Boards to have information about such matters as the volume and rate of flow of rivers and tributaries, the nature and volume of effluents discharged into the rivers, and the points of discharge. . . . It is evident that in the majority of cases the Boards will find it necessary, as one of their first steps, to carry out a factual survey of the rivers and streams in their areas."

We have noted also the attention given in paragraphs 127—139 and memorandum C of the report to water-temperatures and the effect of discharging heated liquids into streams.

14. The powers and functions of River Boards have been described in a Stationery Office publication issued in 1950.* In its introduction appear these words—

"The co-ordination of all these functions, which involve different interests and different aspects of river management, is a task of real importance. It is given further emphasis by the duty which the Act places on river boards to conserve the water resources of their areas in the course of exercising their other functions, and to gather the information as to rainfall and river flow which must be the foundation of any local or national policy of water conservation."

Inland Water Survey Arrangements

15. The principal arrangements for the execution of the Survey are now as follows—

Class of Inland Water	Survey Organisers	Field Agencies
Rainfall	Meteorological Office ...	Private individuals, public authorities and public and private undertakings.
Surface water	Ministry of Health and Scottish Office	Department of Agriculture for Scotland; canal, electricity and water supply undertakings and, in England and Wales, River Boards.
Ground water	Geological Survey	Well-owners, mainly public and private water-supply and industrial undertakings.

16. It should, however, be noted that it is only upon the well-owners and the River Boards that there rests any statutory obligation to measure and record in a manner and for a period that meet the needs of the Survey. The other agencies may be obliged by statute to measure, but only to an extent not comprehensive or accurate enough for Survey purposes, whilst others who have elected to measure in a way that suits the Survey may at any time find themselves unable or unwilling to continue. Any weakness of the present arrangements relates however chiefly to Scotland, and in

* River Boards: A guide to their powers and functions. H.M. Stationery Office, price 2s. net.

particular, since underground water is of minor importance there, to the surface water survey. We discuss this matter again in a later part of this report.

Surface water aspect of the Survey

17. The terms of reference given to us differ from those of our predecessors who were asked to advise on all three aspects of the Inland Water Survey. Nevertheless we may, we understand, be consulted about matters relating to underground water and rainfall, should the need arise. In this connection we would draw attention to the Report of the Geological Survey Board and the Report of the Director of the Meteorological Office.

18. As regards the Surface Water Survey there is now a prospect of systematic surveys of water resources being begun in many of the English and Welsh river basins during the next few years. It has, therefore, become necessary for us to frame our conception of how such surveys should be designed, if they are not only to be of wide and enduring value and impartial character but also to possess the assimilability that will be necessary if they are to constitute a national survey that will satisfy the several interested sections of the public to as great an extent as possible.

Scope of the Surface Water Survey

19. The question to be answered is in effect whether the survey of any given river's resources should attempt to provide data solely for the current and imminent schemes of individual water interests, or whether it should go further so as to enable other water interests to judge the effect upon themselves of those particular schemes; or still further whether it should furnish information which might answer to some extent the questions that any water-interest may ask about the effect of any scheme of water utilization at any point within the river-basin, that may be envisaged at any time, now or in the future.

20. After studying the views expressed in the reports referred to in earlier paragraphs we think that what is wanted is the last of the three varieties of survey described above. We are strengthened in this conclusion by reason of the stress laid upon the need for conservation in those pronouncements of the last decade with which we dealt in our opening paragraphs. We interpret the term conservation as meaning briefly, what the Water Power Resources Committee called in its report of 1921, the reconciliation of a multiplicity of water interests. We have also given heed to the growing extent to which water is being used by industry and energy-generation for processing, cooling and condensing; the tendency to growth in the size of industrial units; and the increased mobility of both industry and population. We think therefore that surface water surveys should cover in some degree or other every part of the basin of all rivers with substantial water resources.

21. If the conclusion reached in the foregoing paragraph is to be implemented, every River Board in England and Wales should in our view aim to establish a systematic and permanent network of gauging stations covering their area, subject to the limitations imposed by such physical hindrances as tidal influence and river control work, where accurate and comprehensive methods of measurement would be used continuously or periodically. The information thus obtained should be recorded in a uniform manner and in this way a national network of stations would be secured. We consider particularly that while quantity is of paramount importance quality and temperature should also be the subject of work by the survey agencies.

22. If the results obtained during a run of years at gauging stations could be made available to the public, they would have at once a background against which to project and bring into true perspective any fresh scheme that may be advanced for the utilization of any water resources. Those who have to prepare such schemes will benefit equally from the existence of the information which should diminish, and might even avoid totally, the need for any special survey on their own part.

Incidence of gauging stations

23. If this concept is adopted, it remains to be worked out by each Board how many primary stations are necessary. Different conditions may lead to different requirements. There may, for instance, be a different density of measuring points for one Board whose streams all flow eventually into a single river from that for another with a long coast-line to which run separately many small rivers. In calculating the density of stations, moreover, it should be remembered that the discharges of individual compartments of a river-basin may get measured again in groups, or even eventually all in a single group, as happens at Teddington for the Thames river-basin.

24. We think a Board may supplement these primary stations with secondary stations, operated perhaps for limited periods of time, or for small drainage-areas with special fluvial features.

25. In the first pre-war report of the Inland Water Survey Committee details were given of a tentative volumetric gauging scheme for the River Nene, which has since 1936 been found practicable and has been carried out by the Catchment Board concerned. The arrangements made have been the subject of many visits, including one by our Committee, and of much study by interested persons. This valuable pioneer work provides the following stations—

Primary stations for individual compartments (areas of 86, 90 and 75 square miles)	3
Primary stations for grouped compartments (groups of 250 and 631 square miles)	2
Total for drainage area of 631 square miles	5
Secondary stations (areas of 41, 27 and 36 square miles)	3
Total	8

26. During 1950 the Thames Conservancy obtained the approval of the Minister of Health for a volumetric gauging scheme which, allowing for the existing stations at Teddington and Day's Weir, yields the following analysis—

Primary stations for individual compartments (areas ranging from 50 to 260 square miles)	22
Primary stations for groups of two or more compartments (areas ranging from 250 to 3,810 square miles)	6
Total for drainage area of 3,810 square miles	28

Secondary stations were not included in the approved scheme.

27. As far as we recall, no ratio of stations to total drainage area or size of individual compartment has ever been specified as being a desirable target by any of those who have pressed for the survey to be made. We think that it will be well if some perspective can now be given to these matters and we have therefore quoted the Nene and Thames data above, although in doing so we do not imply that they necessarily form standards for River Boards to use when framing their own schemes.

28. River Boards can obtain Government grant on the construction or improvement of those gauges which constitute their systematic scheme as approved by the Minister of Health. We assume that any Board may undertake from time to time, or even regularly, volumetric and other gaugings extra to those within the scheme, whether such gaugings be for their own purposes or on behalf and at the request of another water interest.

Scotland

29. Except for any references to River Boards and comparable bodies, all that has been said by us so far applies to Scotland with the same force, we think, as to England and Wales. Though the area of Scotland is but little more than half that of England and Wales its degree of rainfall is relatively so much more that the surface water resources north and south of the Border may, it is estimated, be roughly equal.

30. The need for surface water survey in Scotland was accepted before the last World War. The case for it has since then been strengthened by the establishment of the North of Scotland Hydro-Electric Board, whose works cannot fail to affect the behaviour of river-waters from which they are due to develop power. What we have already said about industry's increased use of water seems to us to enhance the need for much more surface water survey work in Scotland than has yet been possible.

31. We have set up a Standing Sub-Committee for Scotland to consider the Inland Water Survey in that country and recommend to us any changes of organization which may by them be considered desirable. We have formed the opinion that, however much use is made by the existing agents of their present powers and resources of staff and funds to further the survey, early provision is needed of an organization specifically charged with the duty of survey and equipped with the means to perform it. Although this organization will from the angle of the Survey form for Scotland the counterpart of the River Boards of England and Wales, it may, we assume, be constituted very differently.

The brevity of this reference to the Scottish section of the Survey is in inverse ratio to the importance that we attach to the matter.

Availability of information

32. The collection of information will naturally be of little avail unless it can be made accessible to all concerned. We have noted that in the case of River Boards their Act of Parliament requires them to give reasonable facilities for the inspection by interested parties of the hydrometric records kept by them and for taking copies of and extracts from such records. There will however certainly continue to be a need for the annual publication of a detailed list of the gauging-stations established throughout Great Britain

and a record of the results obtained by means of them, such as was provided by the Surface Water Year-books for 1935-36 and 1936-37* and is still furnished for rainfall by the annual volume of "British Rainfall".†

Technique of surface water measurement

33. As regards the technique of surface water measurement, we would recall that a manual on the subject was published in 1936.‡ In Appendix D will be found some items to be added to the bibliography of that publication.

34. In the third annual report the Committee offered advice on the design of recorder-charts and some methods of securing accuracy of measurement. What they said then should be read by anyone who studies the manual, but we would repeat here their recommendation that recorder-charts should be eight-day and use the wording that they specified. Additionally we now recommend that whenever possible the scale of discharges or levels of a chart should be varied once or twice, in such a way that the smaller discharges, which are also much the more frequent ones, get graphically the more generous scale, so that they can be read more accurately. Fig. 2 is an example of what we have in mind. For a total range of 270 cusecs there are three scales, 0-60 cusecs (22 per cent. of the range) occupying as much as 70 per cent. of the total height of the chart, 60-120 (also 22 per cent.) occupying 20 per cent., and 120-270 (56 per cent.) occupying only the remaining 10 per cent. Failure to observe this principle has rendered valueless a lengthy and much needed record of dry weather flows.

35. At the invitation of the Catchment and River Boards' Association, the River Nene Catchment Board have this year prepared and printed a Memorandum on River Gauging which we welcome.§

Current Meters—calibration and recalibration stations

36. Much of the river-gauging to be done by River Boards will require the use of the current-meter, which is an instrument whose performance in varying conditions of river-velocity has to be determined by a process of calibration before its results can be interpreted quantitatively. The continued use of the meter may cause a change in its performance, so that recalibration is required at intervals.

37. There is an urgent need that the existing facilities in this country for calibrating current-meters should be greatly improved and expanded. We strongly recommend therefore that means should be found to meet this need, not merely so that current-meters can be calibrated before use and recalibrated at intervals thereafter, but also so that experiment and research can be conducted in the design of new forms of meter and in the performance of meters in varying conditions of use in the field.

I have the honour to be, Gentlemen,

Your obedient Servant,

(Signed) GEOFFREY CHEETHAM,

Chairman.

C. E. BARSON,

Secretary.

December, 1950.

* H.M. Stationery Office, price 5s. and 4s. respectively, net.

† H.M. Stationery Office. Volume for 1939, 15s.; 1940-42, 30s.; 1943-45, 30s., 1946, 21s.; 1947, 21s., all net.

‡ Memorandum on the Water Survey of a River System. H.M. Stationery Office, 1936, price 6d. net.

§ Obtainable from Office of the River Nene Catchment Board, North Street, Oundle, Peterborough, price 5s. a dozen or 6d. per copy plus postage.

APPENDIX A

Inland Water Survey Committee

Chairman

Major-General G. Cheetham, C.B., D.S.O., M.C., F.R.I.C.S.

The Waffrons Farm,
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APPENDIX B

Extract from the Third Report of the Central Advisory Water Committee 1943

"58. All river interests are concerned, to a greater or less extent, with the quantity of water available for use, as measured by level, depth or rate of flow, and with its quality. Rivers used as sources of supply for domestic, agricultural and industrial purposes and for fisheries must be protected from pollution as far as is practicable and the water must be so conserved and its flow so regulated, that the quantity and quality do not fall below full requirements at any time. As part of the same problem, it may be necessary to protect land from flooding, to provide sufficient water in dry periods for the irrigation of agricultural land, to secure that there is sufficient water for abstraction for water supplies, and that the quantity so abstracted, or the rate at which the river is drained to the sea, will permit of a sufficient flow for fisheries and navigation, and for the dilution of sewage and industrial effluents. It is clear that, with the exception of the Thames and Lee Conservancy Boards, the existing administrative bodies have neither sufficient powers nor the necessary authority to balance the requirements of the various interests, and thus to ensure that the resources of the watershed area are properly developed and used. It is doubtful, also, whether any of these bodies is in a position to estimate fully the available resources and the requirements of the various interests.

At the present time, there is comparatively little information on the flow and the physical and chemical characteristics of the water of most of the rivers and streams of the country. The few available data on river flow and river levels are now being collected and correlated as far as possible by the Inland Water Survey Committee, but very much more information is required. No systematic attempt has yet been made to collect data on the composition of the rivers and streams throughout the country, and few chemical, biological and

hydrographical surveys have yet been made. The need for special scientific investigation of the many problems of water supply and the prevention of pollution has been stressed in many cases in the past by Royal Commissions and other Authorities.

Conservation and Abstraction of Water

64. The duty of conserving water must necessarily include the power to obtain reliable information as to the extent of the water resources of the areas concerned. We recommend that the Boards should be required, if called on by the Inland Water Survey Committee, to gauge the flow of the rivers and streams under their control, and to furnish information on the subject to the Inland Water Survey Committee. This Committee, which was appointed in 1935 by the Minister of Health and the Secretary of State for Scotland, collects and co-ordinates information on rainfall, surface flows and underground supplies and brings it into a form suitable for publication. The data on rainfall are obtained through the Meteorological Office of the Air Ministry and those on underground water are obtained through the Geological Survey of the Department of Scientific and Industrial Research. In present circumstances it is necessary to rely mainly on the voluntary work of numerous organisations and individuals for the basic measurements and records."

APPENDIX C

Extract from the White Paper "A National Water Policy" (Cmd. 6515)

"The next requisite is to build up the body of knowledge necessary to the proper designing of development schemes and an equitable allocation of water resources. There is of course much knowledge already. Comprehensive records of rainfall have long existed, and there are no major sources of water the existence of which is not already known. Nevertheless, much more knowledge is required as to the yield and general behaviour and quality of these sources. This is a matter of scientific assessment and recording. A beginning was made with this work in the Ministry of Health and in the Scottish Departments before the war, with the assistance of an Advisory Committee under the Chairmanship of Sir Henry Lyons, but through no fault of the Committee, it was on an inadequate scale. Moreover it was interrupted by the war. The Government consider that collection and collation of scientific records of the flow of rivers and of information regarding the quality of water and the behaviour of underground water sources should be resumed and pressed on with vigour as soon as circumstances permit. Such records over a period of years will enable conclusions to be drawn on a much more reliable basis than at present as to such matters as the yields of gathering grounds or the appropriate size of reservoirs, will provide valuable data for use in relation to the determination of compensation water and will be of value not merely to water undertakers but to all those interested in the "régime" of rivers and the use of both overground and underground sources. As regards underground water, the work will continue to be done mainly through the Geological Survey of the Department of Scientific and Industrial Research which has already done, and is now doing, much valuable work in this sphere.

In England and Wales much of the data required will be obtained from the new River Boards referred to later, on whom will be placed the duty of maintaining and making available records of gaugings and any other required information as to the behaviour of a river. General powers will be needed to obtain statistics of various kinds from all substantial users of water, including information as to geological strata from all persons by or for whom wells or borings are sunk. The task of the Survey can be summed up as the task of making available to Government Departments, water undertakers, industry, agriculture, canal owners and indeed to all who need it information as to the yield, behaviour and quality of the country's water resources."

APPENDIX D

Revised version of the Bibliography appearing on page 24 of the Memorandum on The Water Survey of a River System, published by H.M.S.O., 1936, Price 6d.

SECTION I. Principles and Methods of Hydrometry

1. "River Gauging", 1917, by G. B. Kershaw. Price 2s. 6d. The Colliery Guardian Company Ltd., 30, Furnival Street, London, E.C.4. Written as the result of work done for the Royal Commission on Sewage Disposal. (Out of print, 1950.)
2. "Stream Gauging", 1927, by W. A. Liddell. Price 18s. 0d. McGraw-Hill Publishing Co. Ltd., Aldwych House, Aldwych, London, W.C.2. An American work. (Out of print, 1950.)
3. "River Discharge", 4th edition 1930, by J. C. Hoyt and N. C. Grover. Price 12s. 6d. Chapman & Hall Ltd., 37, Essex Street, London, W.C.2. Two of the principal engineers of the United States Geological Survey describe the methods of measuring and recording stream flows as practised in America. (Out of print, 1950.)
4. "Hydrology", 1942, edited by Oscar E. Meinzer. Price \$5. Dover Publications Inc., New York City. Contributions by leading American authorities on all branches of hydrology.
5. "Stream Flow", 1943, by N. C. Grover and A. W. Harrington. Price 36s. 0d. Chapman & Hall Ltd. Contains much of the material on the technique of gauging included in "River Discharge", by Hoyt and Grover, together with chapters on more general hydrometric subjects.
6. "Stream Gauging Procedure", 1945, by Don H. Corbett and others. U.S. Geological Survey Water-Supply Paper 888. Price 75 cents. Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., United States of America. A manual describing methods and practices of flow gauging used by the U.S. Geological Survey.
7. "Hydraulic Measurements", 2nd edition 1946, by Herbert Addison. Price 21s. 0d. Chapman & Hall Ltd. The principles and practice of flow measurement in the field and in the laboratory, by the Professor of Hydraulics at the Fuad I University, Giza, Egypt.
8. "Fleuves et Rivières", by Professor Maurice Pardé, Librairie Armand Colin, Paris, 1947. A French geographer's brief account of the behaviour of rivers in many countries.
9. "Hydrology", by Linsley, Kohler and Paulhus, of the U.S. Weather Bureau. McGraw-Hill Publishing Co. Ltd., 1949. Price 72s. 6d.
10. "Flow Measurement and Meters", by A. Linford, E. and F. N. Spon, London, 1950. Price 30s. 0d.
11. "Current Meters for use in River-Gauging", 1922, by M. A. Hogan (Department of Scientific and Industrial Research). H.M.S.O. Out of print.
12. "River Gauging", 1925, by M. A. Hogan (Department of Scientific and Industrial Research). H.M.S.O. Out of print. Deals mainly with the rating and characteristics of current meters.
13. "Flood Flows", 1930, by Allen Hazen. John Wiley & Sons Ltd., New York, U.S.A. A study of flood frequencies and magnitudes treated from a mathematical stand-point. (Out of print, 1950.)
14. "Floods, their Hydrology and Control", 1948, by H. K. Barrows. Price 39s. 0d. McGraw-Hill Publishing Co. Ltd. An American study of floods and works for their control.

15. "Flood Estimation and Control", 2nd edition 1950, by B. D. Richards. Price 21s. 0d. Chapman & Hall Ltd. A consideration of flood intensity formulæ and methods of estimation, with a new method put forward by the author.

16. "The Determination of the General Rainfall over any Area", 1937, being the report of a Joint Committee appointed by the Institution of Water Engineers, the British Rainfall Organization, and the Royal Meteorological Society. Issued by the Institution of Water Engineers, London.

17. "Rules for Rainfall Observers", Form 1111, 1948, issued by the British Rainfall Organization, Meteorological Office, Air Ministry.

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24. Papers presented to The Institution of Civil Engineers, London :

(a) "The Flow of the River Severn 1921-36", by S. M. Dixon, Gerald Fitzgibbon and M. A. Hogan, April, 1937. Paper No. 5113.

(b) "The Measurement of the Discharges of the River-Basins of the White Nile (Sudan) and Nene (Great Britain)", by R. F. Wileman and H. W. Clark, February, 1946. Paper No. 5528.

25. Papers presented to The Institution of Civil Engineers of Ireland, Dublin :

(a) "The Average Annual Rainfall and Run-off of the River Shannon Catchment at Killaloe from 1893 to 1936", J. A. O'Riordan, 1937.

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(a) "The Water Survey of the Channels of the River Nene", 1946. Price 2s. 6d.

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29. Report on Assessment of Compensation Water, 1930, by a sub-committee of the Advisory Committee on Water (Ministry of Health). H.M.S.O. Price 9d.

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31. Irrigation Pocket Book, 1928, compiled by R. B. Buckley. Price 30s. 0d. E. & F. Spon Ltd., 15, Bedford Street, London, W.C.2. Includes formulæ, tables and notes relating to river hydrology. (Out of print, 1950.)

32. The Surface Water Year-book of Great Britain. For 1935-36, price 5s. 0d., and 1936-37, price 4s. 0d. H.M.S.O.

SECTION III. Development of the Survey of British Water Resources

33. Final Report of the Water Power Resources Committee, 1921 (Board of Trade). Out of print. H.M.S.O.

34. "Inland Water Survey in the British Isles", Reprint N.S. No. 31, dated 1933. Price 1s. 6d. The British Association, Burlington House, London, W.1.

35. Report from the Joint Committee on Water Resources and Supplies, together with the Proceedings of the Committee, the Minutes of Evidence and an Appendix (H.L. 67, 184; H.C. 159, Session 1935-36), price 5s. 0d. H.M.S.O. Proceedings, July 3 to 5, 1935 (Volume I) (H.L. 147, Session 1934-35), price 2d.; Minutes of Evidence, July 11 to 25, 1935, together with an Appendix (Volume II) (H.L. 120, Session 1934-35), price 3s. 0d. H.M.S.O.

36. Annual Reports of the Inland Water Survey Committee, published by H.M.S.O.:

- (a) First Report, 1935-36, price 3d.
- (b) Second Report, 1936-37, price 6d.
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- (d) Fifth Report, 1950.

37. "Inland Water Survey", Report No. IV, on Post-War National Development, by The Institution of Civil Engineers, issued June, 1942.

38. "River Boards", Third Report of the Central Advisory Water Committee, Cmd. 6465, August, 1943. Price 1s. 3d. H.M.S.O.

39. "A National Water Policy", Cmd. 6515, April, 1944. Price 6d. H.M.S.O.

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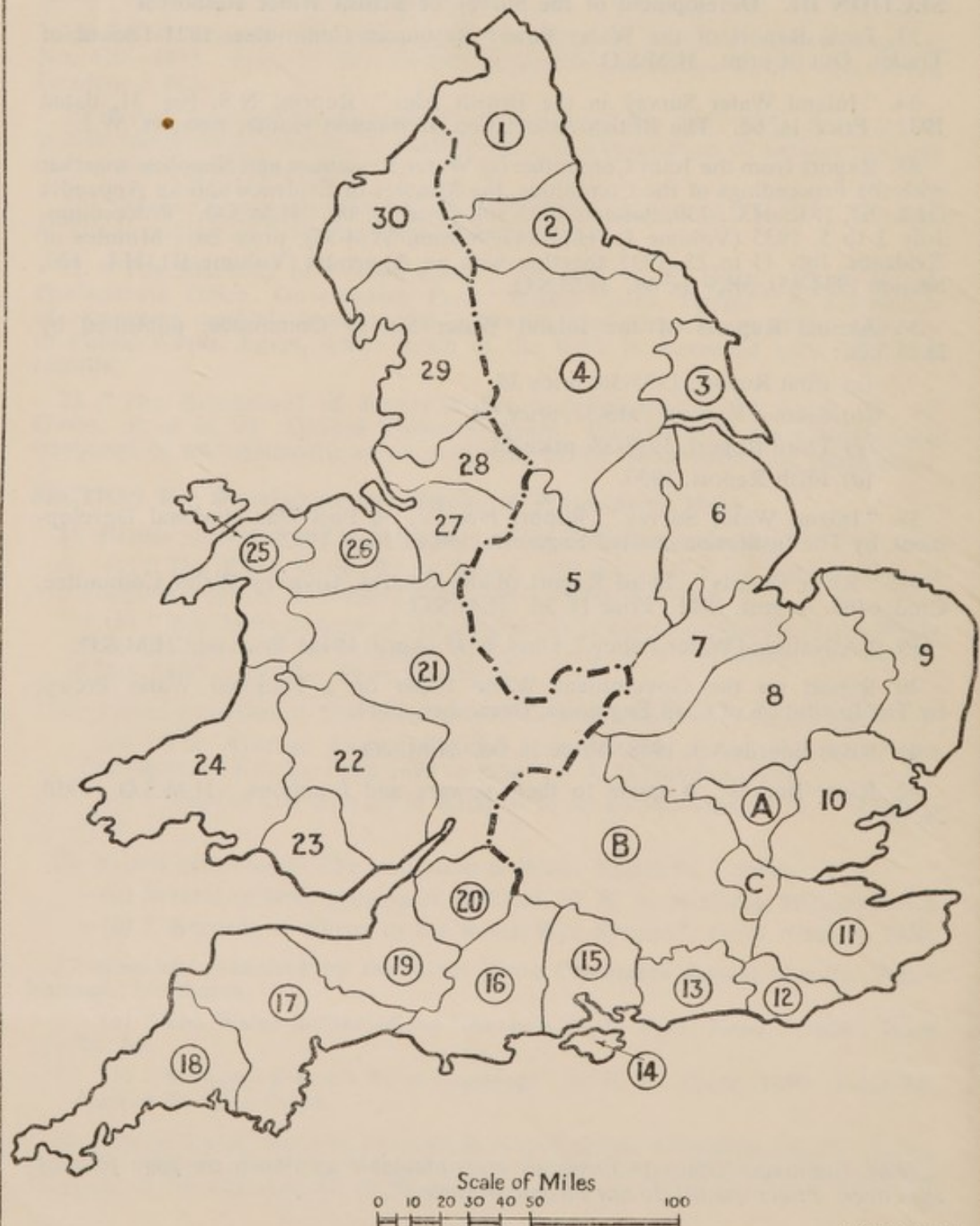
42. River Boards: A guide to their powers and functions. H.M.S.O., 1950, 2s. 0d.

H.M. Stationery Office publications are obtainable as shown on page four of the cover. Prices quoted do not include postage.

GAUGING OF ENGLISH & WELSH RIVERS

MAP SHOWING BOUNDARIES OF RESPONSIBLE AUTHORITIES

East - West Divide
 Area of Authority already operating (A) (B)
 River Board Area whose limits are not yet fixed, or whose Board is not yet operating. } 6



DECEMBER 1950

Fig. 1.

LIST OF AREAS SHOWN ON MAP (FIG. 1)

Area	Name	Area	Name
1	Northumberland and Tyneside	19	Somerset
2	Wear and Tees	20	Bristol Avon
3	Hull and East Yorkshire	21	Severn
4	Yorkshire Ouse	22	Wye and Usk
5	Trent	23	Glamorgan
6	Lincolnshire	24	South-West Wales
7	Nene and Welland	25	North-West Wales
8	Great Ouse	26	Dee and Clwyd
9	East Suffolk and Norfolk	27	Cheshire
10	Essex	28	Mersey
11	Kent	29	Lancashire
12	East Sussex	30	Cumberland
13	West Sussex		NAME OF RIVER AUTHORITY
14	Isle of Wight	A	Lee Conservancy Catchment Board
15	Hampshire	B	Thames Conservancy
16	Avon and Dorset	C	(No Authority is responsible for river gauging).
17	Devon		
18	Cornwall		

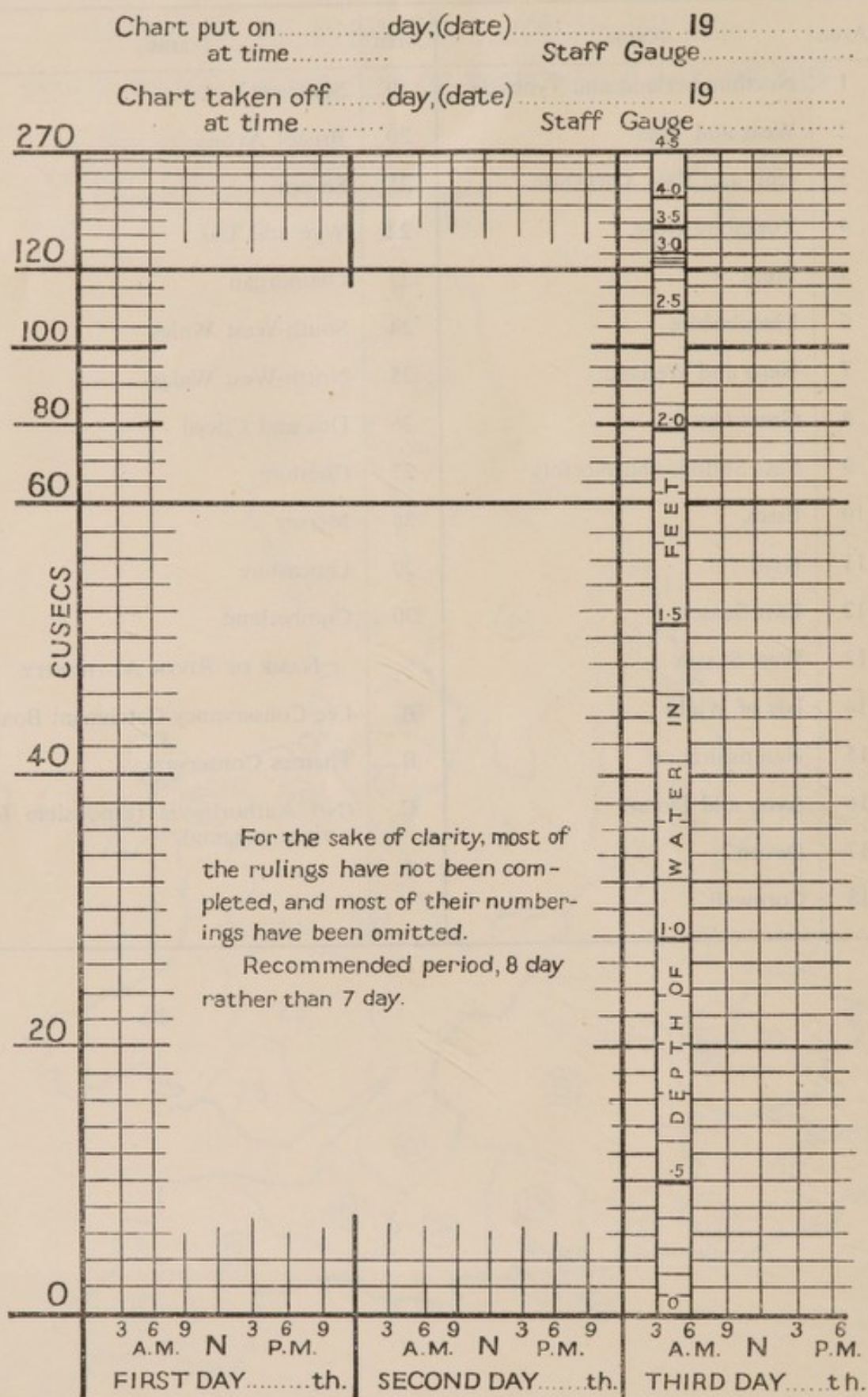
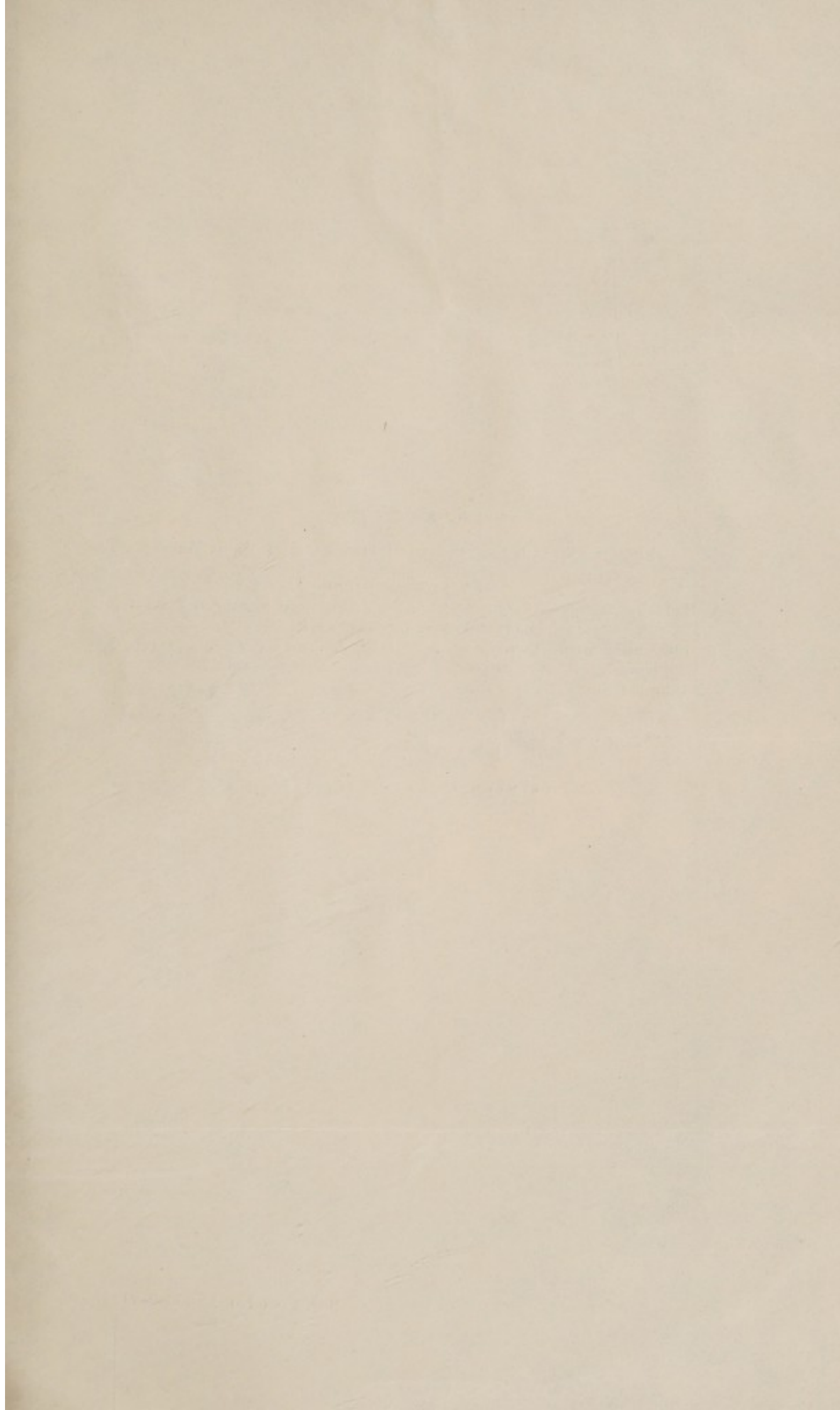


Fig. 2. Example of Multi-scale Chart.



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