

HYDROLOGY

THE FUNDAMENTAL BASIS OF HYDRAULIC ENGINEERING

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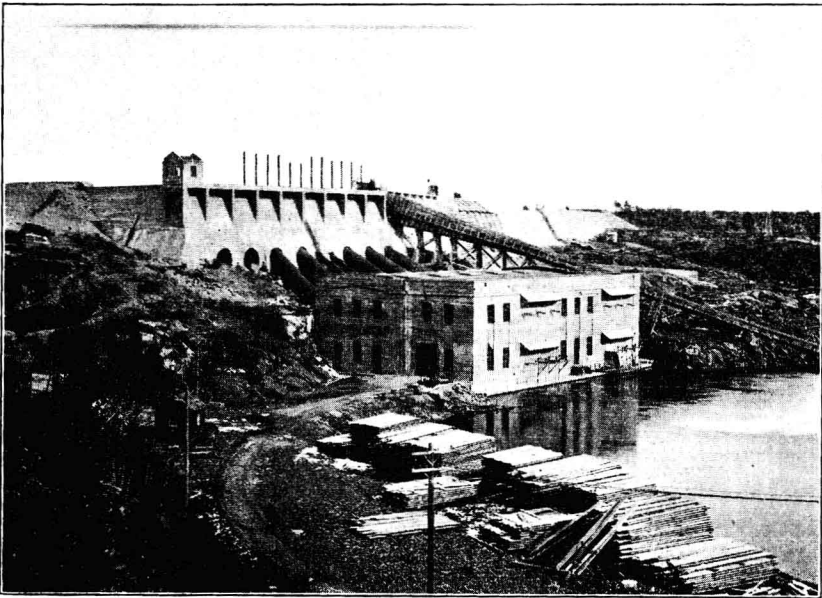
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High Falls on the Peshtigo River, Wisconsin, before Development.
(E. C. Wild.)



The Hydro-Electric Development at High Falls. Building Located at Foot of Former Fall. Power Transmitted to Green Bay, Wisconsin, a Distance of about Sixty-two Miles.

PREFACE TO THE SECOND EDITION

Since the first edition of this book in 1919, Professor Daniel W. Mead continued his studies and collected hydrological data in preparation for a later edition. Because of his failing health, he was unable to undertake a revision of HYDROLOGY. It was his wish that the work of accumulating and analyzing hydrological data, and the publication of a second edition be continued by his associates.

Because Harold W. Mead, his son, and Henry J. Hunt were long associated with Professor Mead, the firm of Mead and Hunt, Inc., Consulting Engineers, with which they are now affiliated, has undertaken the task.

Mr. Henry J. Hunt, under whose direction this edition has been revised, was first associated with Professor Mead in 1906, after his graduation from the University of Wisconsin. A large part of his professional career has been spent on hydrological problems. He assisted in the preparation of the first edition of this book and assisted in the solution of major problems of hydrology which occurred in Professor Mead's engineering practice. Mr. Hunt has collected a large amount of new data which is incorporated in the new edition, as well as many ideas which he has developed in study of the problems involved during his practice.

Minor corrections, revisions, and additions have been made in virtually every section of the second edition of HYDROLOGY, and in many instances entire sections have been added or completely rewritten. Since the publication of the first edition, the gradual accumulation and interpretation of hydrologic data has substantiated many earlier theories and conclusions, and has shown the need for the reorientation of others. The Bergeron analysis of meteorological phenomena in terms of air masses has been discussed in Chapter IV. The more recent approach to evaporation theory and methods of measurement appear in Chapter VI. The new techniques and possible consequences of producing artificial rainfall are mentioned. The methods of weighting precipitation records for given areas and, in particular, the Thiessen method, have been added to Chapter IX. The application of theory of probability to hydrologic data — particularly rainfall and flood frequency data — is discussed in two new sections in Chapters IX and XX.

The droughts of the nineteen-thirties and their serious economic effects focused attention on the extreme minimum phases of hydrologic phenomena. In Chapter XII, by Mr. Henry J. Hunt, the rainfall

characteristics of areas in this country and abroad are illustrated and their effects on droughts and periods of excessive precipitation are analyzed, as well as drought distribution and the concurrence of high and low rainfall in various areas of the United States. The ever-increasing demands on ground water sources in the past few decades by rapidly expanding metropolitan and industrial development, and the resulting critical situations arising in various localities in this country have been reappraised in Chapter XVI.

In addition to the discussion of the application of statistical theory to flood frequency, Chapter XX now contains a review of the development and use of the rational method of computing small area peak flows and the unit-hydrograph and related flood routing procedures for floods on larger areas.

Thanks is due the staff of Mead and Hunt, Inc., especially Mr. William N. Brown, who has edited the revised text and has written the sections on evaporation, statistics, methods of flood flow analysis and others.

HAROLD W. MEAD

Madison, Wisconsin, January, 1950

PREFACE TO THE FIRST EDITION

In the following pages the author has discussed some of the most important facts and principles of hydrology. The author believes, from his observations during more than 35 years of professional practice, that more failures have resulted in various hydraulic engineering projects from lack of adequate conceptions, on the part of the designing engineers, of the fundamental principles of hydrology and of the importance of hydrological factors than from defects in structural design. In many cases the engineer has based his work on unwarranted assumptions and has not possessed sufficient knowledge even to appreciate the necessity of hydrological investigations.

As a result of the lack of appreciation of the importance of the fundamental basis on which every sound hydraulic project must rest, numerous irrigation projects, water power plants and public water works have proved partial or complete failures for lack of adequate water supplies, life and property have been destroyed by failures of dams, inadequate reservoir spillways and protecting works, and drainage and flood protection enterprises have been undertaken with no adequate knowledge of necessary flood capacities. In many ways unnecessary losses are frequently entailed which have been largely due to the fact that the importance of hydrological information has not been sufficiently impressed upon the minds of hydraulic engineers.

The author has made no attempt in the following pages to furnish categorical answers to complex hydrological questions but has endeavored to show that the answers to the same questions may be and sometimes are reversed under different local conditions, and are always greatly modified thereby. He has found it necessary in almost every chapter to warn the engineer against attempts to solve hydrological problems by formulas or rules of thumb of restricted application and to insist in every case upon the necessity of conclusions based upon the detailed consideration of all the local factors in each problem.

While the author has emphasized the impossibility of a high degree of accuracy in the solution of most hydrological problems, he has also attempted to show that such problems are susceptible of a solution fully as accurate as in the case of most other engineering problems.

While hydrology is by no means a new subject it has received far less study and attention than its importance warrants. Some of the phenomena have been discussed in treatises on water supply and sewerage, but the subject has been introduced as a separate technical study in engineering schools only within the last fifteen years.

In 1904 the author issued his "Notes on Hydrology" as a basis for a course of study at the University of Wisconsin but it was found to be not wholly satisfactory and has long since been out of print. The present work is the result of notes derived from both investigation and practice and has been prepared primarily for the author's classes in the University of Wisconsin. Nothing is introduced which the author has not found to be of practical importance in his own professional work, and much has been omitted on account of the necessary limitations of this volume. The literature on the subject is very extensive, and a carefully selected list of the most important sources of information has been added to each chapter.

It is perhaps needless to call attention to the necessity of much further investigation and study in order to correlate correctly many of the intricate factors of hydrological problems and to make their true relations manifest. On the subject of stream flow, one of the most intricate of these problems, the various methods of correlation which have been suggested by various hydrologists are shown in order to explain both their strength and weakness, and in order to indicate the desirable direction of further investigations. The methods used and suggested by the author for the solution of stream flow problems are not offered as final methods but simply as the best practical methods which in his judgment have been devised up to the present time.

The author has endeavored to give credit to the source of all illustrations and methods in connection with their presentation. He acknowledges his indebtedness to the technical press and to various reports, technical works and society proceedings to which reference has been made. His acknowledgments are especially due to Mr. L. R. Balch for material assistance in the preparation of this volume, particularly in connection with the editorial work. Acknowledgments for valuable suggestions are also due to the author's associates, Messrs. C. V. Seastone and F. W. Scheidenhelm.

DANIEL W. MEAD

Madison, Wisconsin, September, 1919.

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