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WATER SUPPLY STATISTICS.

(1.) CATALOGUE OF EXHIBITS RELATING TO AMERICAN WATER WORKS AT THE CENTENNIAL EXPOSITION IN PHILADELPHIA. BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS, embracing a list of towns in the United States having a public water supply. J. J. R. Croes, C.E. 1876.

(2.) LIST OF WATER WORKS IN THE UNITED STATES AND CANADA. E. Prince, C.E. 1877 to 1880. 5 issues. Sheets.

(3.) INFORMATION RELATING TO FIRE HYDRANTS, WATER PRESSURES, &c., IN THE WATER WORKS OF UNITED STATES AND CANADA. Ithaca Water Works Company. E. M. Treman, Secretary. 1878. Sheet.

(4.) A TABLE OF GENERAL INFORMATION CONCERNING THE WATER WORKS OF THE UNITED STATES AND CANADA. C. G. Hildreth, Secretary of the Holly Manufacturing Co. Lockport, N. Y. 1878.

(5.) REPORT TO THE NEW HAVEN COMMON COUNCIL, giving statistics of American water supply. Julius Twiss. 1881.

(6.) THE HISTORY AND STATISTICS OF AMERICAN WATER WORKS. By J. James R. Croes, C.E. *Engineering News*, N. Y. March, 1881, and following numbers.

(7.) THE PURCHASE OF GAS AND WATER WORKS, with the latest statistics of Municipal Gas and Water Supply. By Arthur Silverthorne, C.E. London, 1881.

(8.) WATER WORKS STATISTICS. 1881. Compiled from special returns received from engineers and secretaries throughout the united kingdom. 1st issue. Edited by Charles W. Hastings. London.

(9.) DIE STAEDTISCHE WASSER VERSORGUNG. BESCHREIBUNG DER ANLAGEN IN BAU UND BETRIEB. E. Grahn. München, 1877.

Although works for the supply of communities with water have been in use since the earliest historic ages, the amount of information obtainable regarding their practical operation and their financial results viewed as business enterprises, has always been small. Monographs describing the construction of particular works have been published, treatises on the general subject of water supply to towns have been written, introducing some statistical information, but it is only recently that efforts appear to have been made to furnish in compact and intelligible form such precise data regarding the extent, the character and the results of the various enterprises in any one country or at any one period as will enable engineers and business men to act intelligently in deciding on the scope and character of works likely to prove, not only successful as regards the quantity and quality of the supply, but financially remunerative also.

The treatises of Hughes and Humber, in England, and of Fanning in America, are useful in their way, but they do not furnish the exact information which is wanted, and there is so much generalizing and so many notices of projected works which have never been executed, that one becomes confused and unable to distinguish between what is merely theoretical and suppositious, and what has stood the test of experience.

The publications, the titles of which are given above, are intended to supply partially this want. None of them are complete and some of them are notably the reverse, but all are, or have been, to some extent, useful.

The earliest in date, the catalogue of exhibits relating to water works made by the American Society of Civil Engineers at the Centennial Exposition is simply a catalogue, but it contains the

first attempt at the publication of a list of American Water Works, and shows that a collection of valuable statistics intended for compilation and issue had been begun by Mr. Croes.

At the Exposition there was exhibited in the German department an elaborate tabular collection of statistics of the water works of towns in Germany, prepared by Mr. Grahn, and in the following year his volume was issued, in which are contained historical and descriptive sketches of nearly 400 works for water supply, prepared from original information gathered by persistent correspondence and the issue of many circular letters.

In his preface the author relates the difficulties encountered in collecting information, which seem to have been as great in Germany as similar collectors have met with in America, and from the delay in the publication of the promised additional volume of statistics and deductions cannot have been yet entirely overcome.

In 1877 Edward Prince, C. E., of Quincy, Ill., published his first list of American Water Works, for which he had succeeded in obtaining the names of 457 towns, or 138 more than had been discovered by Mr. Croes. To these Mr. Prince has since added 196 names, and from most of the towns has procured certain statistics and many documents, which as yet remain undigested and unpublished. The publication of these lists, however, has been of value to officials of water works by enabling them to know where to apply for information, and the result has been a largely increased communication between the officers of works in different places, and interchange of views and experience.

Without the preliminary issue of Mr. Prince's list it is hardly probable that the secretary of the Ithaca Water Company would have undertaken the collection of the hydrant statistics published by him in 1878, giving the population, ownership and system of supply, the ordinary pressure on the street mains, the number and distance apart of hydrants and the annual cost of each to the town, in 296 towns, nor would the Holly Manufacturing Company have been able to issue in the same year their valuable pamphlet, giving the method of supply, the number of hydrants and gates, the miles of pipe, the number, capacity and kind of pumping engines and the principal officers' names of the water works of 334 towns.

These two publications are to be found in every water works office in the country, and are highly prized. What they contain is what every manager of works wants to know for comparison of his own with other works. They are, however, incomplete, and do not give, by any means, all the information desirable even on the points professed to be covered. The New Haven report prepared by Mr. Twiss during the past year gives replies from 114 towns to questions propounded by a Committee of the Common Council, bearing on the propriety of a transfer of the water works from a private corporation to the municipality. These replies embrace the cost, running expenses and revenue of the works, the ordinary water rates, and the number of employés. The figures given are only approximately correct in most cases, and the answers to a question asked regarding the satisfaction of the citizens with the management of the works are clearly inspired by individual feelings in many cases. Some of them are known to be extremely far from correct.

In addition to these partial statistical statements, several trade circulars contain interesting fragmentary statistics compiled from official documents. Thus a Water Meter Company publish a table of daily consumption, quantity used per head, miles of pipe, number of taps and of meters

in use, in 30 towns, and a pipe manufacturer gives a table showing the miles of pipe, the number of hydrants and the kind of service pipe used in 37 towns. These last are mentioned merely as showing that a demand for such statistics must be felt, and not as endorsing their accuracy at all. In fact, they are far from being worthy of confidence.

The book undertaken by Mr. Croes, and now in course of publication in *Engineering News*, is more comprehensive in its character than any of those above named. It is more like the work of Mr. Grahn, in that it gives a sketch of the history and progress of each town's water works. The failures and successes of various structures and machines are noted concisely and impartially, without a word of excuse, censure or commendation. The latest statistics are given fully. Some tabular statements have been given and more are promised. About a hundred and fifty water works have so far been described. Of course the co-operation of an enormous number of persons is requisite to the success of the undertaking, and while there has been much kind and hearty assistance rendered the author, it would appear from some of his statements that he has been hampered by the neglect of many officers of works to send replies to questions addressed to them. It is unfortunate that such should be the case, and it is to be hoped that all who are in charge of works for water supply will freely and promptly contribute their share toward the perfection of what promises to be a volume of great value to them.

The same difficulty seems to have been encountered by the compilers of similar statistical works in England. Mr. Hastings, the editor of the *Review of Water and Gas Engineering*, sent out a list of nine questions to the towns in the United Kingdom. Only 133 towns responded, and of these only 47 answered all questions. Of the 77 works of which Mr. Silverthorne gives statistics, 48 are not mentioned by Mr. Hastings, in his "first issue" which gives the source of supply of 108 towns, the mode of supply (whether by gravitation or pumping) of 131, the mode of distribution (whether constant or intermittent) in 130, the quantity distributed annually in 69, the mode of assessing water rates in 127, the meter rates per 1,000 gallons in 90, the number of meters in use in 99 and the dividends paid in 46. It is interesting to note that only 14 towns have an intermittent supply and that 10 of these furnish a constant supply to a portion of their consumers. Neither Hastings nor Silverthorne gives any statistics of the Liverpool water supply, one of the most interesting in England.

Mr. Silverthorne's interesting book is devoted mainly to the financial aspect of undertakings for gas and water supply. He is an ardent advocate of a public ownership of all such works, in preference to their being in the hands of private corporations, and furnishes the details of the conditions of purchase of 49 gas works by the local authorities, from 1868 to 1880, and further statistics of 60 gas undertakings which are under the control of the local authorities, and of 5 London companies—under private control.

Merely noticing that the facts and figures given in this connection are worthy of careful study by gas works managers, we must pass to the consideration of the portion of the book relating to water works.

The statistical portions embrace the details of the purchase of 17 water works by the local authorities, between 1868 and 1880. The population supplied by the several works ranges from 15,466 in Taunton, to 481,000 in Birmingham, and the prices paid ranged from \$115,000 for the

Taunton Works to \$4,005,570 for the Stockton and Middleborough Works, supplying 75,078 people, and \$4,325,000 for the Birmingham Works. The fixed charges created by the purchase of the works vary from \$44.65 to \$116.95 for each million gallons furnished per annum, and receipts from water rates are from \$95.95 to \$220 per annum for each million gallons.

The next table gives the financial standing of the eight companies supplying London for the year 1879. These companies supplying daily 134,340,000 gallons to 4,289,254 people, received in water rentals \$139.35 per million gallons delivered, and paid in interest and dividends \$87.10, being nearly 7 per cent. on the total stock and bonded debt.

Mr. Silverthorne is particular in giving these figures as to the affairs of private corporations, but in the statistics which follow, relating to 69 towns, the works of which are owned and managed by the local authorities, the receipts from water rates are not given either absolutely or in proportion to the quantity furnished. Neither is the ratio of the fixed charges to the gross receipts given, so that it is impossible to verify from his statistics, what is implied in the text, that it is a greater burden on tax payers to have water works under private than under public control. As nearly as can be judged, the rate of assessment is the same in each case, averaging five per cent. on the valuation of the property and not, as in this country, based on the size of house and number of openings. The American method seems to be the more equitable of the two. The whole question of water rates is a vexed one, however, and is not satisfactorily adjusted anywhere. Consumers everywhere complain that they are compelled to pay too much, and non-consumers object to paying for water from which they personally derive no direct benefit. Where water works are under public control the rates are not ordinarily sufficient to pay all expenses of maintenance and interest, and a portion must be met by a tax on property at large. Where water is supplied by a company the deficiency of income from private consumers is sought to be met by the payment of a sum from the public treasury, ordinarily assumed to be for the protection from fire and regulated by the number of fire hydrants. This is perfectly fair in either case. The presence of a good water supply is a public benefit, and the public should help to pay for it. The capital which furnishes the supply must be remunerated for it, and will be in one way or another. If the money is loaned to the city, there is a fixed charge on the public for interest. If the works are built by private parties they assume the risk of remuneration, and it is not improbable that the cost of the works will be less and the adventurers' income the less for several years at least, than the cost of the public's building the works, and the income of the bondholders. With all his predilections in favor of public control of such works, Mr. Silverthorne is very cautious in advising the purchase of existing private works. Some of his remarks are worthy of serious consideration. He says:

"It must be admitted that the water companies, except in a few instances, have certainly not been addicted to declaring large dividends—the ruling profits are rarely in excess of 6 or 7 per cent. upon paid up capital; and, considering that they have been the pioneers of health, it cannot be gainsaid that they are entitled to a good deal of consideration at our hands." * * *

"Careful inquiry into the subject will reveal that the great development and success attending the supply of gas is attributable to the circumstance that the increase is not due to new consumers alone, but to increased consumption on the part of original consumers—waste, it may, perhaps, be described as, but which is, nevertheless, paid for integrally.

"The same increase takes place in the consumption of water; an enormous and increasing waste of water, in addition to the legitimate supply to new tenements, has annually to be provided against by companies and corporations, with

this difference, that it is not paid for; and this must, and ever will, restrict the profits of any well-conducted concern to 6 or 7 per cent. upon the necessary outlay." * * *

"There is no subject that should be approached with greater caution than the purchase of a water undertaking by the local authorities, as, should they by mischance pay more than the value of the undertaking it is questionable if they will ever recover the lost ground.

"This is just the converse of our practice with gas works, in which high prices are frequently paid, with no worse result than that of deferring surplus profits a few seasons. In the supply of water, it may be pointed out that there is no prospective economy to be derived from a new supply; and yet, in less than a decade, and sometimes almost as soon as the works are acquired, the question of new works forces itself upon the attention of the water committee, and invites occasionally a very large outlay in new schemes for extending the supply. * * * *

"It is needless to travel over previous ground; but the chief inducement of water companies—as in the case of gas companies—for selling on voluntary terms to the authorities, will always be found in the approaching exhaustion of their sources of supply, and the increased difficulty of maintaining their dividends in presence of any new schemes having to be carried out. * * * *

"It is easy to understand how a corporation, pledged to economy and low rates, will do anything rather than acknowledge the necessity for revising the water rates; but if the fashion for huge gravitation and compensation schemes, in order to administer to the present scale of extravagant waste, must be continued, then the sooner this revision is made the better; because those who have to pay for it will learn, ere it be too late, the cost of waste and improvidence, even in such an article as water." * * *

The true and equitable adjustment of the questions of water rates and the best mode of conducting works can only be reached by the study of the experience of the past. To aid in this study, or it may rather be said to make such study practicable at all, the collecting of statistics of the kind undertaken by the compilers of the works above named is essential. The labors of these persons should be aided in every possible way by all who are interested in water supply. The desired end will be accomplished better and more quickly by contributing to undertakings already well begun, than by attempting to make new and independent collections of data.

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