HISTORY OF THE MAIN DRAINAGE SCHEME OF LONDON, ENGLAND.

The works which have been in progress for some years past with the object of improving the London main-drainage system are now approaching completion, and, although certain additional works are to be carried out, the great schemes authorized by the London County Council in 1899 and 1903 are now in practical operation The capital expenditure on the main-drainage works of the metropolis was £6,824,877 up to March 31st, 1912, making a total expenditure of $59,264,560.

It was not until the year 1856 that steps were taken to provide for the complete interception of the sewage of the metropolis and for its discharge into the river below London instead of within the boundaries of the City. The scheme then adopted on the advice of Sir Joseph Bazalgette, the chief engineer to the Metropolitan Board of Works, required eighteen years for its completion, and consisted in the construction of intercepting sewers parallel to the course of the River Thames and connected to the old main sewers. The sewers on the north side of the river terminated at Barking, eleven miles below London Bridge, and the south side sewers at Crossness, thirteen miles below London Bridge. Three such sewers, high, middle, and low-level, were provided on the north side of the river. The high-level and middle sewers converged at Old Ford and the low-level sewer at Abbey Mills, Stratford, all three being carried side by side thence to Barking on an embankment known as the northern outfall. Four main sewers were also provided on the south side of the river, converging at Deptford, and carried as one sewer, known as the southern outfall, to Crossness. The northern high-level and middle-level sewers and two of the sewers on the south side of the river drained either to Barking or to Crossness by gravitation, but pumping plant had to be provided in the case of the low-level sewers at Pimlico, Stratford, and Deptford, and these pumping stations, to which additions have been made at different periods, are still employed in the drainage scheme of the London County Council.

The completion of the Bazalgette scheme added to the old main sewers, which had been constructed at right angles to the river, a comprehensive system of parallel and outfall sewers which were of sufficient capacity to meet the needs of that period. The population of London at that time, taking the mean of the official figures in the Census of 1851 and 1861, was 2,586,000, but the plans adopted were designed for a population of 3,450,000. The dry weather flow provided for was 108 million gallons a day and 286 million gallons of rainfall, but the discharging capacity of the sewers was made much larger than this quantity in view of the fluctuations in the rate of flow. The old sewers, which discharged directly into the Thames, were utilized as storm overflows, and their employment for this purpose had the effect of relieving the floodings which had previously taken place in times of heavy rainfall.

At the outset the sewage was discharged into the river from both the northern and the southern outfalls without any artificial treatment whatever, and, indeed, it was not until the year 1891 that the precipitation works at Crossness were completed, the works at Barking having been finished two years before. The chemical treatment of London sewage is, however, still in the experimental stage, and, of course, the question is not so urgent in the case of the metropolis, where the discharge is into a large river with great tidal capacity, as in that of inland towns discharging into small streams. To safeguard the future, however, the London County Council have acquired an additional area of 750 acres at the outfalls in anticipation of the further treatment of London sewage by bacterial or other methods. Sir Maurice Fitzmaurice, the late chief engineer to the Council, in a report made shortly before his retirement, expressed the opinion that the further purification of London sewage will not be necessary for some years, but that meanwhile experience in sewage purification elsewhere should be carefully watched.

The Metropolitan Board of Works was superseded by the London County Council in 1889, and, though the need for fresh works had been recognized, it was not until ten years later that the plans for the extension of the drainage works now completed were definitely formulated. The need for additional sewers arose not from any defects in the old scheme, but from the operation of perfectly natural causes. The population of two and a half millions on which the original drainage plans were based was mainly on the north bank of the Thames, the population of the south side at that time being only 691,761. The rapid inrease of the population during recent years, particularly on the south side of the Thames, and the substitution of houses and streets for fields and arable land, not only increased the volume of sewage, but swelled the amount of rain flowing into the sewers. Relief works, therefore, became necessary, and the construction of the additional sewers and works was put in hand in 1901, no fewer than twenty-four main contracts, exclusive of contracts for machinery, having been placed for this work.

The additional sewers which have been provided on the north side of the Thames bring the total of additional sewers, other than storm relief sewers, constructed on the north side of the river up to a length of about forty-four miles.

The additional drainage works on the south bank of the Thames bring the aggregate up to about thirty-three miles of new southern sewers.

The Method of Construction.—The construction of the new sewers has presented greater difficulties than those which had to be met in the carrying out of the original scheme. The area covered by buildings is now much larger, and the number of pipes laid underground and the existence of a large mileage of tube railways made the selection of the routes of the sewers a subject needing careful consideration. On the north side of the river a good deal of the excavation was in the London clay. On some sections the Greathead shield method of driving was adopted, and in places where water-bearing ballast was encountered, as in the case of the length of new low-level sewer westward from Trafalgar Square, it was necessary to work under air pressure. This sewer is carried under the Metropolitan District, and East London Railways, and over the newer "tube" lines. Different strata were met with on the south side of the river. The new southern high-level sewer is mainly in chalk and ballast. The new low-level sewer from Battersea to Deptford lies for a portion of its length in waterlogged sands and gravels, and here also it was necessary to work under pressure, and to employ, as for certain sections on the north side of the river, bolted iron ring construction. On these lengths liquid grouting applied under pressure was used to form a solid backing, and the ironwork was lined with 3 to 1 concrete and the invert faced with blue bricks.

In addition to the new lengths of sewers, about ten miles of storm relief sewers have been constructed. It is now proposed to carry out extensive works for the relief of Holloway, and North London generally, and also of the area in the valleys of the rivers Wandle and Graveney and other parts of South London. The total length of main intercepting and storm sewers taken over from the Metropolitan Board of Works was about 283 miles, and the length of the County Council additions, which are principally large main sewers, is about eighty-seven miles. The length of local sewers