Dublin main drainage scheme : souvenir handbook ; published by the authority of the Municipal Council to mark the inauguration of the Dublin main drainage, September, 1906.

DUBLIN MAIN DRAINAGE SCHEME

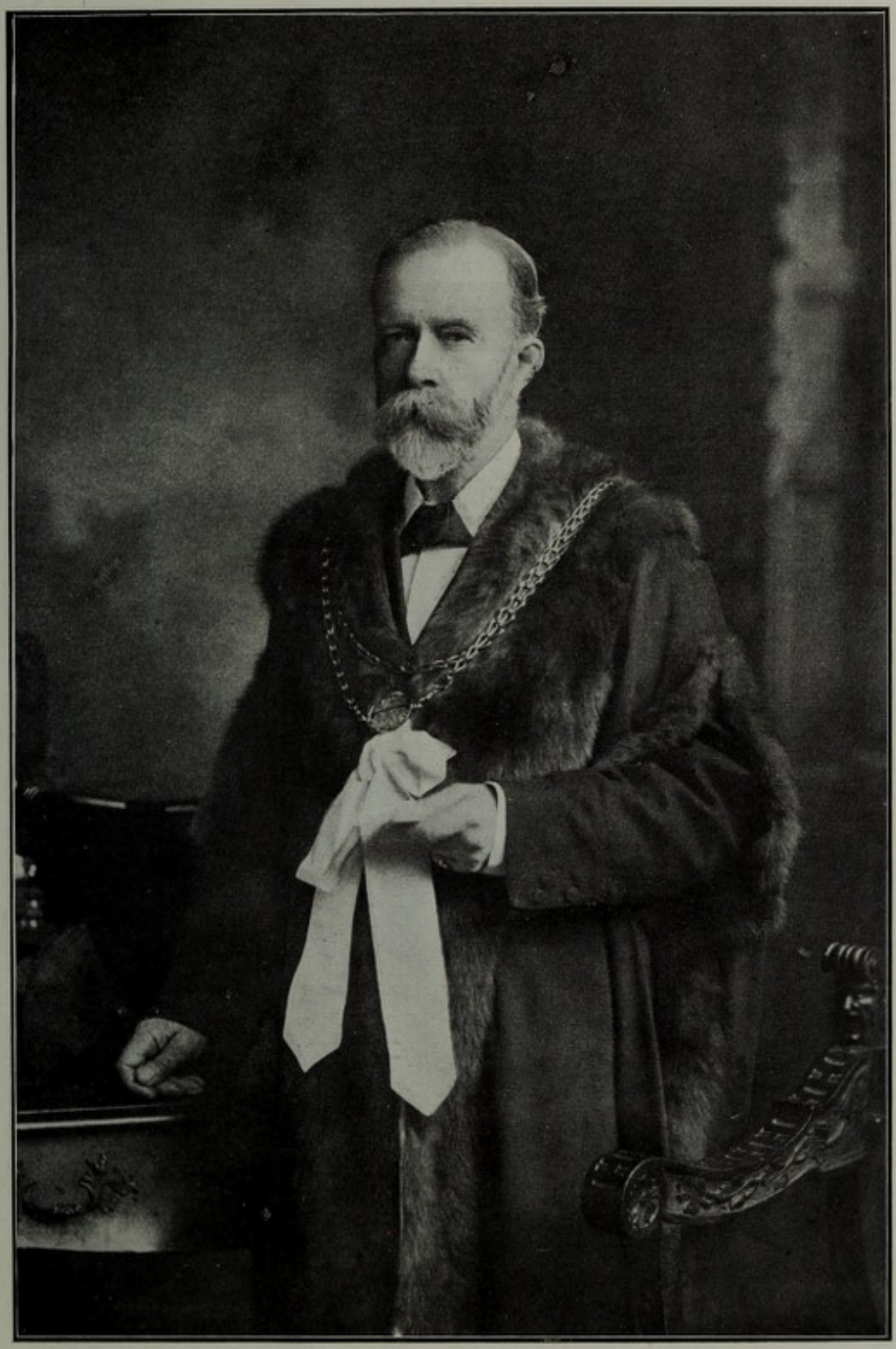
Souvenir Handbook,

1906.

DUBLIN MAIN DRAINAGE SCHEME.

Souvenir Handbook.

THE RIGHT HONBLE. JOSEPH P. NANNETTI, M.P., T.C.
Lord Mayor when works were inaugurated.



ALDERMAN W. F. COTTON, D.L., J.P.,
Chairman of the Improvements Committee, and who performed the Inauguration Ceremony, September 24th, 1906.

DUBLIN MAIN DRAINAGE SCHEME.

Souvenir Handbook.

PUBLISHED BY THE AUTHORITY OF THE MUNICIPAL COUNCIL TO MARK THE INAUGURATION OF THE DUBLIN MAIN DRAINAGE, SEPTEMBER, 1906.

Members of the Improvement Committee, 1906.

THE RIGHT HONOURABLE THE LORD MAYOR,
J. P. NANNETTI, M.P.,
Ex-Officio.

ALDERMAN WILLIAM F. COTTON, D.L., J.P.,
Chairman.

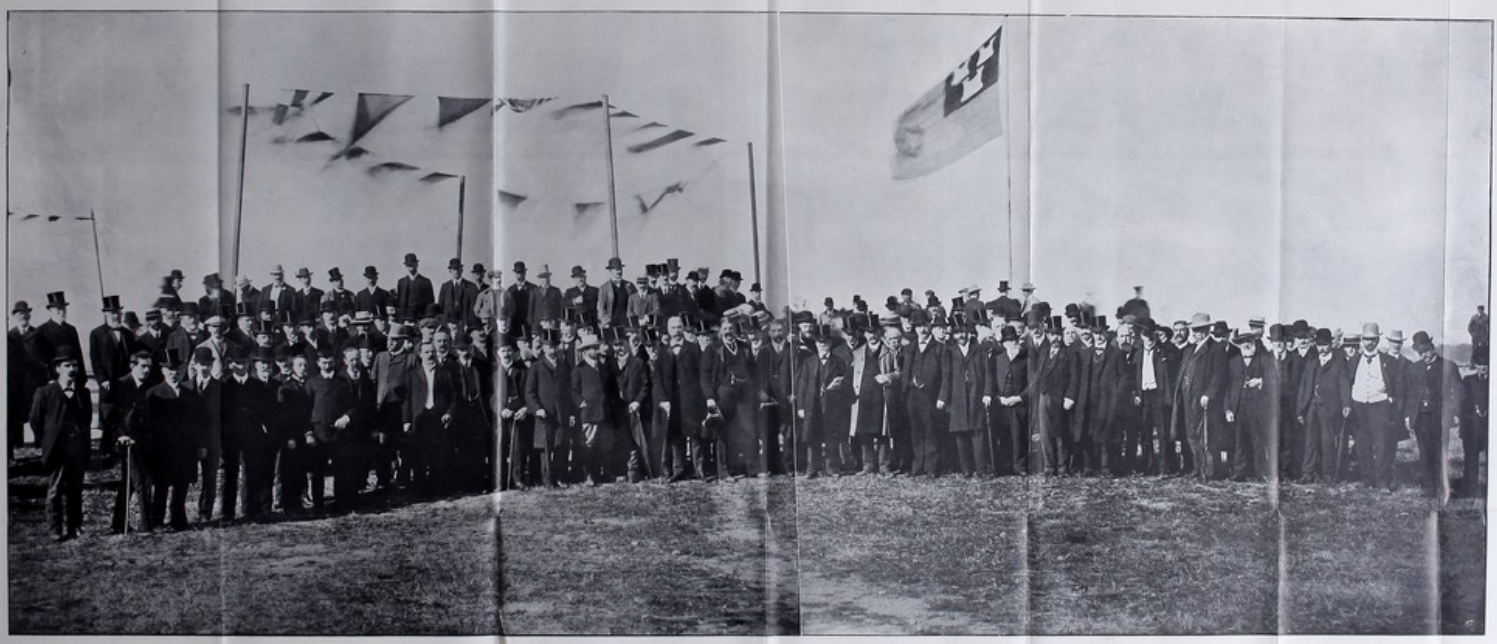
COUNCILLOR SIR JOSEPH DOWNES, J.P.,
Vice-Chairman.

ALDERMAN CHARLES DOWLING
ALDERMAN WALTER L. COLE
COUNCILLOR THOMAS ROONEY
COUNCILLOR WILLIAM MCCARTHY
COUNCILLOR PATRICK LENNON
COUNCILLOR PATRICK O'CARROLL
COUNCILLOR THOMAS BYRNE
COUNCILLOR WILLIAM JOHNSTON

PATRICK TOBIN,
Secretary.

DUBLIN:
SEALY, BRYERS AND WALKER, MIDDLE ABBEY STREET.
1906.

PRINTED BY
SEALY, BRYERS AND WALKER,
MIDDLE ABBEY STREET,
DUBLIN.



FROM PHOTO TAKEN IMMEDIATELY AFTER MAIN DRAINAGE INAUGURATION CEREMONY, 24th SEPTEMBER, 1906.

THE

MAIN DRAINAGE OF DUBLIN.

THE INAUGURAL CEREMONY.

On Monday, 24th September, 1906, the Main Drainage Works of the City of Dublin were formally declared complete, and opened by Alderman William F. Cotton, D.L., J.P., the Chairman of the Improvements Committee of the Corporation. A large party of citizens, representative of the various professional and commercial interests of the community, attended the ceremony on the invitation of the Chairman. Amongst those invited were:—

The Right Hon. the Lord Mayor, Commander A. G. Riall, Sir James B. Dougherty, C.B.; Right Rev. Dr. Donnelly, D.D.; Sir John Ross of Bladensburg, K.C.B.; the Right Hon. the Earl of Meath; Sir Antony McDonnell, G.C.S.I., P.C., Under Secretary for Ireland; Sir Frederick R. Falkiner; Colonel Sir A. H. Courtenay, C.B.; the Hon. the Recorder, Thomas L. O'Shaughnessy, K.C.; Sir William Goulding, Bart.; Sir Robert Gardner, J.P.; Sir John G. Barton, C.B., Chief Commissioner of Valuation; His Honor Judge Carton; Sir Robert Arbuthnot Holmes, M.A., K.C.B.; Sir Andrew Reed, K.C.B.; George S. Chatterton, M.I.C.E., Consulting Engineer; Right Hon. Sir Henry A. Robinson, P.C., K.C.B., Vice-President Local Government Board; John Gordon, K.C., M.P.; Sir Francis MacCabe, Sir George Moyers, D.L.; Lieutenant-Colonel Henry Plews; John Redmond, M.P.; Alderman George Healy, J.P.; John B. Swayne, Esq.; J. Ward, Esq., J.P.; John Carolan, J.P., T.C.; Alderman James Derwin, Sir Maurice Dockrell, Alderman John Davin, Charles Lawler, J.P., Professor T. H. Teegan, Michael Cahill, T.C.; John Mulligan, Esq., J.P.; Alderman Wm. Coffey, Charles Coyle, Esq.; John N. Lentaigne, J.P.; Sir Joseph Downes, J.P., T.C.; Percy S. Sheardown, Bernard O'Reilly, Alderman Joseph Delahunt, James Crozier, J.P., T.C.; George Collins, solicitor; John L. Scallan, solicitor; Alderman John Irwin, J.P.; Sir Howard Grubb, F.R.S.; Edmund Hutchinson, Esq.; Frederick W. Higginbotham, T.C.; Joseph Doyle, T.C.; Robert Booth, Esq., J.P.; James Goff, Esq.; Alderman Wm. Reigh, Henry Martin, Esq.; James Brady T.C.; Thomas

Rooney, T.C. ; S. J. Shannon, C.E. ; William McCarthy, T.C. ; Walter Scott, Esq.; George Macnie, J.P.; William M. Murphy, J.P. ; Alderman Abraham Lyon, Charles R. Morgan, Alderman Patrick W. Corrigan, Francis Vance, T.C. ; John P. Cox, T.C. ; A. Manning, Thomas Davy, Thomas Byrne, T.C.; Percy B. Bernard, D.L. ; John P. Griffith, M.I.C.E.; Laurence A. Waldron, M.P. ; J. Magee Finny, M.D. ; Alderman Francis Keegan, Thomas J. Lawler, T.C.; A. G. Reid. Esq.; Patrick Lennon, T.C.; Alderman Daniel Bergin, James H. North, Esq., J.P. ; Thomas Dunne, T.C.; Edgar Anderson, Esq.; J. A. Rice, Esq.; Wm. Anderson, J.P. ; George Dames Burtchaell, M.A., M.R.I.A. ; Rev. J. Dempsey, D. O'Connell Miley, solicitor ; R. O'B. Furlong, C.B.; W. Kaye-Parry, M.I.C.E.; Dr. James C. McWalter, T.C ; John Lawler, T.C.; George Casson, Esq., J.P. ; Edmund Lloyd, Esq. ; William Cahill, Esq. ; Hamilton Drummond, J.P. ; Alderman W. Doyle, Martin F. Mahony, J.P.; Andrew Dawson, T.C. ; Joseph Hatch, T.C. ; John P. Smyth, Esq. ; Adam S. Findlater, J.P. ; Wm. Findlater, H. E. Powell, Esq., C.E. ; Joseph Hutchinson, T.C. ; Patrick J. Rooney, T.C.; T. C. Harrington, M.P., T.C. ; Richard Butler, Esq.; George O'Connor, Esq. ; Michael J. O'Lehane, T.C.; Patrick O'Carroll, T.C. ; F. T. McPeake, Esq.; W. A. Locker, Esq.; James Vaughan, T.C.; W. H. Brayden, Thomas Clear, T.C.; John J. Ryan, T.C.; W. T. Dinnage, T.C.; M. A. Manning, Esq.; Alderman W. L. Cole, Charles A. James, T.C.; Thomas Morrison, Esq.; Alderman M. Flanagan, Vere Ward Brown, J.P. ; John H. Bell, Esq. ; Sir John Moore, M.D. ; R. L. Swan, M.D. ; Henry O'Neill, Thomas Kennedy, T.C. ; Patrick J. Monks, Joseph Tatlow, Moses Crowe, T.C. ; Garrett Begg, T.C. ; Anthony Madden, T.C., High Sheriff ; P. J. O'Neill, J.P. ; Chairman Dublin County Council ; Frederick P. Dixon, C.E. ; F. P. Fawcett, Alderman Robert O'Reilly, James Cahill, T.C. ; W. B. Connolly, Esq. ; W. Butler, Esq. ; Alderman Gerald O'Reilly, Thomas Baker, Esq. ; Francis McKenna, Esq., T.C. ; John Scully, T.C. ; Thomas O'Reilly, T.C. ; A. McMurrogh Murphy, Esq. ; J. C. Hogan, Esq. ; Richard Jones, J.P. ; R. Findlay Heron, Esq. ; Ed. P. Monk, Esq. J.P., T.C. ; Henry Campbell, Town Clerk ; Thomas Cahill, T.C. ; J. J. Clancy, M.P. ; Joseph Mooney, J.P. ; James Byrne, T.C. ; James J. Henry, Esq., Assistant Town Clerk ; James Carlyle, James Crabbe, Michael Murray, T.C. ; Charles J. McCarthy, City Architect ; Joseph P. Kerrigan, John J. Murphy, Esq. ; Patrick J. M'Call, T.C. ; John P. Wakeford, W. Cranwill Wilson, C.E. ; Ed. Meade, T.C. ; Henry Allen, Esq. ; Stephen MacKenzie, Esq. ; Thomas Morrison, J. R. Lloyd, Wm. Johnston, T.C. ; George Perry, J.P. ; Spencer Harty, City Engineer ; F. Scallan, Esq., solicitor ; Nicholas Proud, Esq. ; David Ross, Esq. ; Alderman Thomas Kelly, Alderman Charles Dowling, E. Cameron, Esq. ; Charles Power, Esq. ; Dr. Louis A. Byrne, Patrick Tobin, Secretary Improvements Committee ; George D. Gray, Esq., C.E. ; G. S. Harty, Esq., C.E. ; Messrs. Gwynne, contractors ; Henry G. Burgess, Esq. ; Laurence Malone, Esq., J.P. ; Alderman J. J. O'Farrell, John Kelly, T.C. ; Joseph N. M'Coghlan Briscoe, T.C. ; Francis Purcell, Esq. ; Frank FitzGerald, Esq. ; A. R. Barlas, Esq. ; James Martin, Esq., contractor ; John Wyse Power, Esq. ; Lorcan G. Sherlock, Esq., T.C. ; John Parkinson, T.C. ; Frederick J. Allen, Esq., Secretary Lighting

THE RIGHT HONBLE. JOSEPH M. MEADE, LL.D., P.C.

Lord Mayor 1891-2, and Chairman of the Special Main Drainage Committee for ten years.

Committee ; E. W. Eyre, Esq., City Treasurer ; Henry Williams, Esq. ; Bindon B. Stoney, Esq., LL.D. ; H. H. Hellins, C.E., Resident Engineer; Marcus Goodbody, Esq,, J.P. ; Wm. Wallace, J.P. ; Charles Smith, Esq.; John O'Reilly, Esq., T.C. ; John Kavanagh, Esq., T.C. ; Patrick T. Daly, T.C. ; James D. O'Connor, J.P. ; Samuel S. McCormick, J.P. ; Michael Murphy, J.P.; the Attorney-General, R. R. Cherry, K.C., M.P. ; Sir James Murphy, Bart. ; Sir Wm. Watson, D.L.; the Solicitor-General, Redmond Barry, K.C. ; James H. Campbell, P.C., K.C., M.P. ; John Murphy, Esq.; John J. O'Meara, T.C. ; Daniel Burke, Esq., T.C.; Joseph P. Camac, T.C.; Michael Moynahan, C.E. ; Ml. J. Buckley, C.E. ; Charles J. McCarthy, Isaac Usher, J.P. ; Oliver Fry, J.P. ; W. G. Barrett, J.P. ; John Hughes, John Kavanagh, Thomas F. Burke, solicitor ; James F. Egan, John H. Parnell, John Barlow, Wm. Kavanagh, T.C. ; Gerald J. Sherlock, R. S. Trisilian, Esq. ; C. W. Gordon, Esq. ; Sir John E. Barry, J. Beckett, J.P. ; E. J. M'Weeney, M.D. ; M. J. Crosby, James Kavanagh, J.P.; W. L. A. Goulding, Patrick Byrne, Esq. ; Thomas O'Donnell, Esq.; F. A. Riggs, Esq. ; William Edie, Esq. ; Captain Thomas Purcell, Vincent Crosby, Esq. ; D. Stewart and Co., contractors ; John Clancy, Esq.; W. A. Craig, J.P. ; Joseph Berry, C.E. ; J. C. Percy, J.P. ; T. J. Cotton, P. C. Cowan, M.I.C.E. ; Mark Ruddell, M.I.E.E. ; Stanley Beeton, Ralph Smalley, Esq. ; Patrick Nally, Esq. ; Wm. J. Leahy, Esq. ; Charles Dawson, Esq. ; Francis Purcell, Esq. ; T. R. Lamphier, Esq. ; Frederick W. Pim, Esq. ; M. F. Keogh, Esq. ; F. H. Wayland, Esq. ; Henry O'Connor, Esq. ; R. J. O Dwyer, Esq. ; Wm. J. Murphy, Esq. ; Henry Conyingham, Esq. ; Thomas Fitzpatrick, Esq. : Sir Charles Cameron, C.B., M.D., Executive Officer of Health; Max Green, Esq.; Alfred Tenison Collins, Esq.; Thomas Brindley, Wm. Collen, Esq., C.E.; John M. Kean, Esq. ; Joseph Tatlow, Wm. Ireland, J.P. ; G. C. V. Holmes, Esq.; Thos. Stewart, Esq. ; L. A. West, Esq. ; Thomas Martin, John Mooney, J.P. ; J. C. Manly, Esq. ; John Doyle, Esq. ; David Pigott, Esq. ; J. W. Drury, Esq., M.A. ; J. H. Middleton, C.E. ; P. H. Hanson, Esq. ; M. F. Purcell, Esq., M.I.C.E. ; E. J. Harty, Esq. ; John Smellie, Thos. Hewson, Patrick O'Brien, M.P. ; J. H. Davis, William Brew, W. F. Cotton, Jr. ; F. T. Cotton, Esq. ; W. H. Mills, Albert Gordon, Percy La Touche, D.L. ; Robert Jameson, Esq ; Edward FitzGerald, Esq., J.P. ; R. L. S. Badlam, Esq. : J. Talbot Power, Esq., D.L. ; J. D. Bolton, Arthur Armstrong, C. A. Fleming, J. W. Chancellor, James Clements, B.A. ; Robert S. Jackson, Sir Lambert H. Ormsby, M.D. ; T. W. Russell, M.P. ; Daniel Tallon, A. Beattie, D.L., J.P. ; David Byrne, J. A. Kinnear, Captain John Weatherill, E. L. Richardson, J. G. O'Sullivan, C.E. ; John St. P. Macardle, John McCabe, C.E. ; James Gallagher, T. Foley, J. E. S. Condon, LL.D. ; A. J. Callaghan, LL.D. ; John Byrne, Esq. ; A. G. Coates, Esq. ; Francis M'Bride, J.P. ; M. F. Judd, J.P. ; J. Dignam, Esq. ; Richard Cronin, George Waterfield, Bartholomew North, Rev. J. Byrne. P.P. ; R. J. O'Dwyer, J. J. Cleary, R. H. Gill, George Freeman, Very Rev. Dr. McHugh, P.P., V.G. ; J. McAuley, B.L. ; John E. Fottrell, J. J. Lenehan, James Shanks, J.P. ; N. Kavanagh, Charles Hyland, M. O'Reilly, F. B. Ormsby, Captain Geo. Greaves, George Fottrell, E. H. Ennis, B.L. ; H. G. Cooke, Andrew Dunlop, A. J. Murphy, A. E. Murray, T. O'Meara, Thos. Sexton, Jas. Beatty, Chas. McDermott, Esq.

Alderman Cotton having, amidst loud cheers, set in motion the machinery which allows the effluent from the precipitation tanks to enter the River Liffey, said, "I now declare our Main Drainage Works open," and the formal part of the proceedings terminated.

At the subsequent luncheon given by the Chairman, Alderman Cotton, the following letter from Mr. Hellins, C.E., formerly the Corporation's Resident Engineer during the construction of the works, was read :—

"DEAR SIR,—I wish to thank you for remembering me in connection with the inauguration of the new Main Drainage, but I regret the distance is so great, and hope you will excuse me not accepting your kind invitation to lunch on the 24th inst. I am writing with the knowledge that my position as resident engineer to the works for so many years enables me to do, when I add that the structural fabric of the Dublin Main Drainage Works is second to none in the world. Whilst your inspectors may speak with some knowledge of details of particular sections, and your consulting engineer can speak of the finished work as a whole, I can speak of every section from daily contact with it whilst in progress. I consider the cost of maintenance of the works which fell to my lot to supervise will be almost nil—at least something very small when their enormous size is taken into consideration. I wish the scheme every success."

The Chairman then made the following statement :—

"GENTLEMEN,—It is now nearly three-quarters of a century since the drainage of the City of Dublin was first contemplated. Indeed, so far back as the year 1868, the Corporation, by advertisement and otherwise, sought proposals from all parties competent to advise on the subject of abating the Liffey nuisance. About that time their Engineer, in conjunction with Mr. Bazalgattee, Engineer to the Metropolitan Board of Works, London ; Mr. Stoney, Engineer to the Dublin Port and Docks Board ; and several others, were consulted on the subject. Plans and specifications were prepared by Messrs. Parke Neville and Bazalgattee to discharge the whole of the sewage of Dublin and certain townships at the North Bull. Subsequently it was found that the Corporation had no means, statutory or otherwise, for raising the necessary funds for carrying out the works, consequently they had to be abandoned. Year after year complaints became more numerous, so much so that a Royal Commission was called for ; deputations were appointed, who waited on the Lord Lieutenant and on the Government, but to no purpose. Matters remained in this condition until June, 1869, when the plans of Messrs. Parke Neville and Bazalgattee were adopted by the Municipal Council, and it was decided to apply to the Exchequer Loan Commissioners for a loan to carry out the works. Subsequently, a memorial of the inhabitants of Dublin was presented to the Lord Lieutenant, praying that the Privy Council would make an order under

HENRY CAMPBELL, TOWN CLERK,
Secretary Main Drainage Special Committee, 1893 to 1901.

29-30 Vic., cap. 90, sec. 49, requiring the Corporation to take measures for the purification of the River Liffey. In 1870 communications passed between the Government and the Corporation with a view to obtaining a loan of the necessary funds, with the result that a statute was passed enabling the Exchequer Loan Commissioners to lend the Corporation £350,000. The Corporation in the next Session of Parliament (1871) promoted a Bill to enable them to carry out the works. The Bill became law, and is known as 'The Dublin Main Drainage and Purification of Liffey Act, 1871,' which Act included not only the City of Dublin, but also the Pembroke and Rathmines townships. Surveys, levels, plans, and specifications were completed in 1873, and tenders were sought for the necessary works, but owing to the

ENORMOUS AND EXCEPTIONAL PRICES

to which all materials, especially iron and cement, had risen at the time, consequent on the coal panic and the extraordinary disturbance in the labour market, it was found that the lowest tender amounted to £775,054, the next lowest being slightly under £900,000, consequently the works had to be abandoned. Again in 1874 the Corporation sought for and obtained tenders, the lowest being £443,494. As the Corporation was neither empowered to borrow or the Treasury to lend so large a sum, it was proposed to seek further powers from Parliament and afford the citizens an opportunity of considering whether they would sanction the increased taxation necessary. Meantime several suggestions were made for the temporary abatement of the nuisance caused by the state of the river. Suggestions on the subject were received from the Lord Lieutenant and Mr. Roberts, Assistant Commissioner of Works, all of which fell through. Questions were asked in the House of Commons as to complaints made by the Lord Chief Justice and others as to the state of the Liffey. It was then intimated by the Chief Secretary that the Government would deal with the matter if steps were not taken by the Corporation to abate the nuisance, while at the same time intimating that if the delay in executing the works was caused by the question of expense, favourable consideration would be given to any application made by the Corporation for a loan. It was therefore resolved to apply to Parliament to increase the borrowing powers of the Corporation to the extent of £150,000 to make up a sum sufficient for the execution of the works. In August, 1875, an Act (38 and 39 Vic., cap. 69) was passed, which empowered the Loan Commissioners to advance £500,000 for the works, but in November following the Chief Secretary wrote stating that the Treasury had considered the reply of the Corporation to the interrogatories furnished by them, and that the Public Loan Commissioners were of opinion that the statement supplied by the Corporation of the assessments made by them for various purposes for the next three years, and as the valuation of such assessments discloses that the amount required to be raised by the assessment involved the levelling of unusual high rates upon the valuation so set for the assessment within the existing limits of the area rateable for the repayment

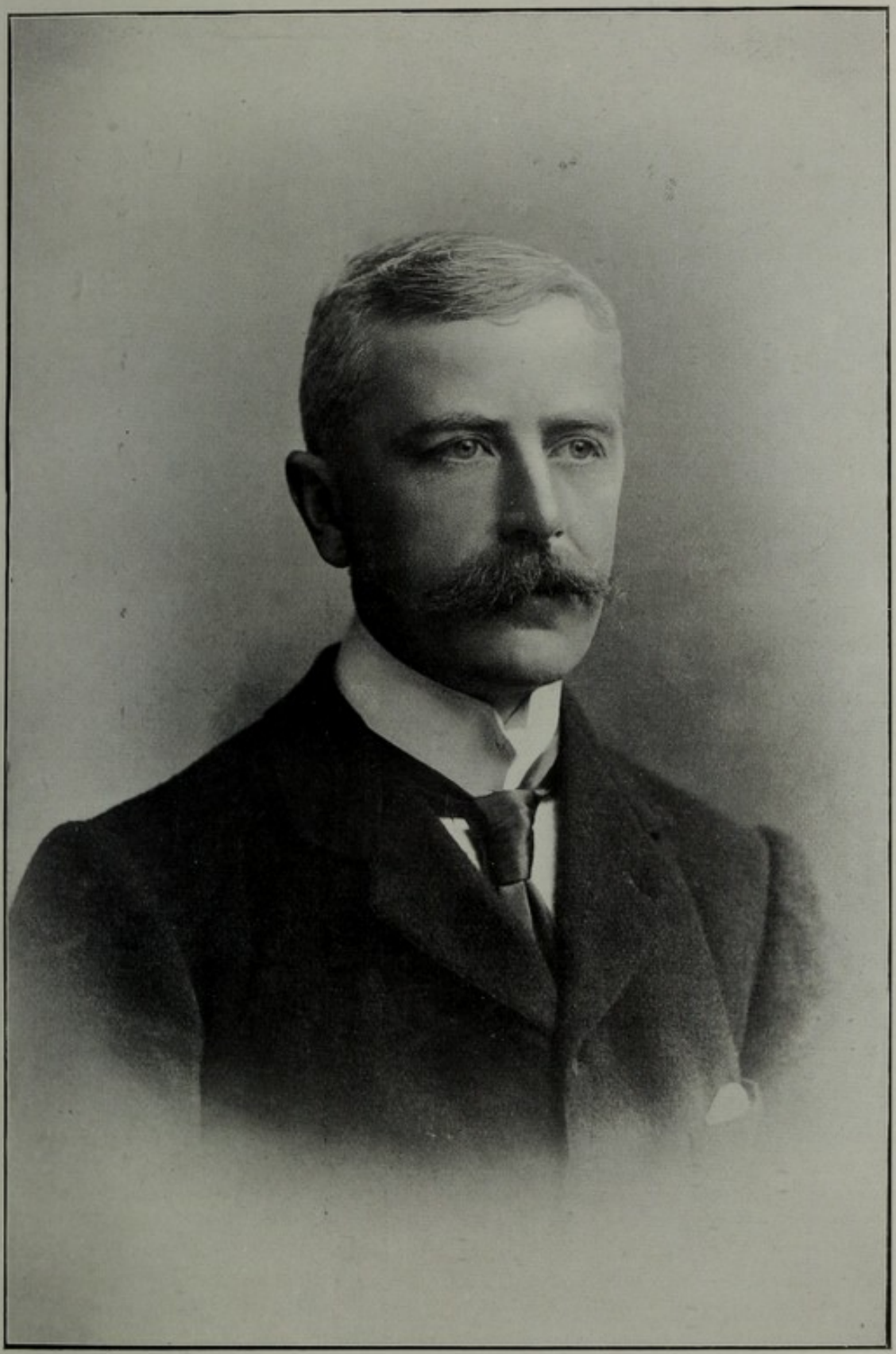
of the proposed loan, and such being the case, the security of a further rate upon the property within these limits appears to be insufficient, the Treasury state that, under the circumstances, it was

IMPOSSIBLE FOR THEM TO AUTHORISE THE ADVANCE

in the face of this information, and that it was for the Corporation to improve the security offered. The Chief Secretary pointed out that no time was to be lost if it should be found that increased Parliamentary powers were necessary to enable the Corporation to satisfy the requirements of the Public Works Loan Board. But what happened towards the end of the month? Notice was served on the Corporation of an application for an injunction to restrain the Corporation from proceeding with the proposed Main Drainage Amendments Bill, consequently it was decided not to proceed with the work, the Government having declined to grant the required loan. No steps were taken from 1875 until the Public Health (Ireland) Act was passed. The passing of that Act placed the Corporation in the position to raise money by the issue of stock without applying to the Treasury. Some time subsequent the Corporation opened negotiations with the War Office for the purchase of the Pigeon House Fort, but what with disputes about the site of the precipitation tank, the outfall, etc., it was not until the Local Government Board held an inquiry in 1892 that a decision was arrived at and a provisional order obtained for the carrying out of the works. The Committee (the Main Drainage Committee) was appointed by the Municipal Council to carry out the works, which have been brought to completion so far as the City of Dublin was concerned. I might mention that the money raised for carrying out the whole of the works was borrowed on the security of stock issued by the Corporation of Dublin, and that no money whatever was borrowed from the Treasury.

THE CREDIT OF RAISING THIS STOCK

at a reasonable rate of interest is due to our City Treasurer, Mr. Eyre. Previous to the Public Health Act, 1878, the river was comparatively a very pure one, and it was only after the passing of this Act that w.c.'s were regularly introduced into the city, and privies and cesspools done away with under the distinguished administration of the officer of Public Health, Sir Charles Cameron. Although this advanced improvement was, and is, for the benefit of the public health, yet it was the chief cause of the fouling of the foreshores of the river. Indeed, previous to the introduction of the Vartry the streets of the city were watered by pumping water from the river, as pumps were fixed at each end of the bridges, and from thence the water was taken. It is only of comparatively recent date—about 35 years ago—that these pumps were removed. The Dublin Corporation Main Drainage Works were designed in 1891 to take the sewage of the then outlying districts of Clontarf township, Drumcondra, Clonliffe, and Glasnevin township, the urban district of Grangegorman, and New Kilmainham township, together with the City of Dublin as it then existed, and convey it to the Pigeon House to be treated there. Since then these districts, together with the comparative small additions of Chapelizod village and a small portion of the rural district of Crumlin and Donnycarney, were annexed by the Corporation, and the



EDMUND W. EYRE, CITY TREASURER.

city extended under the Dublin Corporation Act, 1900, which came into operation on the 15th January, 1901. When the works were designed the Corporation was not the sanitary authority of the outside districts above referred to, and, consequently, had nothing to say to their internal drainage, the scheme as designed merely enabling the Corporation to take their sewage and drainage into the Corporation system and so treat it. Clontarf drainage will be dealt with by an intercepting sewer running along the foreshore, and together with that coming from Drumcondra, will be taken into the main drainage system at Poplar Row, near Ballybough Bridge, thus purifying not only the sea front all along the Dollymount and Clontarf foreshore, but also purifying the Tolka River, which at present is very much fouled by the drainage from Glasnevin and Drumcondra districts. Kilmainham district is to be drained by two systems of sewers —one which follows the line of the Camac River, and the other goes through the Great Southern and Western Railway grounds at Kingsbridge, and thence along the bed of the Liffey to Hospital lane, at Island Bridge. It was necessary to have two lines of sewers for these districts, as two separate valleys or drainage districts had to be dealt with. One is the Liffey Valley, and the other may be called the Camac. The internal main drainage of the city is dealt with by two main intercepting sewers, one on the Northern quays, and the other on the Southern. That on the Northern side commences in Parkgate Street at Infirmary road, and ends opposite Marlborough Street, where it is joined by the drainage coming from Drumcondra, Glasnevin, Clontarf, and the North-Eastern portion of the old city; the entire there passing under the River Liffey by means of a syphon to Burgh Quay, where it is joined by the main intercepting sewer on the South side of the river; the entire being then carried by an eight feet circular brick and concrete sewer from Burgh Quay to Victoria Bridge, under Grand Canal Docks at Great Brunswick Street, the whole of this eight feet sewer being carried out in tunnel, and in connection with which

GREAT DIFFICULTIES WERE ENCOUNTERED.

From Victoria Bridge the sewer was continued by an eight feet cast-iron sewer to the pumping station on Pigeon House road, the work being carried out by the Greathead Shield process, and in connection with which even greater difficulties were met with, inasmuch as the entire of this ground is composed of loose filling—sand, gravel, earth and is what is known as made ground. In passing under the River Dodder there were only from two to three feet of clay between the top of the sewer and the water in the river, so that naturally there was great anxiety on the part of the contractors and engineers and all concerned until this portion of the work was executed, as provision had to be made for the escape of the men and engineers in case the river came in on them during the process of driving the shield; indeed so porous was the ground that air bubbles could be seen coming up all over the river, close to where the shield was working, and also in other places where there was water on the surface. Whilst the works were under construction the connections between the old city sewers and the main intercepting sewers were temporarily built off by timber shutters, but some of these have now been removed to permit of the system being put into operation, and the remain-

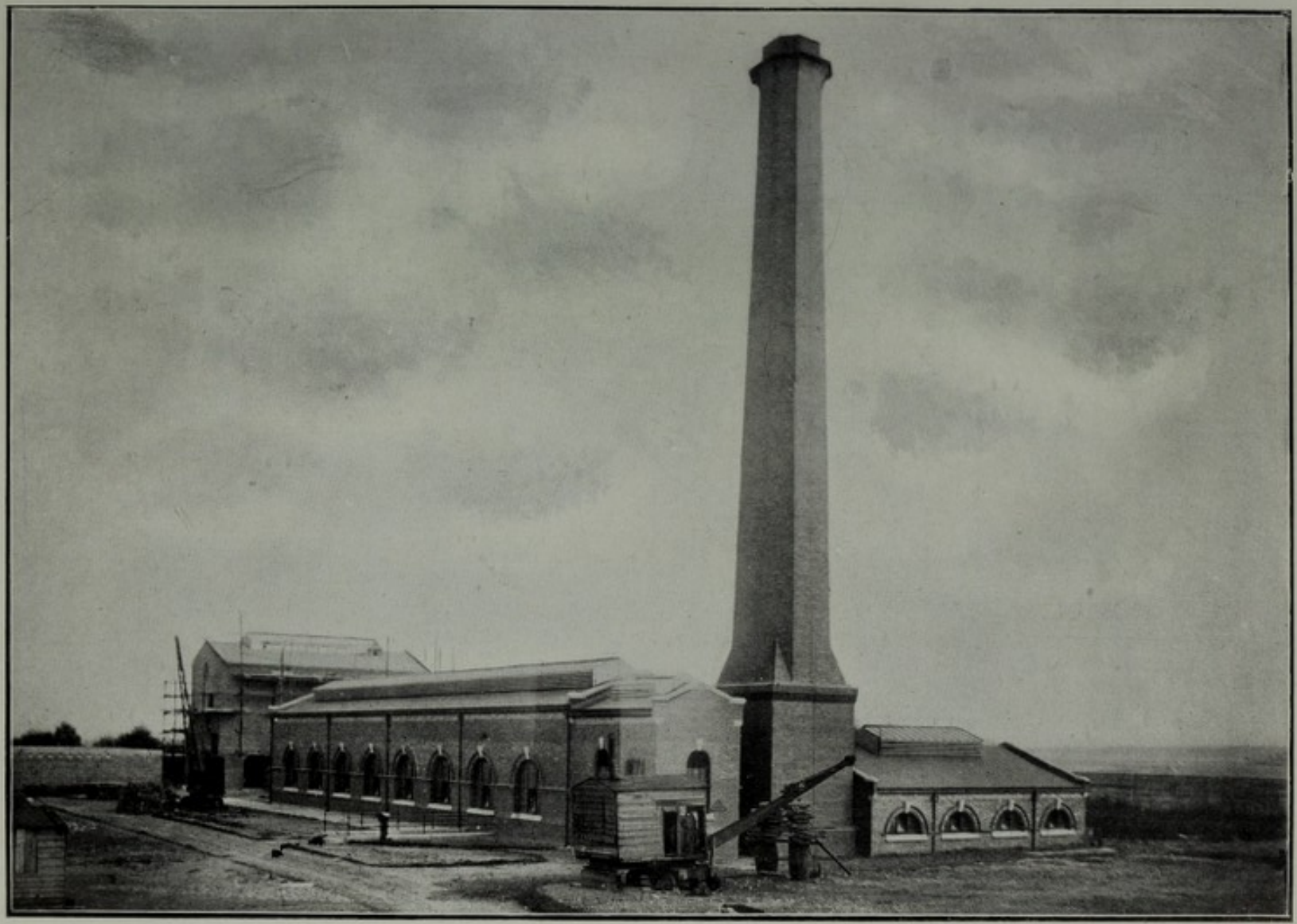
der daily, until the entire city is dealt with. The syphon under the river is constructed of cast iron pipes, lined with blue bricks, finishing to a diameter of 3ft. 4in. It is carried through solid rock at a depth of 21ft. under the bed of the river (taken in the centre of the stream) the bottom of catch-pit being 50ft. below the quay road level at Burgh quay. The length of 200 feet horizontally from centre to centre has a fall of 6in. for constructional purposes. The descending leg is reduced by a proper taper pipe from 4ft. 6in. to 3ft. 4in., and the rising leg is also 3ft. 4in. in diameter, so that the same velocity should be maintained in the whole course. At

THE PUMPING STATION

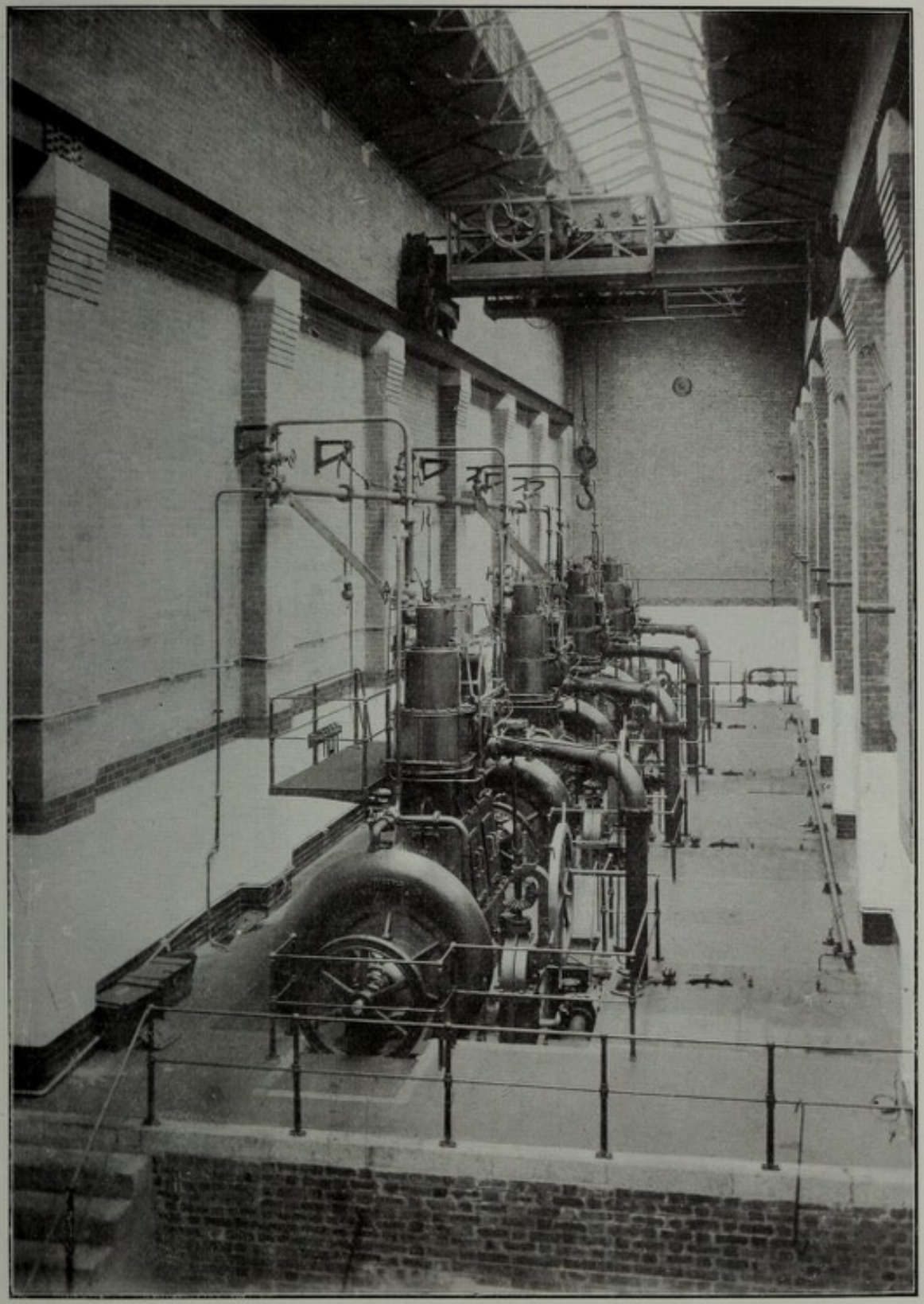
there are four main pumps fixed at the station on Pigeon House road, each to lift fifteen million gallons per twenty-four hours, the lift being 23 feet—three being kept constantly at work and one in reserve. There are two small pumps to lift five per cent. of the dry weather flow of sewage, to mix with the lime in order to make lime water—one, of course, as is usual, acting as reserve. The total of the working capacity of the three large and one small pump is 46,107,000 gallons per day—equal to 5,123 cubic feet per minute, but if the stand-by plant had to be utilised and put into work, the entire would be capable of dealing with 62,214,000 gallons per diem, or 6,912 cubic feet per minute. A screen chamber, with screens or filth hoists, in duplicate, has been inserted at the junction of the low-level sewer and the pump walls. This screen is made of half-inch iron bars, with one-inch pitch. There are in all eighteen precipitation tanks, each being 94 feet square. Of these six will always be in full working, three being cleared daily, and nine out of use, being kept for storm water emergencies and storage. The process of clarification will be by lime, and what is known as continuous precipitation ; practically all suspended matter will be taken out of the sewage. The sludge is to be swept from the tanks into a culvert, which has been constructed under the inlet channel from one end of the works to the other, from which the sludge will be pumped to the high level sludge tank, the sludge ship being served from this tank. The sludge culvert, together with the low level sludge pit, and high level sludge tank, will store eight days' sludge to provide against periods when the sludge vessel cannot go to sea in consequence of stress of weather. The sludge which remains

AFTER PRECIPITATION

must be discharged outside the port and Bay of Dublin, not less than six miles distant from Poolbeg Lighthouse, and North of a line drawn due East from the Bailey Lighthouse ; and in order to carry out this requirement the Corporation entrusted the Dublin Dockyard Company with the building of the "Shamrock," at a cost of £11,139, and which does much credit to this firm and to local labour employed by them. This sludge vessel will go out to sea daily, and at each trip, when works are in full swing, will take about 350 tons of sludge to sea. The total cost of these great works being £508,000. The Corporation and the citizens certainly have cause for congratulation upon the completion of the Main Drainage undertaking—the last of a series of works of great magnitude which have become necessary in the modern development and

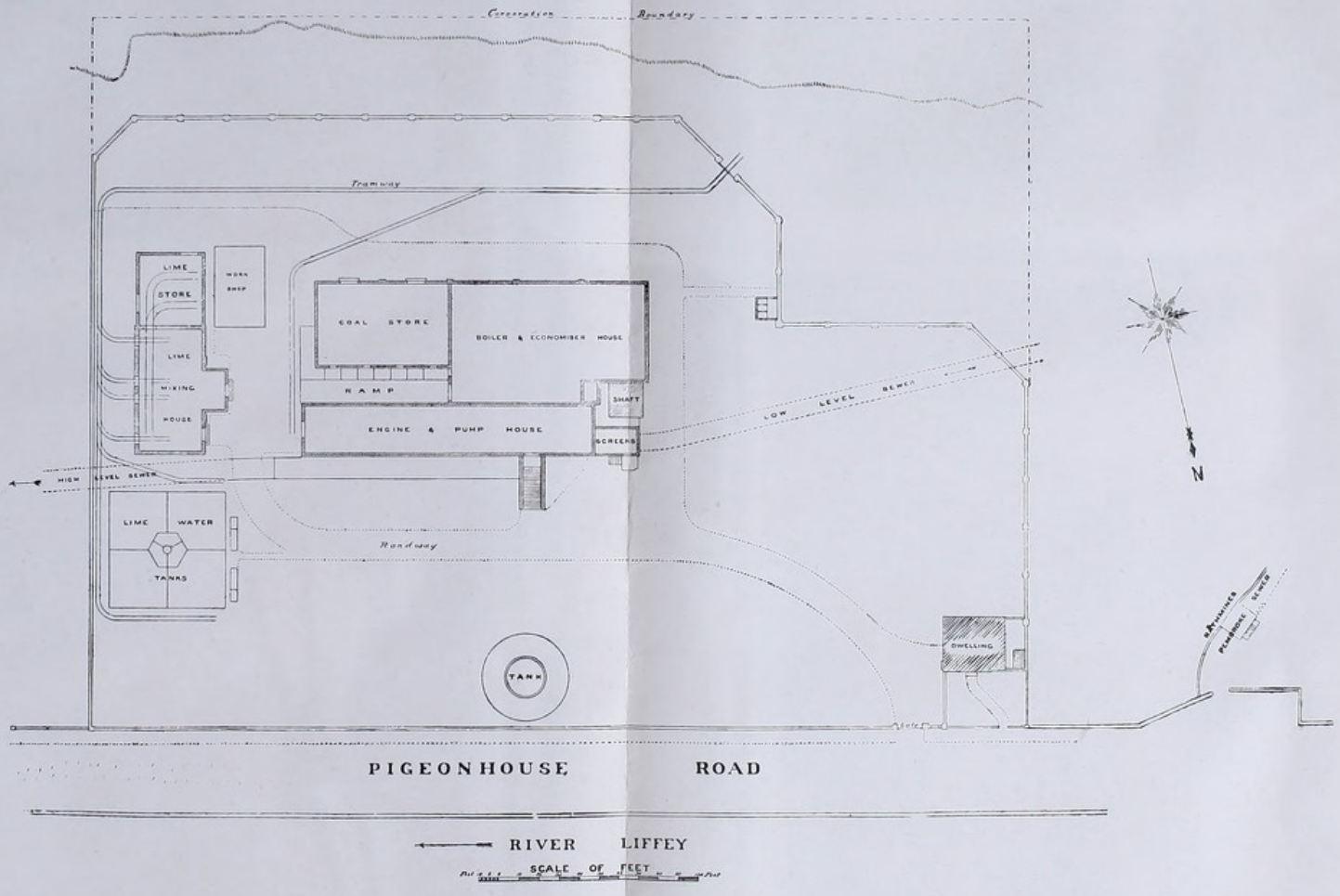


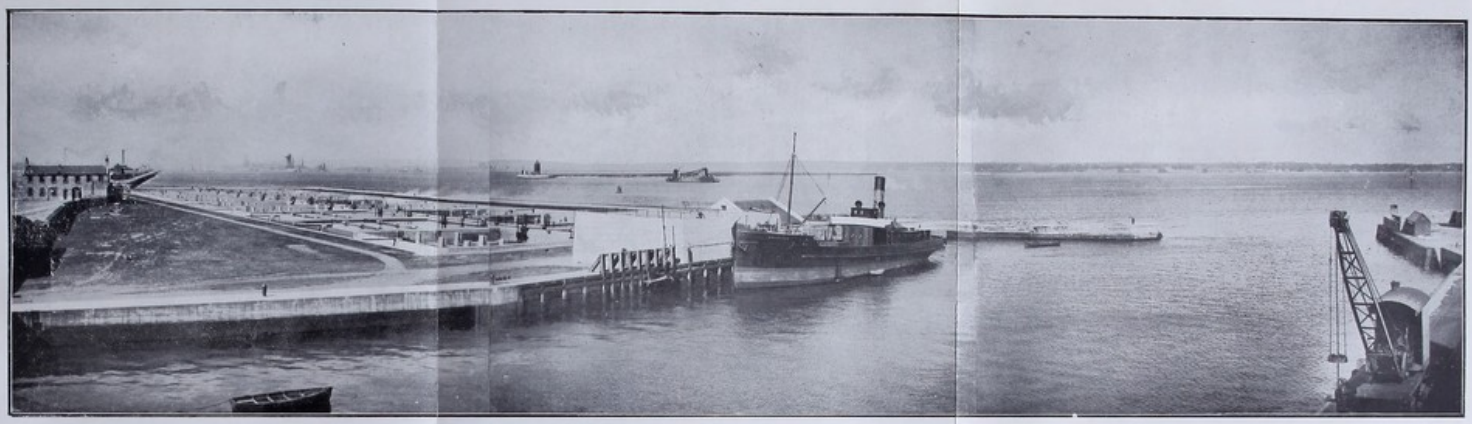
PUMPING STATION,
With Liming Station in background nearing completion.



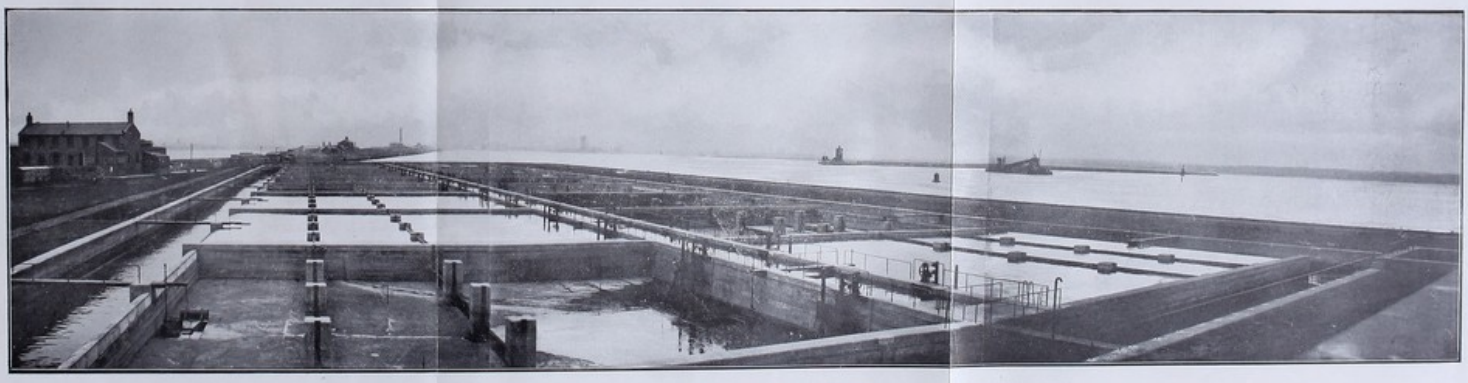
INTERIOR OF PUMPING STATION.

DUBLIN MAIN DRAINAGE
PUMPING STATION





GENERAL VIEW OF OUTFALL WORKS AND NEW HARBOUR WITH SLUDGE VESSEL T.S.S. "SHAMROCK."



OUTFALL WORKS, SHEWING SOME OF THE PRECIPITATION TANKS IN OPERATION.

organisation of large cities. In thus completing its Drainage Scheme Dublin stands well abreast of any other city of its size and resources, indeed, it is second to none—irrespective of size and resources—in the promotion and carrying out of its various schemes of improvements, and certainly many cities which boast of greater wealth and larger population must take a backward place when compared with Dublin in the matter of municipal works carried out for the welfare of its citizens. As another safeguard in the interests of public health, the magnificent system of the Vartry Waterworks still remains a standing memorial to the foresight of its originators and promoters. There can be no doubt that the introduction of this

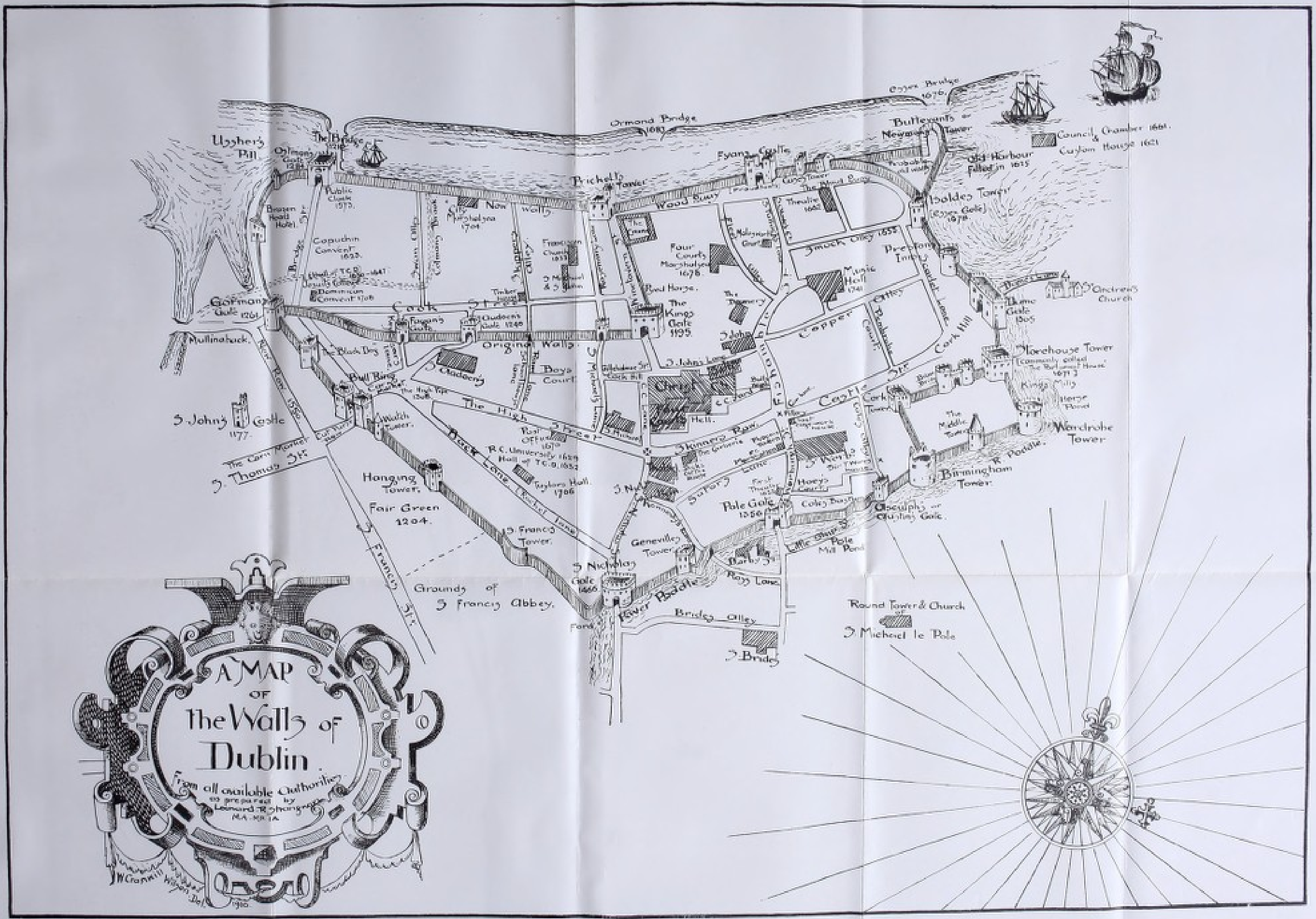
SPLENDID WATER SUPPLY

wrought a great improvement in the health of the city, and proved a wonderful boon to the citizens of all classes. For the purpose of maintaining this water supply in its state of full efficiency, and to enable an ample supply to be had both in the city and outlying districts at all times of the year, the Corporation is now engaged in completing a new line of arterial main through the country, and in laying a large number of new mains throughout the city to the higher levels; while as a precaution to any possible lengthy drought an additional reservoir is about to be constructed at Roundwood, so that as far as human effort can avail the supply of Vartry water will, under all possible conditions and circumstances, be both ample and reliable. The completion of the extensive electric light and power installation in the city is of too recent a date to be now further dealt with, but reference might fairly be made to the activity of the Corporation in the matter of the housing of the working classes, which is one vitally affecting the public health. The Corporation has already provided a large number of different schemes for properly housing the workers, and at the present time the works are in operation for two additional schemes, viz., one at Foley Street, and the other at the Oblate site, Inchicore. Both will provide a much needed extension of housing accommodation of the working classes. A third scheme, in Townsend Street, will be undertaken almost immediately. In addition a number of open spaces and recreation grounds have been made from time to time, so that Dublin is now amply provided in what are well described as the "lungs of the city," but notwithstanding this the Corporation is at present constructing a park of about 57 acres at Fairview to replace the sloblands there, which have long been a nuisance, an eyesore, and a danger to public health. The solicitude of the Municipal Council for the safety of the lives and

PROPERTY OF THE CITIZENS

in the matter of fire is well exemplified in the provision of increased fire brigade facilities in various parts of the city. At present the new Central Fire Station, corner of Tara Street and Great Brunswick Street, is well on the way to completion, and, when finished, Dublin will not be second to any city of the three kingdoms, or, possibly, even cities in America, which are well known to be so advanced in the matter of organisation for prevention and fighting of fire. Again, the number of public libraries which have been established throughout the city shows

that the Council has not neglected the improvement of the minds of the citizens, and the utility of these institutions is well demonstrated by the very large numbers of the public who patronise them. Apart from the recent completion of the new market in Francis Street, so generously provided by Lord Iveagh, the Corporation has already an admirable system of markets for cattle, sheep, and pigs, hay and straw, as well as fish, fruit, and vegetables, which are found to be of the greatest benefit to the users, and to be fully equal, if not superior, to such accommodation provided in other cities. The public abattoir, which is likewise a Corporation institution—equipped, as it is, with modern cold storage accommodation—is another undoubted benefit to public health in the city, as any extension of the private slaughter-house system is most undesirable, whilst all operations in the abattoir are conducted with the maximum of cleanliness. Again, the fine public baths and wash-houses, which the Corporation have now in operation for many years, are a great boon to their numerous users, and in their own way contribute to the improvement of the public health. In addition to the above works, of course the ordinary routine work of cleansing, paving, etc., throughout the city is carried on continuously with the greatest efficiency, and have now thoroughly succeeded in causing to be forgotten the old-time expression, "dirty Dublin" (applause).



A MAP of The Walls of Dublin.
From all available authorities as prepared by Leonard R. Strangways M.A. M.R.I.A.
J.W. Crannill Wilson Del. 1910
Essex Bridge 1676
Ormond Bridge 1683
The Bridge
Ussher's Pill
Gorman's Gate 1261
Mullinahack
S. John's Castle 1177
The Corn Market
S. Thomas St.
Hanging Tower
Fair Green 1204
Grounds of S. Francis Abbey
S. Francis Tower
S. Francis St.
Cook Street
Original Walls
The High Street
Back Lane
Four Courts Marshalsea 1678
Wood Quay
Prickett's Tower
Fyans Castle
Buttevants Tower
Council Chamber 1681
Custom House 1621
Old Harbour Filled in 1615
Isoldes Tower
Essex Gate
Prestons Inns
Smock Alley 1655
Music Hall 1741
Copper Alley
Cork Hill
S. Andrew's Church
Dame Gate 1305
Castle St.
Storehouse Tower
Wardrobe Tower
Birmingham Tower
R. Poddle
The Middle Tower
Pole Gate 1356
Geneville's Tower
S. Nicholas Gate 1466
Pover Poddle
Bride's Alley
S. Brides
Round Tower & Church of S. Michael le Pole
Skinners Row
The Kings Gate 1195
Boys Court
S. Audoen's
Bull Ring
Tailors Hall 1706

DUBLIN: ANCIENT AND MODERN.

AN HISTORICAL SKETCH.

To obtain a true notion of what Old Dublin was like three or four centuries ago, one must first dismiss all, or nearly all, ideas suggested by the city of to-day. As in other walled towns of the Middle Ages, every inch of space was of value. A large area necessitated a long wall with corresponding gates, towers, and ramparts, and this meant a greater strength of garrison if the ward was to be effective. Hence the wall was kept as short as possible, though the consequence was a frightful congestion of the city's inhabitants in streets that were but narrow lanes, and in passages and courts that admitted no sun and little air. Sanitation, even of the crudest kind, was unknown. Street and alley reeked with filth: open drains served in a fashion as sewers; the water supply was obtained from wells sunk in the foul soil, from springs, open conduits, and tanks that could not under much better circumstances escape contamination. Visitations of the plague and of other epidemics were frequent, and only when the mortality menaced the whole population was any special alarm created. When unthinking critics of the present talk of the "Good old times," with their pageantry, colour, picturesqueness, and the rest, they might profitably remember, also, that these were the Ages of the Black Death.

How small was the area of the walled city towards the close of the sixteenth century may be gathered from a contemporary description of the entire circuit. Starting at the Bermingham Tower we are told that:

"From Bremyngham's Towre to Stanirste his Towre is one hundred and ninety-six foote distant, whereof there is next the said Bremyngham's Towre sixty-four foote within the Castell diche not rampered, and from thens to Stanirste his Towre being one hundred and thirty-two foote is sufficientlie rampiered and firme grounde, twenty foote hie from the foundacion of the wall; which wall is twenty-eight foote hie, whereof eight foote is above the said rampier, besydes the garettes and seven foote thicke. The said Stanirste his Towre is rounde without the wall and skware within, three stories hie with three tymber loftes, and in the loer storie three lowpes, in the seconde storie one lowpe (loop-hole), and in the third storie twoe lowpes; the wall six foote thicke nineteen foot sqware within, and the Towre forty-six foot hie, besydes the garrettes."

This may be taken as a fair description of the other towers and the curtain-wall connecting them. It may be of interest to name them with the city gates in order, as well as the distance between, omitting the quaint verbiage of the old survey. From Stanihurst's Tower to the Pole Gate, at the Southern end of Werburgh street, was 168 feet; thence to Genevel's or Joinville's Tower, 186 feet; thence to St. Nicholas Gate, which stood at the meeting of Nicholas street and Patrick street, was 252 feet. From this Gate, which was strongly defended by two towers that were customarily used for displaying the spiked heads of Wicklow rebels, to the Tower described as "in Sir Wm. Sarsfelde's[1] pocession," was 312 feet. Next was the small Tower in the possession of Mr. Christopher Sedgrave, 340 feet distant; after that a Tower in Mr. Richard Fagan's possession 90 feet away; and, a further 120 feet distant was "the Sowtheaste Towre of the Newe Gate . . . . the wall seventeen foote hie and fyve foote thicke and no rampier within the said wall, but howses joyning close to the said wall within . . . . The Newe Gatte have twoe Towres and every Towre is three heightes," and there is a long description of the New Gate of the olden days. Whoever passes through the gate leading to Kilmainham from the old Priory, commonly known as the Old Man's Hospital—a rather curious perversion of title that still retains a meaning—will see a replica of the ancient Newgate or Newe Gate that stood where Francis street runs at an angle to meet Cornmarket. It was the strongest point in the City defences, and dated back to some time before 1188, for the old laws of the City enact at that time that the ancient watchman should thence "begin his patrole at the New Gate and so through the High Street to the new Tholsel, and so far as St. Patrick's Gate at the end of Bertram's Court, including Rochel Street, and the three lanes (venellæ), namely, St. Audoen's Lane, Gillamocholomog's Lane, and the other lane leading to the house of Thomas le Marechal." That seems to have been the furthest range of the police regulations of Dublin in that remote era.

Towards the river, the 22-ft. high wall ran to "the Towre in Mr. Fitzsymons' pocession," a massive structure designed to protect the lower slope of the hill, and 140ft. lower down was Gormonde's Gate, corruptly Ormonde Gate, and later Wormwood Gate. Then Harbarde's Tower, Mr. Usher's House, and the "Bridge Gatte" brought the line of circumvallation down to the river—"and the Liffie goethe hard by and at every full sea it floes upe against the said wall, being a springe tyde." Being now on "the Marchaunt Key" one encounters in succession, facing

[1] He was Mayor of Dublin in 1566, in which year he was Knighted for his services against Shane O'Neil (Shane the Proud). He died at Lucan in 1616, and was ancestor of the famous Irish soldier, Patrick Sarsfield, Earl of Lucan.

seawards, Prickette's Tower, Fianes' (or Fiandes') Castle, another Fitzsymond's Tower, Issolde's Towre,[2] and Buttevant's Tower,—"an ould square ruenus Towre"—by way of the strong house of Mr. Robert Bise, which must have stood near where Crampton Court is now, and so to "the Easte Gatte," called Dame's Gate, just sixty yards away, thus completing the circuit. Looking at a map of the space thus environed by fortifications, one will see how cramped and confined were the sturdy old burghers who lived so very strenuous a life.

It may be noted that the depth of the Liffey which washed the walls is given as varying from three to six feet, and the account from which this description is taken adds that:—

"There can be six foote depte of watter at leaste drawn in to all the diches abowte the town, with chardges done upon cleaning of the said diches and upon mackinge of Slussis for to staye the watter where the groundes do not meete in height levell."

Notwithstanding the danger of a sudden attack from the Irish enemy, as the native Irish were always termed, some proportion of the population ventured to live outside the walls. Streets, more or less substantially built, were pushed out from the various city gates. They probably counted upon finding refuge in the great ecclesiastical foundations that were in turn protected by the religious respect in which they were held by the Irish. The Anglo-Normans had small respect for any churches but those of their own foundation; the rude hillmen had no respect for Anglo-Norman lives, but they did not make war upon churchmen. Some of these ecclesiastical establishments acquired great wealth, mainly from the confiscation of the lands of the natives, and when Henry VIII. seized upon their possessions great was the spoil to be divided. Of such were the Abbey of St. Thomas in Thomas's Court, St. Mary's Abbey, founded by the Danes after their conversion to Christianity, originally for the Benedictines, but granted to the Cistercians in 1139; the great Dominican Abbey of St. Saviour's, which occupied the site of the present Four Courts; the abbey of St. Francis; the priory and abbey of St. John the Baptist; the monastery of the Holy Trinity, on part of the site of which Cecilia Street Medical School now stands; the Carmelite Priory, giving its name to White Friars Street—still, though externally changed, devoted to its ancient use; the great Priory of All Hallows, now with its grounds occupied by Trinity College, which with the Convent of St. Mary de Hogges was founded by

[2] Isod's Tower: Everybody knows the tale that has given opportunity for utterance to majestic song, music and story-telling. But this tower had no connection with the romance.

Dermot Mac Murrough before he, in conjunction with the devil and a woman, wrought the undoing of Ireland; with others of minor importance. St. Patrick's Cathedral was, of course, without the walls.

As illustrating the relations between the Norman ecclesiastics and the Irish, reference may be made to an Act passed in 1474, wherein it was enacted that as Richard, Abbot of St. Thomas, Walter, Abbot of St. Mary's, and Willian, prior of All Saints (All Hallows), Dublin, "having much land within the quarters of the Irish enemies, they were by the said Act permitted to send victuals to the said Irish; to let to farm, and sell the profits of their lands to them, to intercommune, treat, and be conversant with them, as well in war as in peace; and that they might be godfathers to the aforesaid Irish, without any offence or breach of law." At this time there was no peace between the two races. Any individual Paleman could legally kill an Irishman without question asked. On the other hand, the Irish took their revenge by desolating the Pale when least expected, thus provoking a counter attack, and the chronicles for nearly two hundred years are in no small part a catalogue of these incursions. But the citizens were themselves no mean fighting men. Thus we read under date A.D. 1405 that they fitted out a fleet of barques and going on board in June invaded Scotland at St. Ninian's, where they behaved themselves valiantly, and did much mischief. After this they sailed along the channel, and made a descent into Wales, and having ravaged the coasts brought from thence the shrine of St. Cubic, which on there return was deposited in Christ Church among other reliques there. Both these actions were in aid of King Henry IV., against whom the Scots had marched an army into England, and the Welsh, under the conduct of Owen Glendower, had rebelled. A subsequent entry in the annals is to the effect that on March 5th, 1407, the King, in recognition of these services, granted a license "that the Mayor, and his successors for ever, should bear before them a gilded sword, for the honour of the King and his heirs and of his faithful subjects of the said city, in the same manner as the mayors of London had borne before them." As a matter of fact this grant bears date 5 March, 1402/3. At a later date, throughout the Elizabethan wars, the citizens—or the mercenaries employed by them—displayed great activity in the various campaigns against the Irish.

The back-bone of the old walled-city that has been described was the ridge running westward from the castle, "the ridge of the hazel-wood" in Gaelic, along the top of which, then as now, lay the High Street. From it sloped down on either side the principal streets, or rather lanes, which were connected and intersected by numerous narrow alleys. At the Eastern End of the High Street, John le Decer, first provost of Dublin, erected at his own expense in 1308 a marble cistern to hold water for the

benefit of the citizens.[3] As early as the year 1254 a supply of water was brought to Dublin from the Dodder by the aqueduct which still exists. Passing by Templeogue the water course is joined beyond Mount Down flour mills by a small stream called the Poddle, which has its rise in a spring at Tymon. The stream thus formed was brought by way of Kimmage and Larkfield to the "Tongue," where it was divided, two-thirds of the current going to form the Poddle, well known to all citizens, and the other third to the city reservoir at Mount Brown, probably on the actual site of the present enlarged city basin. In the last section of its length the water course is known as the "High Pipe" or the "Pypes" in ancient records, and innumerable references to it may be found in the municipal archives.[4]

A city constructed as Dublin was, a veritable stack of combustibles, could not be expected to escape fires of a destructive kind. In 1190 a great part of it was swept away; in 1282 High Street was burned; and on the 2nd of January the greatest part of the city was destroyed by an accidental fire, which did not spare the steeple, chapter-house, dormitory and cloisters of Christ Church. In 1301 a great part of the city, with St. Werburgh's Church, was burned, and only three years afterwards a similar disaster occurred, but on this occasion the North Side suffered most, the Church of the Dominicans and a quarter of the Abbey of St. Mary being consumed. The year 1316 was specially unfortunate for the sorely-tried citizens, but this time they themselves were responsible for their worst troubles. It appears from the narrative given in Warburton, Whitelaw, and Walsh's history that information being given that Richard de Burgo, Earl of Ulster, was instrumental in bringing Bruce and his Scots into Ireland, Robert de Nottingham, then Mayor of Dublin, and a strong band of the Commons, marched to St. Mary's Abbey (where the Earl lay in a state of quietness, notwithstanding Bruce was encamped at Castleknock) and arrested and imprisoned him in the Castle of Dublin. He made resistance, and seven of his men were slain in the affray, and the Abbey spoiled, upon suspicion that the monks favoured the enemy . . . During the imprisonment of the Earl, which lasted until Whitsuntide, 1317, Bruce marched to Dublin at the head of his army and

[3] This John le Decer was probably the greatest merchant of his time. In 1329 he and Thomas Colys provisioned the King's armies in Scotland. His name frequently appears in the Chronicles as a benefactor of the religious houses and he was equally famed for his public liberality. Amongst other works he built at his own expense the bridge over the Liffey between Leixlip and Celbridge, near St. Wolstan's, which still stands, and another over the Tolka at Ballybough, which, however, was swept away by a great flood shortly after its erection.

[4] This early water-supply, upon which the city was dependent until the construction of the Grand and Royal Canals, owed its origin to the Corporation, who obtained from Maurice Fitzgerald, Justiciary of Ireland, in 1244, a writ commanding the Sheriff of Dublin, with the advice of the Mayor and citizens, to make inquisition as to the place from which water could best be taken.

made a show as if he would besiege it. The citizens, to prevent any danger from his approach, by common consent set fire to Thomas Street, the flames whereof laid hold of St. John's Church, without Newgate, and burned it down to the ground, together with Magdalen Chapel and all the suburbs. St. Mary's Abbey was destroyed, and St. Patrick's Church rifled by the enemy. The Church of the Dominicans was also razed, and the stones of it employed in building and repairing the city walls, which were enlarged on the North part, and extended to the Quays The damages done to the Dominican Abbey were afterwards repaired by the citizens. Then followed nearly seventy years of misfortune, in which two severe and long-continued famines and four outbreaks of pestilence reduced the city to the necessity of keeping the peace with the Irishry, saving an occasional inroad, in company with the Lord Deputy, upon the Wicklow, Leix, or Offaly septs. But they kept in practice by having riots amongst themselves, in one of which at Oxmantown Green in 1493 "several eminent citizens" were slain, and under date 1496 the chronicles record that:—"Jenico Marks (who had been Mayor of Dublin ten years before) was this year slain in Keysar's Lane, endeavouring to compose a riot of the citizens." In course of time they recovered their former strength, and the hostings were resumed, though not always with satisfactory results. Thus, in the year of the rising-out of Silken Thomas, they attempted to intercept at Kilmainham Bridge the O'Tooles, who had plundered Fingal, and were driving their cattle-spoil to the mountains. They met the Irish "near the wood of Salcock," but were routed, and four score of them slain. But in 1547 the O'Byrnes and O'Tooles, with some outlawed Fitzgeralds, having wasted up to the vicinity of the walls, the Lord Deputy, Anthony St. Leger, with the standing army and a considerable body of the City Militia, defeated them at Three Castles and drove them back to their mountain fastnesses This incident is, apparently, commemorated on the arms of Dublin. Yet the citizens would only fight of their own volition; they would not be commandeered. In 1568 a general hosting was proclaimed "and the Mayor of Dublin was fined one hundred pounds (Irish) for disobeying the Lord Deputy's command, and committed to the Castle of Dublin; but after two days' imprisonment was enlarged." This was not the first, nor by any means the last, instance of a conflict between the City and the Castle. The Earl of Desmond was in 1573 committed to the keeping of the Mayor, who told the Government that the Earl should be welcome to meat, drink and lodging, but that he would take no charge of him; and the Earl having license from the Government to walk abroad, made his escape. Upon this he was proclaimed a traitor, and a large reward was offered for him, living or dead.

History concerns itself with the lives, habits, and manners of the

people, and touching the characteristics of the citizens of old Dublin, their virtues and failings, we have ample evidence by which to judge. They were quick in quarrel and, as a community, prone to resent a real or fancied affront, great lovers of martial exercises and of fine pageants. But they were severe in punishing offences against public morality. Public penances were performed at the High Cross which stood at the junction of the High Street and Skinners' Row, that is, where Nicholas Street now joins Christ Church Place ; or in the pillory at the junction of Werburgh Street, Fishamble Street, Skinners' Row, and Castle Street.

Despite all disadvantages, the citizens must have prospered, or they would not have borne the expense of border forays and of more ambitious armaments. The leading citizens were truly merchant princes in the sense that one attaches to the term when referring to the old trading nobles of Venice, Florence, or London. In the year 1556, John Chaloner, Mayor of Dublin, imported from Spain, in a ship of his own, several pieces of ordnance and 150 muskets, with which he armed the citizens for Queen Mary's service, and he and the sheriff and citizens offered their services to assist the Lord Lieutenant against all rebels, upon which many of them submitted. The Lord Lieutenant would have knighted the Mayor, but he declined the honour. One may question, in the light of later events, the value of the submission of the rebels ; still no man may question the sturdy self-righteousness of the martial Mayor who would not be honoured for doing what he considered to be the simple duty of his place. But all the good things were not reserved for the wealthy. A contemporary writer observes of the shambles of the fleshers kept in High Street until the reign of James I. :—

"The great expenses of the citizens maie probablie be gathered by the woorthie and fair-like markets weeklie on Wednesdaie and Fridaie kept in Dublin. Their shambles is so well stored with meat and their market with corne as not onelie in Ireland, but also in other countries, you shall not see anie one shambles, or anie one market, better furnished with the one or the other than Dublin is."

Again, the list of the guilds, indicates that the craftsmen of Dublin were representative of every trade then practised.

On the 13th March, 1596, a great disaster happened. A large quantity of gunpowder—144 barrels—was landed at the Wood Quay for conveyance to the Castle Through accident, or otherwise, they blew up. Forty or fifty houses were completely destroyed and the whole city shattered, even the towers and walls of the Castle being injured. The loss of life was between three and four hundred according to the Sydney State Papers (Vol. II., p. 97): but six score is the number certified by the Mayor and Sheriffs after the official investigation.

The Rebellion of 1641 brought affliction upon Dublin. The plan of Maguire (Baron of Enniskillen), MacMahon, and their coadjutors, was to seize the Castle, and the plot failed only through the incredible folly of MacMahon, who, on the eve of its execution, confided the design to Owen O'Connolly. The latter conveyed the information to the Lords Justices, and was rewarded with a gift of £500 and an annuity of £200 for life. Although the city was held alternately for the Parliament and the king, the inhabitants were Royalists. They were greatly reduced in numbers, as a census taken in August, 1644, shows the population to have been only 8,159. On the Restoration, King Charles II. complimented the city with a Collar of SS. The style of Lord Mayor was granted by Charles I., 29th July, 1641, but was not used till the attention of the Municipal Council was directed to it by the Duke of Ormonde, then Viceroy, 20th September, 1665, when Sir Daniel Bellingham, whose portrait hangs in the Council Chamber, became the first Lord Mayor. The King further granted to the city £500 for ever to support the dignity. But Charles II. would have inflicted an irreparable injury upon Dublin had it not been for the firmness of Arthur Capel, Earl of Essex, who was Lord Lieutenant from 1672 to 1677. The greediest of that scandalous monarch's many mistresses was Barbara Villiers, Duchess of Cleveland—a veritable harpy—and to gratify her avarice Charles proposed to grant to her the Phœnix Park. Essex resisted this infamous scheme of public plunder fearlessly and with success. "I do desire there may not be the least grain of my concurrence in it," he wrote to Arlington, and his remonstrances to the king were equally outspoken. Though he subsequently helped to create the "Popish Terror," and was thus, in a measure, responsible for the crimes that the perjuries of Titus Oates begot, the integrity of his Irish government stands to the credit of Essex.[5] As allusion has been made to the collar of SS., so called from the shape of its links, it may not be out of place to tell the story of its disappearance. Eight years afterwards Sir Michael Creagh was Lord Mayor, and during his Mayoralty he absconded, taking with him this valuable article. As late as the last century the ancient usage of opening certain municipal courts by proclamation was continued, and the delinquent was regularly summoned to appear, the citation being in these terms:—"Sir Michael Creagh, Sir Michael Creagh, Sir Michael Creagh, come and appear before this Court of our Lord the King holden before the Right Honourable Lord Mayor

[5] Evelyn's character of him (18th April, 1680):—"He is a sober, wise, judicious, and pondering person, not illiterate beyond the rate of most noblemen in this age, very well versed in English historie and affairs; industrious, frugal. methodical, and every way accomplished." High opinions are expressed of him by Burnet (I. 396), and Ormonde bore testimony to the honesty and ability of his government.—Carte, IV., 529.

of the City of Dublin, or you will be outlawed!" As the fugitive never returned or sent back the chain, Bartholomew Vanhomrigh,[6] Lord Mayor in 1697, obtained from William III. a new Collar of SS. with a medal bearing the royal donor's effigy, valued at that time at £1,000. This is the chain of office still worn by the Chief Magistrate.

Early in the reign of James I. the extension of the city beyond the walls became rapid. A map of the year 1610 shows houses extending on both sides of the street as far as St. James's Gate, Patrick Street has been built in regular design, and Bride Street as far as the Church. Ship Street is completed, and a few houses stand in Stephen's Street and George's Lane; now George's Street, the north side of Dame Street extends from Dame's Gate to what is now the corner of Eustace Street, and Mullinahack has been pushed out from Ormonde Gate along the declivity to the water-mills from which it takes its name. Beyond the river, Church Street has been erected, and St. Mary's Lane. The north side of Pill Lane has been built upon and Mary's Abbey occupied by a block of houses. Thenceforward the growth of the city, though checked by the troubles of 1641 and the following years, was never wholly interrupted. Charles II. granted a patent for a market to be held at Newmarket, and in the same reign a patent was granted by Lord Meath to act plays in the theatre built in Rainsford Street; facts that attest the existence of a considerable population in these localities. Smock Alley Theatre was erected in 1661, and by 1670 the population had so increased in the west end of the larger city that the annals note:— "This year there was a long wall of stone built at the south side of St. James's Gate to convey the water to the new cistern, and new leaden pipes were laid through the city, much larger than the former, for conveyance of water, which was all done at the city charge." The revocation of the Edict of Nantes drove great numbers of the French Protestants abroad. As a matter of state policy, William III. encouraged them to settle in Ireland. They brought with them their manufactures, and their settlement in the Liberties became the centre of the city's industrial activity. It was at this time that the Coombe, Pimlico, Spitalfields,[7] and Weaver's square were built, and though the infamous laws enacted in the reign of William III. crushed the much older woollen trade out of existence, the silk manufacture prospered. The foundation of the Old Custom House in Essex Street[8] was laid in 1707;

[6] Father of Vanessa, whose relations with Dean Swift have been the subject of so much conjecture and controversy. He purchased the estate at Celbridge, where his hapless daughter lived and died.

[7] See Gilbert's History.

[8] On the site where now stands Dollard's Printing-house and the adjacent premises.

three years earlier Castle Market in Dame Street was built on the site of the ancient Church of St. Andrew.[9]

With the construction of the river walls,[10] a great area of ground over which the tidal waters had ebbed and flowed for ages, and the adjacent swamps, became available for building; hence the course of the city's expansion was directed eastwards. The history of this great work of reclamation not being generally known, may be here narrated. To defray the expense an Act of Assembly—what we would to-day call a Resolution of the Corporation—was passed for letting the ground to be enclosed in perpetuity, rent free, to a set of subscribers (*hodie* a company) who were to undertake the enclosure of it; and a map of the whole ground was made out, which divided it into lots, denominated foot and acre lots, leaving room for proper quays and roads. A foot-note at page 1084 of White Law and Walshe's History explains this arrangement:—

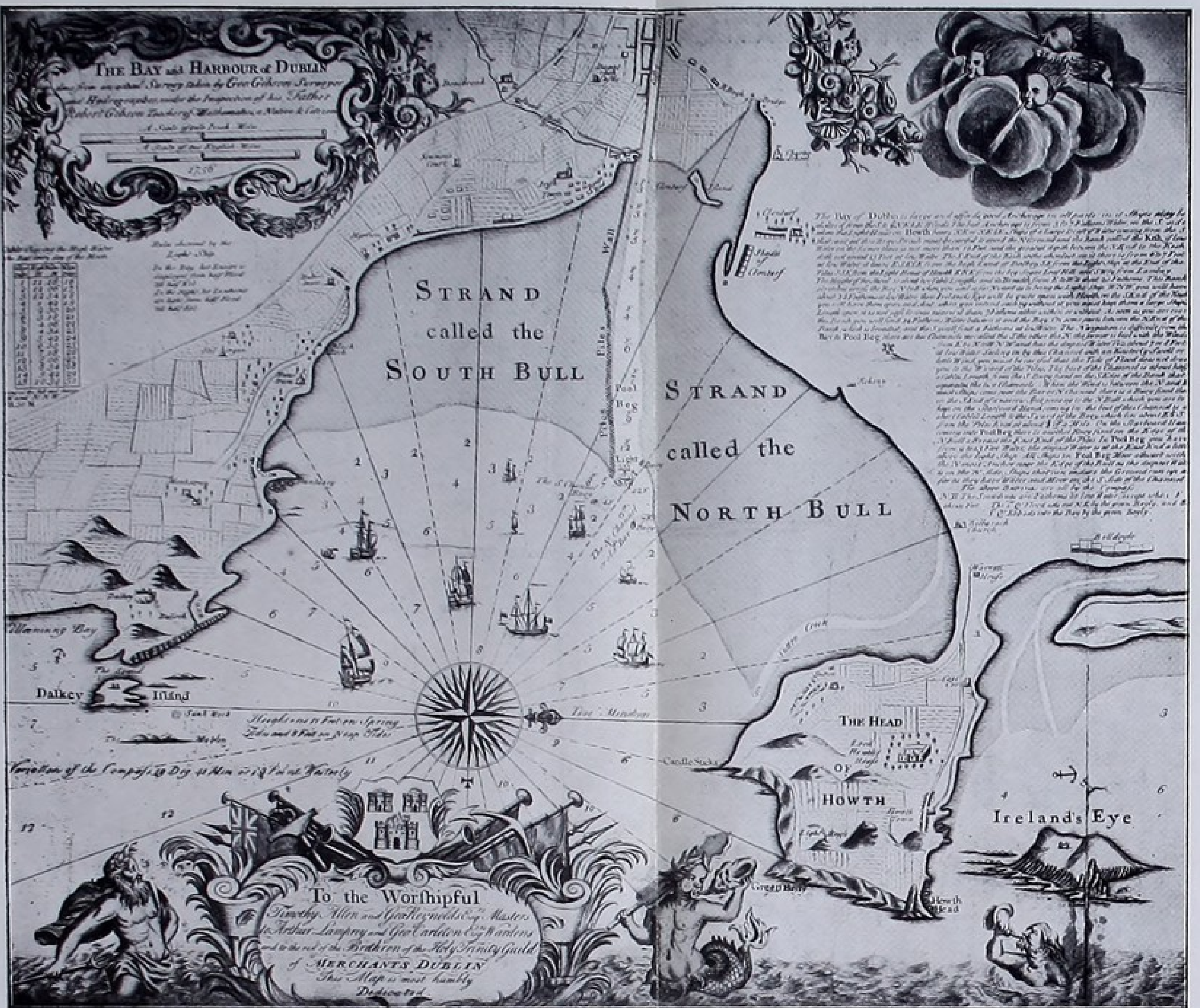
"The foot-lots were those that fronted the river or were near it, and they varied as to their dimensions according to their vicinity to town, so as to be considered of equal value; those distant having in extent what might be supposed to compensate for their being more remotely removed. The entire number of lots were 132 of each class, and the subscribers were obliged to pay a certain sum into the general fund, for the enclosure of and dividing the roads, etc. The whole of these lots being numbered, each subscriber was entitled to a foot and an acre lot. The numbers were drawn as a lottery and made out to the several subscribers. In conformity to the drawing, the north lots were taken in, enclosed, and laid out, from the fund."[11]

The original scheme, which contemplated the reclamation of all that lay inside a line drawn from the extreme point of the North Wall to

[9] This market was removed in 1782 to the site now occupied by the South City Markets.

[10] These walls, showing signs of decay after lasting nearly a hundred years, were re-built in the early part of the last century, and are, apparently, as firm as ever.

[11] The Act of Assemby creating the North and South Lotts was passed in the year 1717. In the same year the preliminary work in connection with the construction of the south wall was commenced. *Note*: the first Corporation for improving the port, constituted by an Act 6th of Queen Anne (1707), vested all the powers for that purpose in the Lord Mayor, Commons, and citizens of Dublin. It was not until 1786 that these powers were transferred to a new Corporation established on the lines of the present Port and Docks Board. The first slob to be reclaimed was Sir John Rogerson's Quay and the low-lying district behind it. This was done in 1710 and the following years. The walls having been neglected, fell to pieces as the result of a great flood in the year 1792, and the South Lotts were completely inundated; a deeply laden collier of 200 tons being actually carried through the breach and deposited inland in a field. In consequence of this neglect, the care of all the quays eastward of Carlisle Bridge was vested in the newly-established Corporation, and by the Statute 43 Geo. III., cap. 127, the line of walls on both sides of the river from Carlisle Bridge westwards, was placed under its supervision. The actual building of the great south wall was begun in 1745 with the section from Ringsend to the Pigeon House, and was completed in 1796, when the length of 9,816 feet from the Poolbeg Light to the latter point was finished


THE BAY and HARBOUR of DUBLIN
STRAND called the SOUTH BULL
STRAND called the NORTH BULL
Pool Beg
Dalkey
Island
THE HEAD OF HOWTH
Ireland's Eye
Candle Sticks
To the Worshipful
MERCHANTS DUBLIN

Clontarf, leaving a course for the River Tolka, has not yet been undertaken. The fielding-in of the slob-lands at Fairview, and the works lately put in hand by the Port and Docks Board, are only a tentative effort to realise, on a small scale, the magnificent conception of the old-time engineers.

Throughout the eighteenth century the development of Dublin as a city was progressive. The Irish Parliament was not properly Irish in many respects, but it was intensively earnest in protecting the interests of the English colony in Ireland that it represented. If it had surplus revenues, notwithstanding the enormous charges arbitrarily imposed upon the Irish Civil list, it could at least spend the Irish revenues in Ireland. Hence the lavish generosity with which it granted subventions to public undertakings. With the virile growth of the community came the love of ornament; with increased wealth the desire of enjoying it; with a widened knowledge of men and things a sense akin to the sentiment of the Homeric hero who proudly boasted for himself and his brethren that their ambition was "ever to be best, and stand highest amongst all." That was the era when Dublin was made beautiful, when Pearce designed the old Parliament House[12], and Gandon the grand pile of to-day; Cooley the Royal Exchange; Gandon the Custom House; Cooley and Gandon the Four Courts; when mansions like Charlemont House, Belvidere House, Tyrone House, Powerscourt House, Leinster House—to name but few out of many—attested not less the cultured taste than the opulence of their owners. The best decorative artists of Europe found that it was to their profit to visit Dublin and be rewarded for their services.

The Corporation had been reformed as to its constitution in the viceroyalty of the Earl of Essex, but for upwards of a century it had been practically dominated by the aldermen of Skinner's Alley.[13] As

[12] It was freely charged at the time that Pearce used the designs of Cassillis or Cassels. Gandon designed the east front in 1785, and two years later the west wing was remodelled by Parke. The interior of the House of Commons was destroyed by fire in February 1792.

[13] When James II. arrived in Dublin in 1688 the Protestant Corporation establishment retired, and took refuge in Skinner's Alley, an obscure avenue in the Liberties, leading from Newmarket to the Coombe. Here they brought with them whatever regalia and emblems of office they could provide, and continued the semblance of their former state, with all its officers, while a Roman Catholic Lord Mayor and Corporation occupied the Chair of the City. To this little remnant all the independent gentry of the same party resorted; and they kept up their institution and the spirit of their party till the arrival of William and the Battle of the Boyne restored them to their former situations. The memory of the transaction was still cherished. . . . . The great anniversary day was the 4th November, the birthday of King William. The qualification to be a member was that the person must be an undoubted supporter of the Protestant Ascendancy and a freeholder of the County or a freeman of the City of Dublin. Their support made a material feature in all the elections of the County and City—(Whitelaw and Walsh, *Hist. of Dub.*, vol. ii., 1068).

inevitably happens when great public interests, involving dealings with large sums of public money, fall under the control of a clique, flagrant corruption permeated the entire system of civic government. The Corporation did not even hesitate to plunder that church of which its members claimed to be the defenders. Whitelaw and Walsh, both Protestant clergymen, in their *History of Dublin* comment pointedly upon the abuses existing in their own time :—

"The rental of the city is ample ; it amounts to £13,917 9s. 7d. This, with the tolls and customs, amounting to £4,867, and other sources of revenue amounting to nearly as much more, and producing altogether an income of nearly £23,000 per annum, should fully answer every corporate purpose ; but the affairs of the Corporation have been so much deranged by bad management that notwithstanding the several plans of retrenchment carried into effect it appears by the last report of the Committee of Accounts for the year 1816 that the expenditure still exceeded the income by £3,000. The Corporation have in their gift some benefices, Taghadoe, in the diocese of Dublin, of which they enjoy the tithes, amounting to £120, and pay the rector a salary of £25 ; Rathrulnie, in the diocese of Ferns, and Rathdrum ; this last is the most valuable ; it had always been usual to confer each of those upon some candidate who had merit or interest to obtain it ; but this practice is now abandoned, and the right of presentation of the last living has been disposed of for £2,861 4s."

The following footnote, as it deals with a subject of frequent discussion, also merits quotation :—

"The city formerly possessed a considerable estate on the seashore, extending from Ringsend and Irishtown to the Black Rock and Stillorgan. This had been let on a lease of lives renewable for ever, and though the rent was not augmented the renewal fines amounted to a considerable sum. By some mismanagement, of which curious stories are told, the city afterwards granted it in fee-farm. About six years ago (*i.e.* about 1810) this extraordinary alteration of the original tenure was contested by the Corporation ; but the deed, duly executed by themselves, was produced, and the city was non-suited. The present income to the lessee is said to be about £16,000 per annum."

One wonders what the annual value of the Pembroke estate is to-day.[14]

The first scheme of improvement which began the transformation of the City originated in this manner : Essex Bridge, first erected in 1676, was rebuilt in 1753–5. The only approaches to it were through

[14] It is but right to say that there does not appear to be the slightest ground for the suggestion of sharp-practise that is here conveyed. The joint historians were rather prone to credit "curious stories." When dealing with matters that came within their own knowledge they may be trusted.

the Blind quay on one side and Crane Lane on the other. The inconvenience felt by the Castle from these indirect and narrow by-ways occasioned the passing of an Act of Parliament in 1757, "to open an avenue from his Majesty's royal palace to Essex Bridge," and certain persons were appointed by name to be "Commissioners for making a wide and convenient street from Essex Bridge to the Castle of Dublin," with power to compulsorily acquire, if necessary, such ground and houses as they required. Towards meeting the cost of the undertaking, a duty of one shilling a ton was imposed upon all sea-borne coal brought into Dublin, besides what was virtually a house-tax. Parliament Street was opened and built in 1762, and Palace Street and Cork Hill enlarged. By subsequent Acts they were directed to proceed with other works of a similar character, and the Irish Parliament made many grants for the purpose. Dame Street was widened from Palace Street to George's Street in 1790. Fleet Lane, Drogheda Street, and the Barleyfields were opened, forming respectively Westmoreland Street, Sackville Street (now O'Connell Street), and North Frederick Street. Various obstructions that blocked up and deformed the quays were removed. Eden Quay was cleared to permit of direct access from Carlisle Bridge, built in 1794; Lower Abbey Street was opened and Beresford Place built. On the West side of the City, Skinner's Row, Cutpurse Row, and James's Gate, and the Market-house in Thomas Street, were swept away. All these improvements cost great sums of money—Dame Street, £206,000, and over; Lower Abbey Street and Beresford Place, £192,000; Westmoreland Street, D'Olier Street, Burgh Quay, and Hawkins Street, £132,000; High Street, £36,000; Winetavern Street, £15,000, and so on. Many of their transactions would not bear close scrutiny, but there can be no two opinions as to the value of their operations generally.

Originally Dublin was lighted, if the word be permissable, by horn lanterns, suspended from ropes that hung across the streets. In the City's most brilliant period, upwards of 5,000 oil-lamps provided the necessary illumination, and bitter complaints were often made that they were concentrated in the fashionable squares and streets, leaving the districts that most required them in partial or nearly total darkness. When it was proposed a hundred years ago that the City should be lighted with gas, the inhabitants resisted the proposal because of its cost, alleging that the existent rates were an excessive burthen.

Within the memory of men who are not yet middle-aged, the streets of the City, even the main thoroughfares, were badly paved, or not paved at all. In wet weather they became little better than expanses of mud; wet or dry they were full of ruts, and a drive over them was, in good truth, a painful experience. The sting of Lady Morgan's half-playful jibe at "dear, dirty Dublin," lay

in the appropriateness of the second adjective. Yet in those days there was a paid Board of Commissioners for Paving and Lighting, appointed by the Lord Lieutenant, and removable at his pleasure, who had entire control of these services, and were empowered to levy rates on the City, not exceeding 4s. 6d. in the pound on the rating of houses valued for ministers' money. They were also empowered to make sewers and water streets at the expense of the inhabitants of these streets. The writers already quoted say of the Board :—

"The conduct of this establishment has excited much animadversion, and Commissioners have been heretofore appointed. The most remarkable circumstance, however, connected with it is the enormous expense incurred, which the citizens of Dublin, loaded with such a weight of other taxes,[15] loudly complain of. It is but just, however, to say that, notwithstanding the unpopularity of this Board, the objects of its establishment are well attended to. Great and important improvements have taken place in paving, lighting, and constructing sewers, and, we believe, no city can exceed Dublin in these particulars."

The notions of sanitation entertained by men of education would to-day be scouted by the least intelligent. They write :—

"The want of sewers was much felt in Dublin. The waste water was usually received in cesspools, which were large excavations made in the front of each house and covered in. It was supposed that the water would filter through the soil, but the clay and limestone strata of Dublin are so very tenacious that the contents of the pools were retained till they were filled up, and it became necessary to remove them by opening the pool, which constanty exposed in the public streets an highly putrid and offensive mass. By the 47th George III. the Commissioners are empowered to make such sewers as they shall think fit, to which the inhabitants of the street are to contribute rateably. Under these powers the Commissioners formed several main sewers and commenced a large and important one in Capel Street, which, notwithstanding, was covered in at the desire of the inhabitants and left incomplete. In Sackville Street and elsewhere these cesspools still continue."[16]

In the poorer districts, where it was impossible to levy a rate for sewer-making, there were consequently no sewers. The Poddle did to some extent serve that purpose in places, but for the rest of the extensive area on the South side of the City that was even then falling into decay there was literally no sanitary accommodation of even the most primitive

[15] The taxes (rates) when Whitelaw and Walsh wrote amounted to £350,000 a year, and the annual expenditure of the Commissioners for Paving and Lighting was rather in excess of £52,000.

[16] It must be borne in mind that effective sewering and draining for towns and houses are works of modern growth dating back no more than sixty years.

description. When Messrs. Whitelaw and Walsh wrote in 1816 they were obliged to pen the following terrible description of the Liberties: –

"The streets in this part of the city are generally narrow, the houses crowded together, the reres, or back yards, of very small extent, and some without any accomodation of the kind. Of these streets a few are the residence of shop-keepers, or others engaged in trade, but a far greater proportion of them, with their numerous lanes and alleys, are occupied by working manufacturers, by petty shop-keepers, the labouring poor, and beggars crowded together to a degree distressing to humanity. A single apartment in one of those truly wretched habitations rates from one to two shillings per week; and to lighten this rent two, three, and even four, families become joint tenants; hence, at an early hour, we may find from ten to sixteen persons, of all ages and sexes, in a room not fifteen feet square, stretched on a wad of filthy straw, swarming with vermin, and without any covering save the wretched rags that constitute their wearing apparel. Under such circumstances it is not extraordinary that from thirty to fifty individuals may be frequently found in one house; and it is a certain fact that No. 6 in Braithwait Street contained a few years since one hundred and eight souls. From a careful survey twice taken of Plunkett Street in 1798 it appeared that thirty-two contiguous houses contained 917 inhabitants . . . and the entire Liberty averages from about 12 to 16 persons to each house. . . . This crowded population, wherever it obtains, is almost universally accompanied by a very serious evil—a degree of filth and stench inconceivable, except by such as have visited those scenes of wretchedness. There are few or no necessaries, and, of course, into the backyard of each house, frequently not ten feet deep, is flung, from the windows of each apartment, the ordure and other filth of its numerous inhabitants; from whence it is so seldom removed, that it may be seen nearly on a level with the windows of the first floor; and the moisture that after heavy rains oozes from this heap, having no sewer to carry it off, runs into the street by the entry leading to the staircase, for, strange as it may appear, it is a fact that there is not one covered sewer in that populous portion of the Liberty south of the street called the Coombe."

The reverend writers give further details of their own experiences amongst those dens of misery, but they are too revolting to be transcribed here.[17]

When, as the result of the Municipal Corporations (Ireland) Act, of 1840, the reformed Corporation took in hands the control of the city's affairs, it inherited all the evil consequences of long-continued neglect and mismanagement, not to say corruption. It was not until after the lapse of some years that it could venture upon anything more than palliative measures. The first grand project to be undertaken was the

[17] See their *History of Dublin*, Vol. I, pages 443-7, and Vol. II. p. 738. They apologise for drawing a picture faithfully and minutely true on the ground that their "sole and anxious object is to have evils of such magnitude alleviated, or, if possible, removed."

provision of an adequate water supply, and the success of the Vartry scheme, in which still further improvements are being made to meet the requirements of the wide areas that have been built upon in recent years, encouraged the Corporation along the path of improvement. Not the least important and beneficial of its consequences was that it enabled a system of sewage-disposal by water-carriage through properly constructed sewers to be made universal. But the utilisation of the Liffey as a main sewer, though the only course available at the time, was at best an objectionable makeshift. Repeatedly plans for the purification of the river were brought forward, discussed, and dropped. At last it was generally conceded that the work was of urgent public necessity, and that the best method of accomplishing it was on the lines followed in the great scheme now happily perfected. With the demolition of insanitary areas and the substitution for them of blocks of well-built, comfortable, hygienic dwellings, suited to the means of various classes of workingmen—undertakings that have been steadily pursued during the past twenty-five years, the completion of the Main Drainage marks a notable advance towards the realisation of what is every good citizen's ideal of Modern Dublin, a prosperous progressive city, worthy to be the Capital of Ireland in her resolution to adopt all that was best in the Dublin of old, and to avoid the faults and errors that had their origin in the sinister influences that overshadowed the City of these distant days.

THE MAIN DRAINAGE SCHEME:

ITS ORIGIN AND PROGRESS.

THE history of the River Liffey in regard to pollution is the history of all rivers which pass through the larger towns. In the early days, before the present practice in sanitation was introduced, the river received only a relatively small quantity of polluting matter, because the population was smaller and the quantity of water supplied and passed away as polluted liquid was considerably less, both in the aggregate and in proportion to the population. The introduction of water closets and the system of water-carried sewage consequent upon it, together with the increase of population, gradually changed the Liffey from a once pure stream to what it now is. Mr. Parke Neville, writing as early as 1853, in his capacity of City Engineer, refers to the complaints that the matter discharged into the river by the sewers, "renders its bed foul, and, at low water, excessively disagreeble to the inhabitants of the Quays and to the public generally passing by or over the Bridges, from the noxious exhalations which rise from it, particulary in hot weather." That description has held true up to the present time, and it is to remove this reproach, and to restore the Liffey to a condition as nearly approaching its original state of purity as the conditions of the case will allow, that the Corporation have been engaged for the last ten years upon the works which have now been brought to completion. Why the Liffey has remained in such a condition for so long a period is a matter which need not be explained at length, but it may be remarked that a municipal work of this magnitude is seldom brought to a conclusion without seemingly endless delays, the reasons for which can only be fully appreciated by those who have taken a prominent part in the government of large cities, but which will appear in some measure in the sketch of the early history of the question given in this handbook. One distinct advantage has accrued by the postponement of the work, and that is that the citizens have had the experience of a period during which the principles that govern the design of sewerage works have undergone great modification. Many of the works in other towns which were carried out at the time of Mr. Parke Neville's first report in 1853 have proved unsatisfactory, and have had to be replaced by others of

more modern design ; among others, the London Main Drainage Works have had to be altered after twenty years' experience.

The earliest projects for the better drainage of the City appear to have been prepared by Mr. Alexander Nimmo, and, later, proposals were put forward by others, among them being Mr. Robert Mallet and Mr. M'Clean. These were all prior to 1853. In 1852, Mr. Parke Neville referred to the question in a report to the Corporation, and in the following year he described his proposals in a report of considerable length. This report is the starting point of the definite efforts made to improve the condition of the river. He proposed to construct sewers, discharging at five different points, dealing with the North and South sides of the City quite separately. The principal points of outfall were to have been at the Eastern extremity of the East wall and at the mouth of the River Dodder ; the other outfalls were into the Liffey itself. No treatment of the sewage was intended. It is interesting to note that the estimate of cost was £104,597. Mr. Parke Neville did not regard the intercepting sewers as a work of great urgency at that time.

In 1865 the Corporation granted to Messrs Barrington & Jeffers a concession of the sewage. At this time the utilization of sewage on land as a source of profit was attracting considerable public attention. Companies were formed in various parts of the country, and a great deal of financial speculation took place. About this time Viscount St. Lawrence addressed a most interesting letter to the Lord Mayor, in which he urged the Corporation to pause before committing itself to a project for the utilization of the sewage, pointing out that there was no experience to justify the expectation of a profit. The proposal then under consideration was to reclaim 2,000 acres of land in the Bay near the North Bull and use it for the disposal of the sewage by irrigation.

The first recorded recognition of the necessity of complete interception as the basis of any scheme was by Dr. D. J. Corrigan, who, writing in 1865 on the utilization proposals, suggested that "the intercepting sewers along the Quays receiving the sewage of the City should be united into one great pipe, running along the side of the South Wall, with a covered catchment basin somewhere between the Pigeon House and the Poolbeg Light, and should discharge itself into the Sea at the Lighthouse."

In 1865, Mr. Park Neville made an exhaustive report on the Main Drainage, in which he considerably modified his proposals of 1853, and suggested the collection of the sewage by intercepting sewers and its discharge at the Smoothing Iron on the East Wall, where a storage tank was to be constructed to prevent the sewers being backed up during high tide. The works were to be so designed as to allow of the

sewage being delivered to a Company for the purpose of utilization. The estimate of cost was £117,000.

In 1866, Mr. (afterwards Sir) Joseph W., Bazalgette, acting under instructions from the Corporation, prepared a report on the subject, in which he recommended interception on the lines of Mr. Park Neville's report of the previous year, but advising the extension of the outfall sewer along the Clontarf Coast Road and down the North Bull, the point of discharge being near the seaward end of the latter. The pumping station was to be at Annesley Bridge, and there were to be storage tanks on the North Bull Wall. The sewage was to be discharged after storage without any treatment. In that report occurs the following significant passage :—

"The borough of Dublin does not include within its boundaries all the populous districts which by pouring their drainage into the Liffey contribute to render its waters impure. If the drainage of these outlying districts should be allowed to continue to flow through Dublin into the Liffey, the drainage of the City cannot be effectually accomplished. The remedy which I should recommend as the most natural and perfect, would be an extension of the limits of the Borough, so as to include the drainage of these populous suburbs with that of the City under one management, and to defray the cost of the drainage works, by which all parts are equally benefited, by an uniform rate upon the whole."

This pronouncement was confirmed in almost identical words in the decision of the Joint Committee of Parliament upon the Dublin Boundaries Bill of 1900.

In 1867 the report was issued of the Special Committee of the Corporation "to consider and devise the best method of preventing noxious exhalations from the River Liffey." The Committee advertised for projects, and received a large number, among them being proposals to flag the bed of the river, to arch over the whole river and construct markets on the top of it, as well as many others which reflect the confusion of ideas which was then prevalent on the sewage disposal question. The Committee, however, saw clearly that intercepting sewers were required, but, owing to the state of the City finances, they were unable to recommend more than comparatively short lengths of sewers along the North and South Quays, at an estimated cost of £30,000. In recognising the necessity of taking the sewage out of the Liffey the Committee were assisted by reports from Mr. B. B. Stoney, LL.D., Mr. Parke Neville, and Sir Joseph Bazalgette, all of whom pronounced interception as the only remedy.

The Committee were unable to recommend Sir Joseph Bazalgette's scheme, as the resources of the Corporation were inadequate.

In 1868 utilisation projects were again under discussion, and a Company was formed, the prospectus showing that the Directors anticipated a dividend of at least 8½ per cent. These proposals were condemned by Sir Joseph Bazalgette, who was of opinion that the works could not be remunerative.

It was in this year that a scheme of a large basin for flushing the Liffey was proposed by Mr. Edwards, and was condemned by the City Engineer. Messrs. Hemans, Hassard and Falkiner also put forward a scheme for the utilisation of the sewage, under which they anticipated an income of £23,300 per annum from reclaimed and irrigated land.

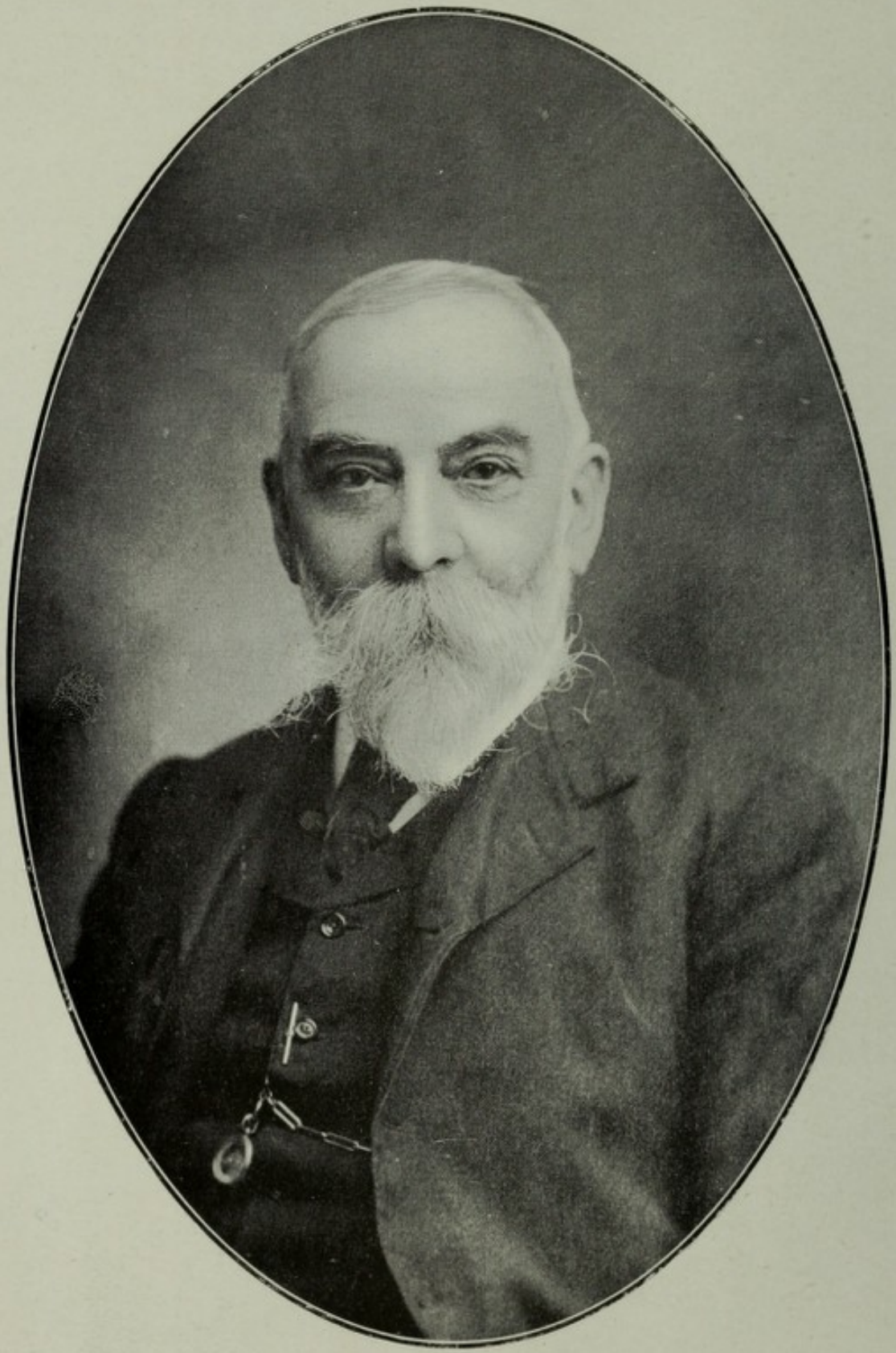
The Corporation, however, made up their minds to carry out the scheme of Sir Joseph Bazalgette and Mr. Parke Neville, and the first report of the Main Drainage Committee was made on September 2, 1870. In it the Committee detailed the results of a successful visit to London to obtain the sanction of the Goverment to a loan of £350,000. The names of the deputation who negotiated with the Government were—Mr. Edward Purdon (Lord Mayor), Sir John Gray, M.P., Mr. John Norwood, LL.D., and Sir William Carrol.

In 1871 the necessary Parliamentary powers were obtained. Tenders were called for in due course, but they proved to be considerably in excess of the Engineer's estimate, the lowest tender being £775,154. The design was revised in detail, and in 1874 a second set of tenders was obtained, when the same difficulty arose, and matters were at a standstill for a considerable time, the Corporation not having the funds to carry out the works at the price of the lowest tender, viz., £443,494.

Various schemes of flushing the Liffey in order to attempt to get rid of the nuisance without having to go to the great cost of intercepting sewers were again brought forward by different persons, but they were all condemned in a report by Mr. B. B. Stoney, LL.D., C.E., as old and exploded ideas.

The next step was taken in 1879, when a Royal Commission was appointed, consisting of Sir Robert Rawlinson and Dr. (afterwards Sir) Francis MacCabe, to inquire into the whole question of the Main Drainage. A number of witnesses were examined, among them being the principal City officers, including Sir Charles Cameron. Dr. John Norwood, who, as a member of the Corporation, took a prominent part in Main Drainage discussions, was also one of the witnesses. Five schemes were submitted to the Commission, who did not consider it necessary to take the sewage to Howth, and reported in favour of the scheme for discharging the sewage at the North Bull Lighthouse, already described. The Commissioners considered the works could be executed for the sum of £300,000.

The report of the Royal Commission was not, however, followed by



SPENCER HARTY, PAST PRESIDENT, INST. C.E.I.,
City Engineer, Borough Surveyor, and Water Works Engineer,
who had charge of the Main Drainage Works.

any action till the year 1884, when the Corporation appointed a Committee to consider the question of carrying the recommendations into effect. Mr. Parke Neville reported upon his own scheme and upon projects submitted by Messrs. Hassard and Tyrrell and by Mr. Purser Griffith, the former proposing a scheme with an outfall at the Nose of Howth, and the latter one with an outfall at Drumlech Point. The Committee considered that further expert advice should be obtained and that the Main Drainage should not be undertaken till the boundaries of the City had been extended. Their report, which was issued in 1886, affords evidence that the political situation was not without its influence on their decision, and they looked forward to the time when it would "be no longer necessary to seek at vast expense at Westminster the legislative powers necessary for such a matter as a scheme of drainage."

Utilisation projects were apparently not altogether dead even in 1887, for Mr. Spencer Harty, who had succeeded Mr. Parke Neville as City Engineer, reporting at that date on his inspection of the Sewage Works of various towns, reminded the Corporation that there could be no question of making a profit out of the sewage. He supplemented this report in 1891 by further particulars of other sewage works.

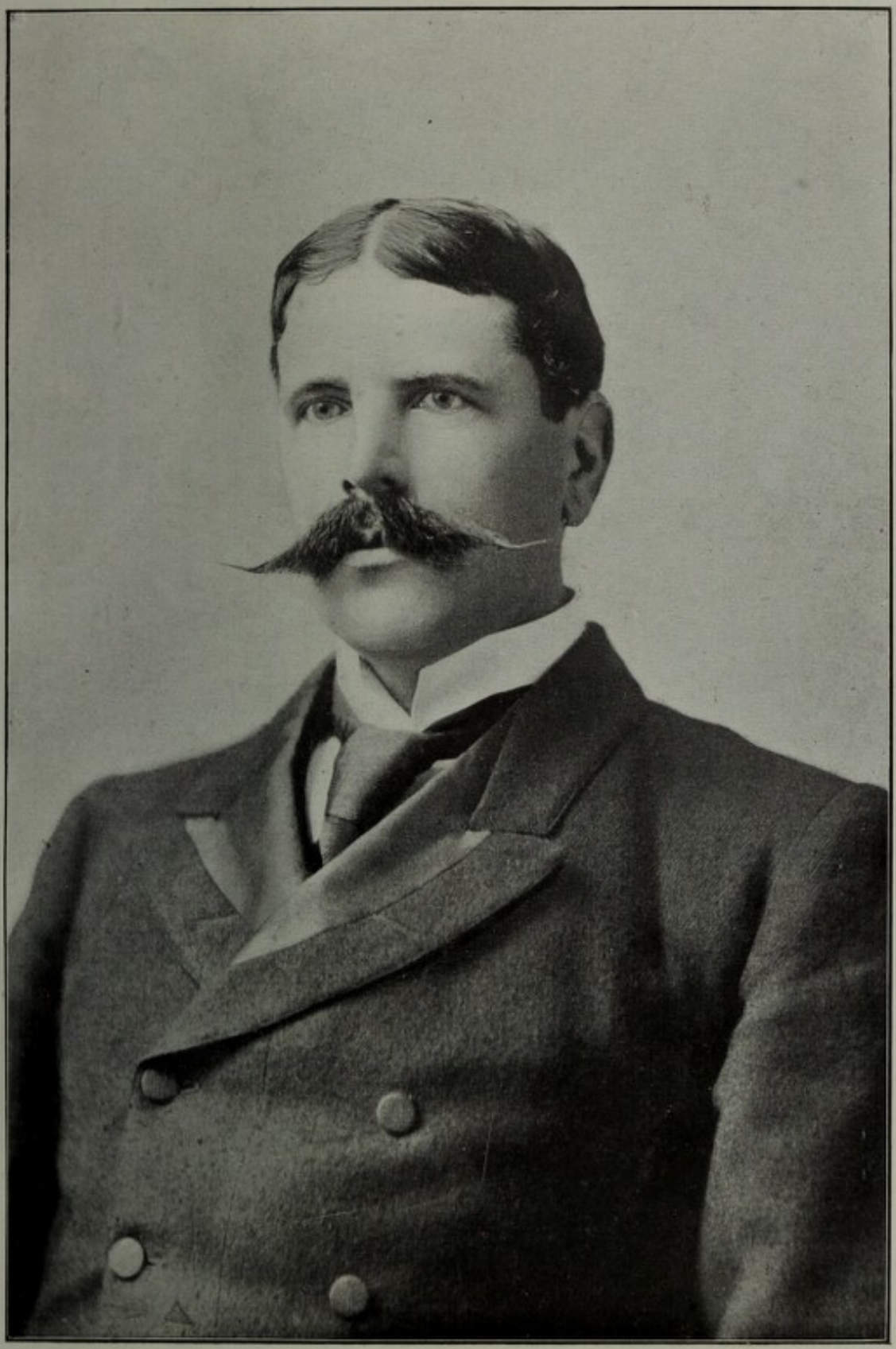
In 1891, as a result of the operations for the consolidation of the City debt, the Corporation were again in a position to attempt to deal with the vexed question of the City drainage, and a new Main Drainage Committee was appointed under the Chairmanship of the late Rt. Hon. Joseph Meade, LL.D., then Lord Mayor. The Committee instructed Mr George Chatterton, M. Inst. C.E. of Westminster, to report, and he did so in September of that year, and in the following November the Committee recommended the adoption of his scheme.

Mr. Chatterton first directed his attention to the North Bull scheme of Sir Joseph Bazalgette and Mr. Parke Neville, and pointed out that the limitation imposed upon the Corporation by the stipulation, inserted in the Provisional Order of 1871 at the instance of the Port and Docks Board, that no solid matter should be discharged into the Harbour, River, or Bay, rendered that scheme impossible without a precipitation process. He then proceeded to consider Mr. Purser Griffith's scheme of 1885, which was one to discharge the crude sewage at Drumlech Point. Float observations were carried out, and shewed that there would be a risk of fouling the shore between Drumlech Point and the Bailey Lighthouse. Mr. Neville's alternative point of outfall at the Bailey Lighthouse was regarded unfavourably in the report, because the sewer, in order to have a free outfall and a proper inclination, would have to be laid considerably above the road level in part of Clontarf. The report then goes on to refer to the scheme prepared by Messrs. Hassard & Tyrrell and presented to the

Royal Commission in 1879, having an intended point of outfall at the Nose of Howth. Float experiments were made, and shewed that the tidal currents were too sluggish to properly carry away and disperse the sewage, and that the discharge of the Dublin Sewage in the neighbourhood would be very injurious to Howth, and, in addition, the scheme was regarded unfavourably from the point of view of expense. An alternative scheme of Messrs. Hassard & Tyrrell was rejected on the grounds, chiefly, that any scheme with an outfall at Howth would involve an embankment along the Clontarf shore if the sewers were properly designed. Schemes prepared by the late Mr. W. G. Strype, M. Inst. C.E., were also considered. Under the first it was proposed to erect Precipitation Tanks between Annesley Bridge and the Great Northern Railway, to which the sewage would be conveyed and the solid matters removed, pressed into cakes, and taken to sea. A second proposal by the same author was to collect the sewage by high and low level intercepting sewers on both sides of the City and convey it to precipitation works to be erected at Ringsend. Mr. Chatterton considered that these schemes did not make adequate provision for the drainage of the City, either as regards capacity or in the levels and designs of the proposed sewers.

Mr. Chatterton then laid down the basis of the scheme which has now been carried out, and which will be described in detail later. He made provision for the drainage of the suburbs of Clontarf, Drumcondra, Glasnevin, Clonliffe, and New Kilmainham, all of which were then outside the city. Before deciding on the point of outfall and the method of disposal, he made a comparison of the relative costs of the various schemes, and considered whether precipitation works could be advantageously erected near Annesley Bridge, and whether there would be any advantage in dealing with the North and South sides of the city separately. He recommended that precipitation works on the South Wall would be the best solution on the grounds of cost, nearness to the body of tidal water, facility of carrying the sludge to sea, remoteness of the site from dwellings, a minimum of interference with private property, and probable absence of opposition from landowners. He proposed that the tanks should be placed at the Whitebank, a sandy spit to the south of the South Wall between the Pigeon House and Poolbeg. A considerable amount of controversy took place on the publication of the report, and the Main Drainage Committee visited a number of towns to see the precipitation process in operation. Mr. Spencer Harty gave his support to the scheme, and it was unanimously adopted by the Corporation in December, 1891.

The Corporation, acting on Mr. Chatterton's advice, which was confirmed by Mr. Walker, now Lord Chancellor, decided to proceed by Provisional Order rather than by a private Bill, and in February, 1892,



GEORGE CHATTERTON, M. INST. C.E.,
The Consulting Engineer for the entire Scheme.

a Local Government Inquiry was held into the application of the Corporation for a Provisional Order to acquire the lands necessary for the scheme. At the inquiry the proposal was supported by Sir Benjamin Baker and the late Mr. James Mansergh, both Past Presidents of the Institution of Civil Engineers, and by Dr. Dupré, the well-known chemist. The Provisional Order was granted in due course.

In order to convey the sewage to the Whitebank it was necessary to lay the main outfall sewer through the Pigeon House Fort, then the property of the War Department, and under the Provisional Order the consent of the Secretary of State for War had to be obtained before the works through the Fort could be commenced. After considerable correspondence, in which the Corporation refused to purchase the Pigeon House Fort as suggested by the War Department, the Permanent Under Secretary wrote stating definitely that the consent of the War Department would not be given. After further negotiations the Army Sanitary Committee visited Dublin in April, 1893, and reported on the proposed works. In their report they expressed the opinion that the sewage of Pembroke and Rathmines, which then flowed and still flows untreated into the harbour, should be received and treated along with the sewage of Dublin. They made various suggestions as to the proposed Dublin works (Sir Charles Cameron dissenting) which were not acceptable to the Corporation, and eventually the latter ascertained that the Department were willing to sell the Fort for £65,000. After further controversy and delay the Corporation, as the best way out of the difficulty, agreed to purchase the Fort for the sum demanded, with a view to utilizing the Pigeon House Harbour as a site for the new precipitation tanks, but the year 1895 was reached before the matter was arranged. The ground upon which the Fort was built had been ceded temporarily to Government by the Harbour Corporation in 1798, and was subsequently purchased for the purposes of the War Department as a place of arms for £100,183.[18]

A second Local Government Inquiry was necessary before the consent of the Local Government Board could be given to the amended scheme. This was held in 1895 and again in 1896, and, after some opposition, sanction to a loan of £350,000 was granted in the latter year.

The Corporation were at last able to proceed, and appointed Mr.

[18] The cession is thus announced in an official bulletin from Dublin Castle, dated 15th May, 1798—"An unexpected event has taken place in this City, namely, a cession made by the Corporation for the Improvement of Dublin Harbour of their property in the Pigeon House Dock, and the newly constructed Hotel to Government for the purpose of a place of arms and military post, if not for ever, at least during the present war. The part alloted for this place of arms, is, we hear, to be insulated by strong redoubts mounted with cannon."

Chatterton as Consulting Engineer and Mr. Spencer Harty as Engineer to the Works, and gave instructions that the necessary drawings, etc., were to be prepared from Mr. Chatterton's designs. The Resident Engineer during practically the whole of the construction was Mr. H. H. Hellins. In March, 1896, contracts Nos. 1 and 2 were entered into with Messrs. H. and J. Martin for the construction of 7½ miles of intercepting sewers along the Quays and in the heart of the city. These sewers were completed in 1900, having been delayed by a strike in the Building Trade

Although the Corporation and the War Department had agreed to terms for the purchase of the Fort, full possession could not be obtained till 1899. In that year a contract was entered into with Messrs. S. Pearson and Son for the construction of the precipitation tanks and the main sewer from the pumping station to the tanks. In 1901 a tender was accepted from Messrs. H. and J. Martin for the main outfall sewer from and including the syphon under the Liffey to the pumping station. This portion of the work was most difficult and tedious. Owing to the nature of the ground and the level at which the sewer had to be laid, it was necessary to work for the greater part of the length under compressed air by what is known as the Greathead Shield method. The sewer so constructed is of cast iron, built up in segments and in rings, and lined with fine concrete.

Subsequently contracts were entered into with Messrs. Stewarts of Glasgow for the boilers, with Messrs. Gwynnes for the engines and pumps, with Messrs. H. and J. Martin for the pumping station buildings, and for the plant for making the solution of lime; and with the Dublin Dockyard Company for the sludge vessel. The total expenditure incurred and authorized is £508,000.

The works, although difficult and dangerous in places, have been carried out with comparative freedom from accident, the regrettable disaster at Burgh Quay, in memory of the victims of which a Memorial has been erected on the spot, being the worst, although that was not the result of any accident during construction.

During the progress of the works the Main Drainage has been the subject of some controversy and criticism. In 1899, and again in 1900, the Corporation promoted Bills in Parliament to extend the City Boundaries, and, on both occasions—three hearings in all—the scheme had to bear no inconsiderable part of the attack of the opposition. The Corporation eventually succeeded in obtaining an extension of the city, and all the suburbs provided for in Mr. Chatterton's original Report are now part of the city. It was in 1900 that the joint Committee of both Houses made the memorable statement of

opinion upon the drainage of the townships whose sewage flows into the harbour:—

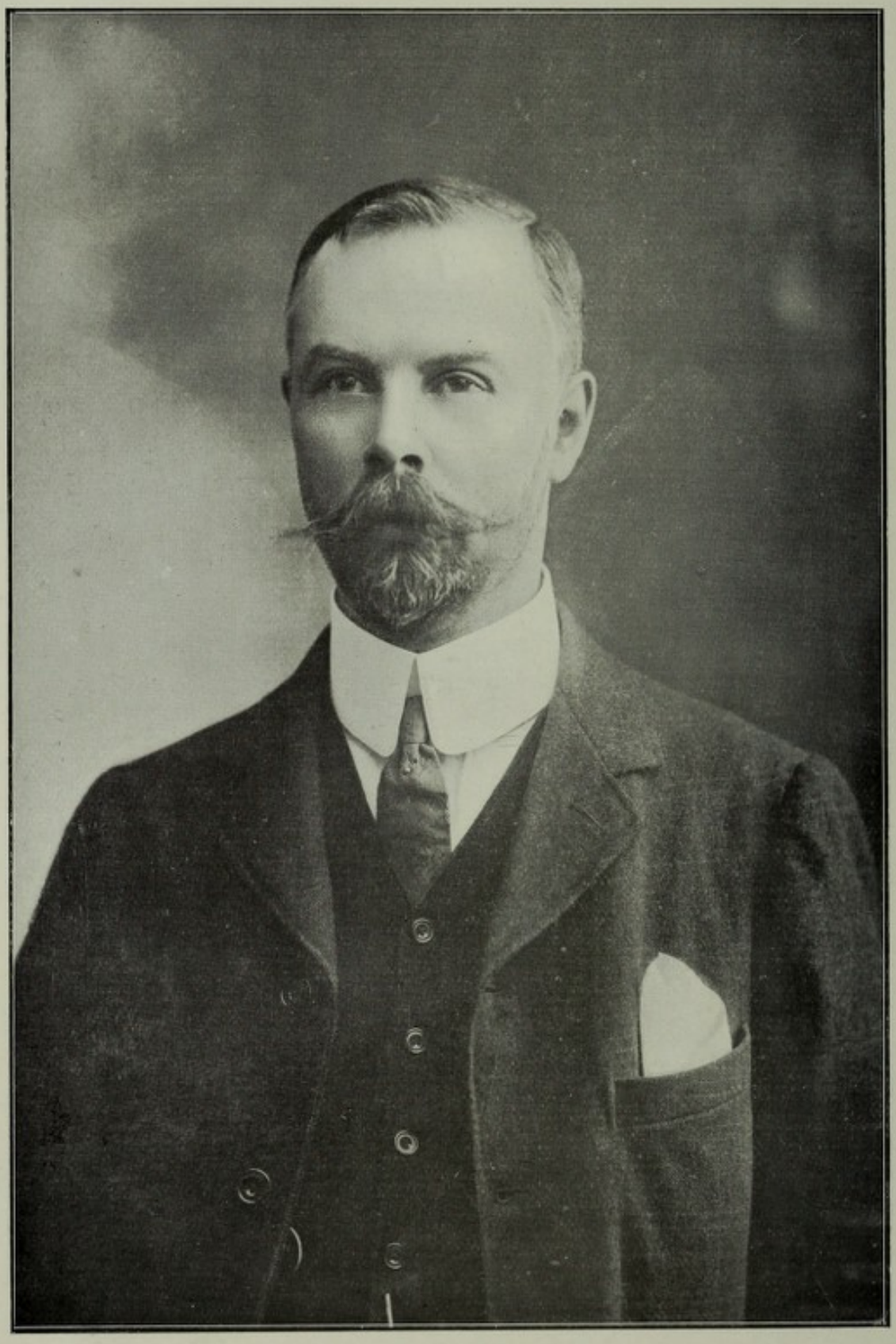
"Your Committee have come to the unanimous conclusion that it would be a public advantage if there were one administration to control the drainage and sewers and treatment of the sewage of Dublin and the townships. They think that it would be absurd if one part of the sewage were treated at Pigeon House Fort and other parts discharged a little distance away within the sea walls of the Bay without corresponding treatment. They are also of opinion that the whole community benefits by the great works now being carried out for purifying the Liffey, and they recommend that legislative steps should be taken to constitute a joint Drainage Board for the city and the townships of Rathmines and Pembroke representing the Corporation and the two Urban District Councils, and to distribute over the entire the past and future burden of both systems of drainage."

In 1903 the Local Government Board held a further inquiry, and immediately afterwards they raised the whole question of the advisability of precipitation by lime as previously sanctioned, particularly in regard to the possible effect of the discharge of the clarified effluent on shell-fish. Mr. Chatterton made an exhaustive report to the Corporation upon the new development, and pointed out that the Board had raised the question of injury to shell-fish after three inquiries held by themselves and two Parliamentary fights, from all of which the Main Drainage Scheme had emerged successful. To afford a clear understanding of the report it is necessary to state that the method of disposal (fully described hereafter) is to precipitate the solid matters in the sewage by lime added in solution, and to discharge the clarified effluent into the harbour at the Pigeon House Fort—generally on the ebb tide, although there is no restriction to prevent the discharge on the flood tide—the solid matters being conveyed to sea by a vessel built for the purpose. The report pointed out that no seaport town of any importance in the United Kingdom treats its sewage by a better method than is proposed in Dublin, the usual course being to discharge the sewage into the sea without any treatment. Here the sewage will be purified to a certain degree of purity which is sufficient for the circumstances and which may be regarded as the economical limit. This could not harm the shell-fish, which now suffer from the discharge of crude sewage untreated in any way. The capacity of the harbour is such that, at high water of spring tides the volume of the clarified effluent will only be 1/1,470th part of the volume of the tidal waters, and at neap tides the proportion will be 1/1,150th part, while the flow of the upland water, not taken into account in these figures, will play an important part in completing the process of purification. In defending the proposal to treat the sewage of Dublin by chemical precipitation the

report proceeds to examine the various artificial or bacterial methods of sewage purification which are mentioned in the interim report of the Royal Commission on Sewage Disposal. Dealing with them seriatim, it shows them to be either inapplicable to Dublin or enormously costly under the circumstances, and to be based upon insufficient experience to justify the Corporation taking them into consideration. The cost of a bacterial scheme was put at a quarter of a million over and above the cost of the scheme as designed, and for that expenditure Mr. Chatterton was unable to see that value would be received.

This report appears to have satisfied the Local Government Board for the time being, but in 1905, notwithstanding all that had gone before, they again raised the question, and required the Corporation to prove by eminent outside witnesses that precipitation by lime in solution was the proper method of dealing with the sewage. At the adjourned inquiry in February, 1906, evidence was given in support of the scheme by Sir Alexander Binnie, President of the Institution of Civil Engineers, and late Chief Engineer to the London County Council; by Dr. MacDonald, City Engineer of Glasgow; and by Mr. Bertram Blount, the chemist who has advised the Corporation on the details of the liming arrangements. Subsequently the Board granted the loan applied for, and it is hoped that they have finally acquiesced in the process which is to be employed.

MR. P. C. COWAN, M.I.C.E.,
Chief Engineering Inspector, Local Government Board, who held the enquiries with regard to the completion of the Works.



H. H. HELLINS, M. INST. C.E.,
Resident Engineer on the Works.

DESCRIPTION OF THE WORKS.

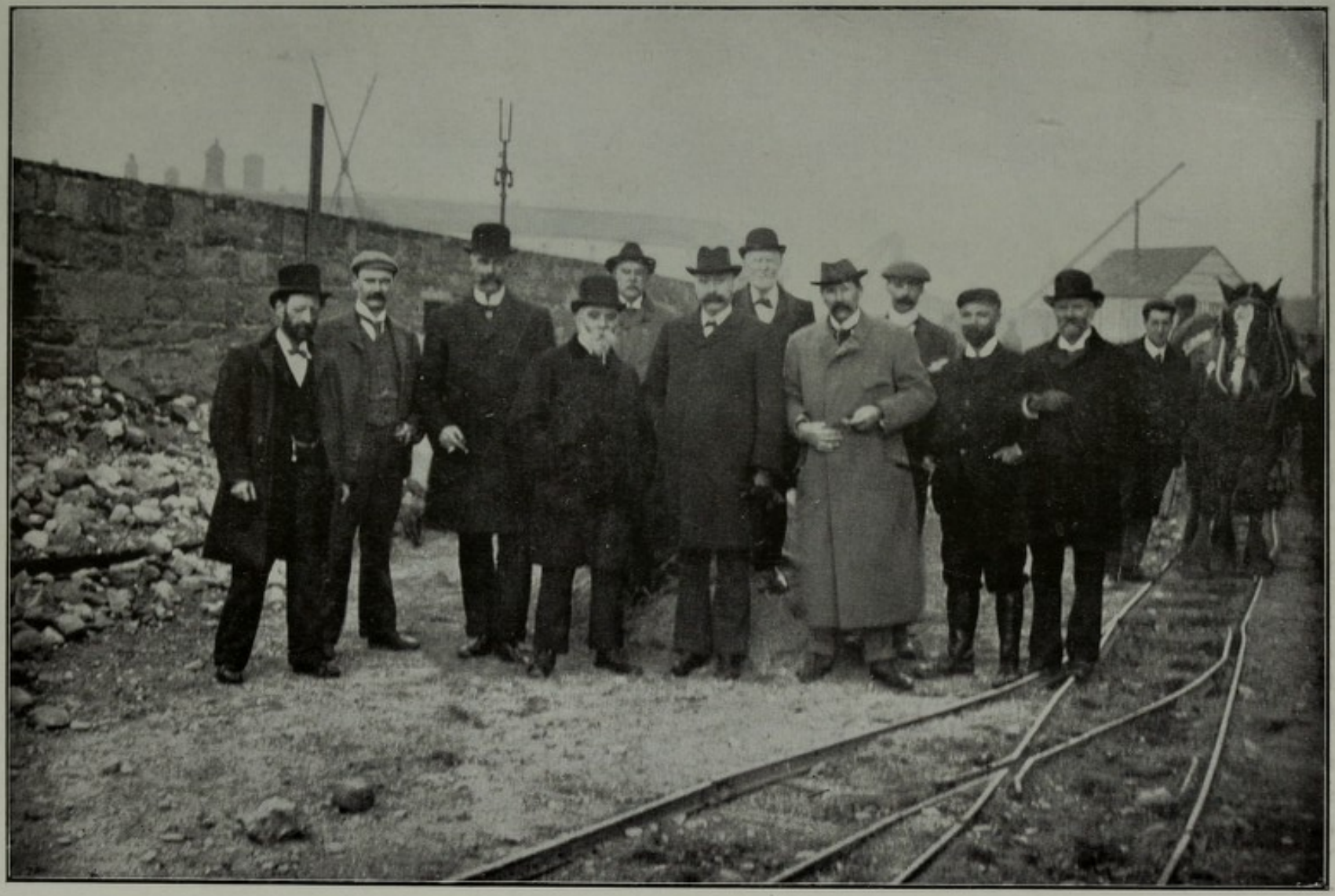
The works are designed to provide for a future population of 325,000. The population at the Census of 1901 was 290,638. The ultimate daily flow of sewage in dry weather is estimated at 14¾ million gallons. It is intended to take into the sewers, pump and treat the rainwater at the rate of a quarter of an inch falling in 24 hours. This, together with the sewage, will make a total flow to be pumped in wet weather of 45 million gallons per 24 hours, or three volumes of the average dry weather flow. During times of heavy rain the surplus water will be passed into the River Liffey through the existing outlets.

The general plan at the end of this book shows the routes of the new sewers. It will be observed that the sewage of the North side of the City is concentrated at the junction of Eden Quay and Marlborough Street, being conveyed to that point by two sewers, one of which starts at Phœnix Park Gates and passes along the Quays and is one mile five furlongs in length and varies from 1ft. 6in. to 3ft. 9in. in diameter, and the other commences at Ballybough Bridge and is laid along the North Strand and Amiens Street, being one mile three furlongs in length and from 3ft. to 3ft. 9in. in diameter, passing under the Royal Canal by a syphon. At Eden Quay the sewage of the North Side is passed under the Liffey by means of a syphon. This syphon is 3ft. 4in. in finished internal diameter. It was constructed by means of a tunnel driven in the solid rock from Eden Quay to Burgh Quay. Cast iron pipes were then laid in the tunnel and the space between the pipes and the rock filled with concrete. The pipes were lined with blue brickwork in cement. On reaching Burgh Quay the sewage of the North Side is joined by that of the South Side, which is collected by a sewer laid along the South Quays to Island Bridge, 2 miles 1½ furlongs in length and from 3ft. to 4ft. 6in. in diameter. This latter sewer has three principal branches, one of which passes through the Castle, and is 3 furlongs in length and varies from 9in. to 12in. in diameter, the second along St. Michael's Hill and Patrick Street, being 4½ furlongs long and varying from 15in. in diameter to 2ft. x 3ft., and the third extends from the Great Southern and Western Railway Terminus to Kilmainham, and is 5 furlongs long, the diameter being 3ft. The lengths given are exclusive of subsidiary branches.

At Burgh Quay the main outfall sewer commences. It is 8ft. in diameter and is constructed along Hawkins Street, Townsend Street, Hanover Street, Clarence Street, and Great Brunswick Street to the Grand Canal Dock, under which it passes, and continues by the Ringsend Road, and across private lands to the Pumping Station. The length is just under two miles. All the sewers down to the Pumping Station, with the exception of the lower mile of the 8ft. sewer, which was constructed under compressed air, as already described, are of brickwork and Portland cement concrete. The length constructed under compressed air was built of cast iron segments and rings with internal flanges, and afterwards lined with fine Portland cement concrete. At the Pumping Station the level of the invert of the sewer is 9ft. below Ordnance datum, or, in other words, approximately 10½ft. below low water of ordinary spring tides.

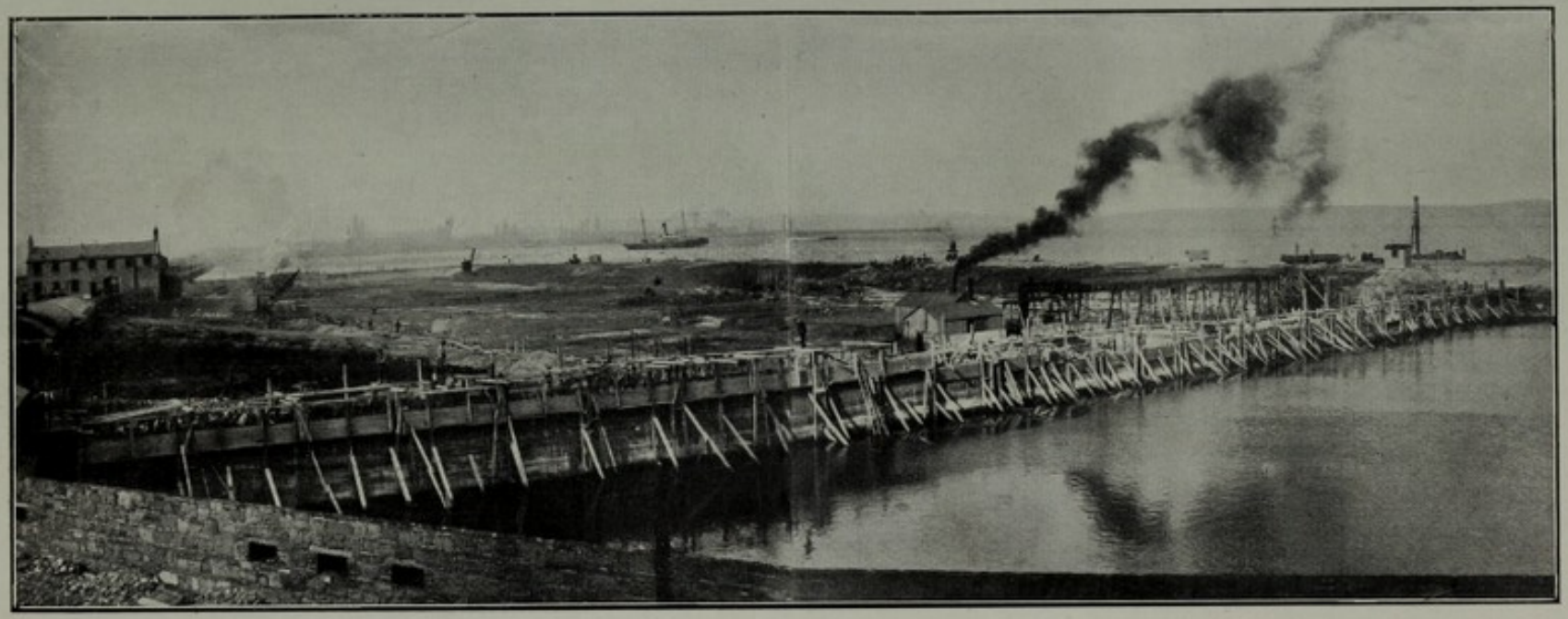
The Pumping Station is situated on the South Wall Intake, near the Coastguard Station. It consists of a group of brick buildings with a chimney shaft 125ft. high from the ground level. The bottom of the foundations is at a level of 15½ft. below Ordnance datum, or about 17ft. below low water of ordinary spring tides, and owing to the proximity of the site to the tidal water, the work was one of considerable difficulty. The pumps as constructed are quite watertight, and reflect great credit on Messrs. H. and J. Martin, the contractors who carried out this part of the work. In the boiler house there are four Lancashire boilers each 28ft. long by 7ft. in diameter, designed for a working steam pressure of 140lb. per square inch. Bennis's mechanical stokers and Green's economisers form part of the plant. Space has been provided for two more boilers should future requirements render them necessary. In the engine room are the main pumping engines. These are vertical triple expansion direct acting engines coupled to centrifugal pumps with 22in. inlet and outlet pipes. There are four of these sets, and three of them will be capable of pumping the maximum wet weather flow, the fourth engine being in reserve in case of a breakdown. The lift of these pumps is 23ft. Space is reserved for two more engines and pumps. There are two smaller pumping sets in this room. These pumps are vertical compound direct acting engines coupled to centrifugal pumps with 7-in. inlet and outlet pipes. They are duplicate sets, and the one at work will pump sewage for making the solution of lime, the lift being about 50ft. In the engine room there are in addition two small Worthington pumps for supplying sewage to the milk of lime mixers. The buildings include a house for the Superintendent and a coal store capable of containing an ample reserve, provision being also made for a workshop for small repairs.

The sewage is delivered by the large pumps into a sewer 8 feet in diameter constructed entirely of Portland cement concrete, laid along



GROUP TAKEN AT COMMENCEMENT OF OUTFALL WORKS.

Including the Engineers and former Members of the Improvements Committee, viz., Messrs. Altman, J. Clancy, R. Jones, W. Ireland.



SITE OF OUTFALL WORKS,
Shewing New Harbour Wall in course of construction.

the intake on the south side of the South Bull Wall to the Pigeon House Harbour, and 5½ furlongs in length. The sewer conveys the sewage to the precipitation tanks at the Harbour. As already explained, the Pigeon House was purchased with a view of utilising the harbour belonging to it as a site for the tanks. A heavy wall has been constructed across the harbour, leaving the Eastern end open to the tidal water. In the reclaimed space the tanks have been constructed. They are 18 in number, built entirely of Portland cement concrete, and have a working capacity of 6½ million gallons. The tanks are rectangular in shape, and the sewage, after receiving the solution of lime which will be added to effect the precipitation of the suspended solid matter to the bottom of the tanks, will be admitted through penstocks at the end of each tank, and after passing slowly through the tank will pass out in a clarified condition over the outlet weirs extending the whole width of the tank. It will then be conveyed by the effluent outfall channel and pipes to the harbour. Reflux valves are provided to prevent the tidal water gaining access to the tanks. When it becomes necessary to clean out a tank the sewage will be shut off from it and the contained liquid discharged by pipes provided with hinged arms having floats attached, so as to ensure the liquid being discharged from the top—to imitate, in fact, the ordinary process of decanting. This precaution is necessary so as not to disturb the solid matters at the bottom of the tank.

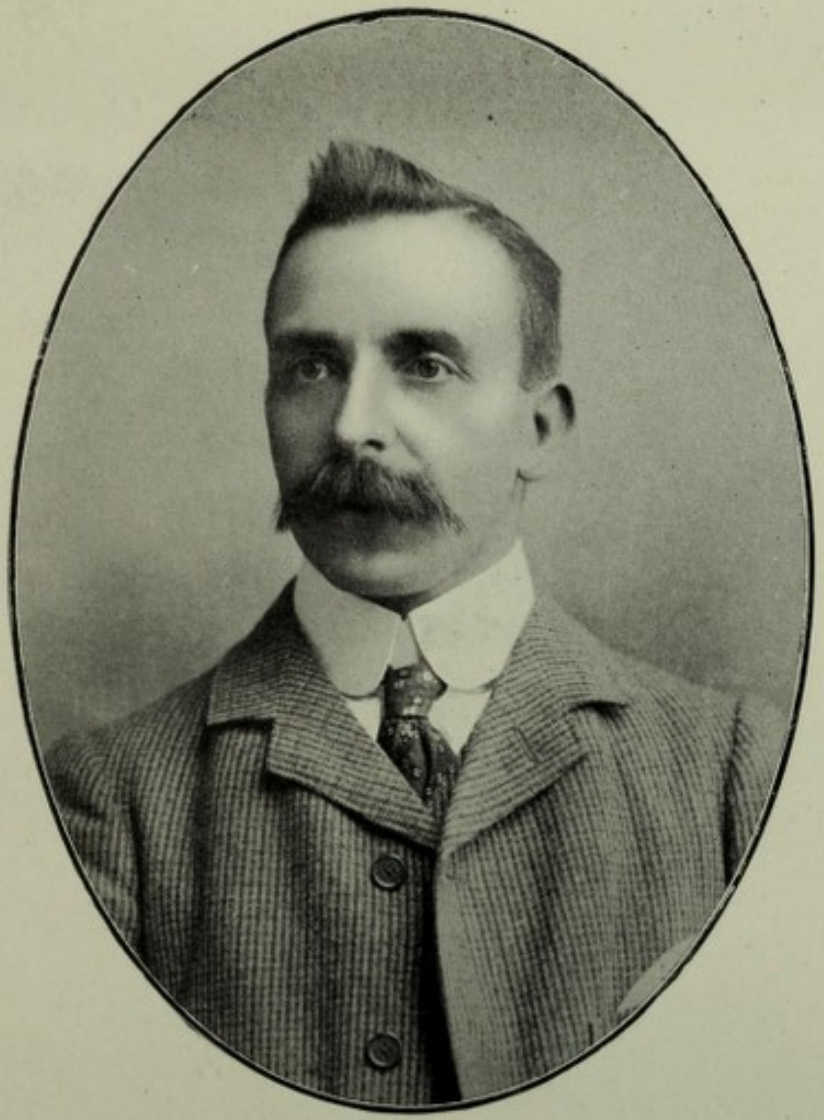
Lime in solution will be employed in preference to lime in suspension, because of its greater efficacy as a precipitating agent. The plant for its manufacture is novel, and may therefore be described in some detail. The solution will be made at the buildings erected for the purpose, at the pumping station site. The lime will be delivered in bulk from the manufacturer into the lime store, and from there will be loaded into small steel wagons, running on a tramway in the buildings. The wagons will be run under a hoist, and will be slung and lowered into slaking pits, full of water. On being taken out, the lime having absorbed enough water for slaking, they will be lifted and discharged into storage hoppers. From these hoppers, the slaked lime will be fed into mechanical screens, where stones and other impurities will be removed the screened lime being delivered into "boots" or pits on the floor. From these it will be conveyed by elevators, consisting of endless bands, to the mixers. The elevators will be capable of adjustment for controlling the delivery of lime, because, on account of the varying character and flow of the sewage, the quantity of lime required will be constantly changing. In the mixers the lime will be converted into milk of lime by the addition of a suitable quantity of clean water, which is laid on for the purpose, or of sewage pumped by the Worthington pumps,

already referred to. The milk of lime then passes through agitators to ensure the more perfect admixture of the lime and water, and afterwards flows to the solution tanks. The latter are three in number, and are raised above the surface of the ground on brick walls, in order to give the head or height necessary for the conveyance of the solution to the tanks. The 7-inch centrifrugal pumps deliver into these tanks, and the solution is made by intimately mixing the milk of lime and the sewage by means of centrifugal mixers of the Gabbett type. The process will take about half-an-hour. Automatic devices are provided to enable the three tanks to work in rotation, each one filling, mixing, and discharging in turn. The solution will be discharged through tanks provided with modules designed to give a constant discharge of liquid, irrespective of the head or pressure. From the module tanks, the solution will pass along pipes, which have been laid on the haunch of the 8-feet sewer, until, when close to the precipitation tanks, it will be discharged into the sewer. This will be the normal method of working, but by-passes are provided for such variations as may be necessary for the purpose of carrying out repairs. The plant will be worked by steam engines, steam being obtained from the boilers at the pumping station.

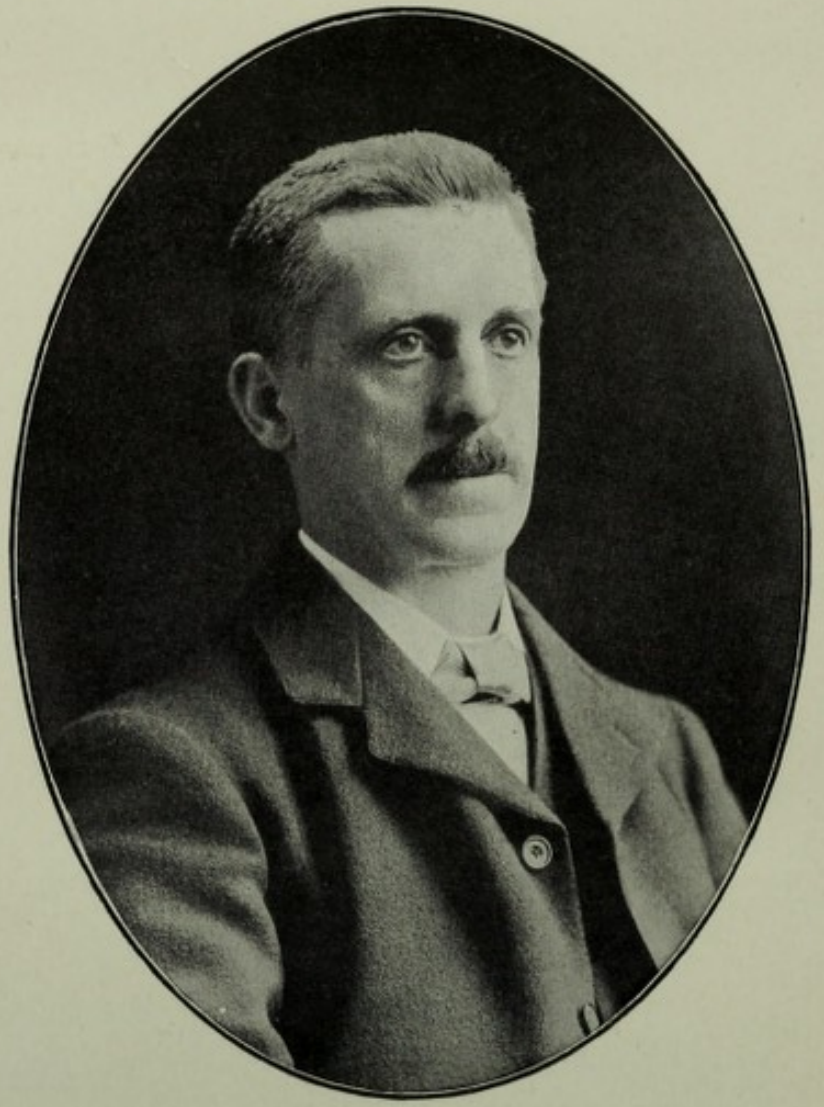
The solid matters precipitated to the bottom of the tanks will, when a tank is emptied for cleaning, be swept into the sludge culvert which runs under the tanks, and will thence flow into the underground sludge-storage tanks in connection with it. The matter passed into the sludge culvert will contain about 90 to 95 per cent. of moisture, and to reduce the latter as far as possible, pipes with floating arms are provided in the sludge tank to draw off as much of the top liquor as possible. The liquor so drawn off will be pumped back to the sewer and will undergo retreatment with the sewage. The sludge remaining in the storage tank will be pumped to a high-level tank and delivered in the sludge vessel, "The Shamrock," which has been built by the Dublin Dockyard Company, as already mentioned, for taking the sludge to sea, and which will lie for loading in the portion of the Pigeon House Harbour still retained. The sludge and liquor pumps will be worked by electricity supplied from the Corporation Station at the Fort. Under the Provisional Order, the vessel must discharge the sludge "outside the Port and Bay of Dublin, not less than six miles distant from Poolbeg Lighthouse and North of a line drawn due East from the Bailey Lighthouse," thus ensuring its complete and permanent removal.

OUTFALL WORKS IN COURSE OF CONSTRUCTION,

Showing inlet channel with sludge culvert under.



JOHN SMELLIE,



WALTER SCOTT,

Dublin Dockyard Company, Builders of the "Shamrock."

THE

SLUDGE STEAMER "SHAMROCK."

The twin screw steamer "Shamrock" was built by the Dublin Dockyard Co., Shipbuilders and Engineers, North Wall, expressly for the Dublin Corporation in connection with the Main Drainage Scheme.

The principal dimensions of the vessel are as follows:— Length between perpendiculars, 148 feet; breadth moulded, 31 feet; depth moulded, 12 feet 9 inches.

The vessel is of the flush deck type, having machinery fitted aft and four large compartments amidships fitted in the 'tween decks. A topgallant forecastle is provided forward, and bulwarks are fitted all round so as to give ample protection to the crew in the discharge of their duties.

The "Shamrock" has been built under special survey, and is very strongly constructed of steel in excess of Lloyd's 100 A.1. class, and having to load aground, she has been designed to resist deformation, the central longitudinal bulkhead being carried down to the keel, and the vessel's floors and bottom plating have been made specially heavy. There are two steel decks, and as these are intersected by the central longitudinal bulkhead, which is watertight, and by athwartship watertight bulkheads, the vessel is divided into no less than 13 watertight compartments instead of three, as would be required by Lloyd's for a vessel of this size, consequently the "Shamrock" is practically unsinkable, a very important consideration in a vessel employed at a busy harbour mouth, and compelled to put to sea, by reason of the special nature of her employment, in all conditions of weather, whether foggy or stormy.

The sludge tanks, of which there are four, are fitted forward of the machinery space and built into the structure of the vessel. The crown of these tanks is formed by the upper deck and the bottom by the lower deck, and this lower deck is at such a level as to be above the general surface of the water outside when the tanks are empty, in order that efficient drainage may be secured. The ship's sides, centre longitudinal bulkhead, and athwartship bulkheads, are all very specially stiffened by web plate, framing and brackets suitably spaced, with an object to prevent deformation in a sea-way should the tanks happen to be only partially full.

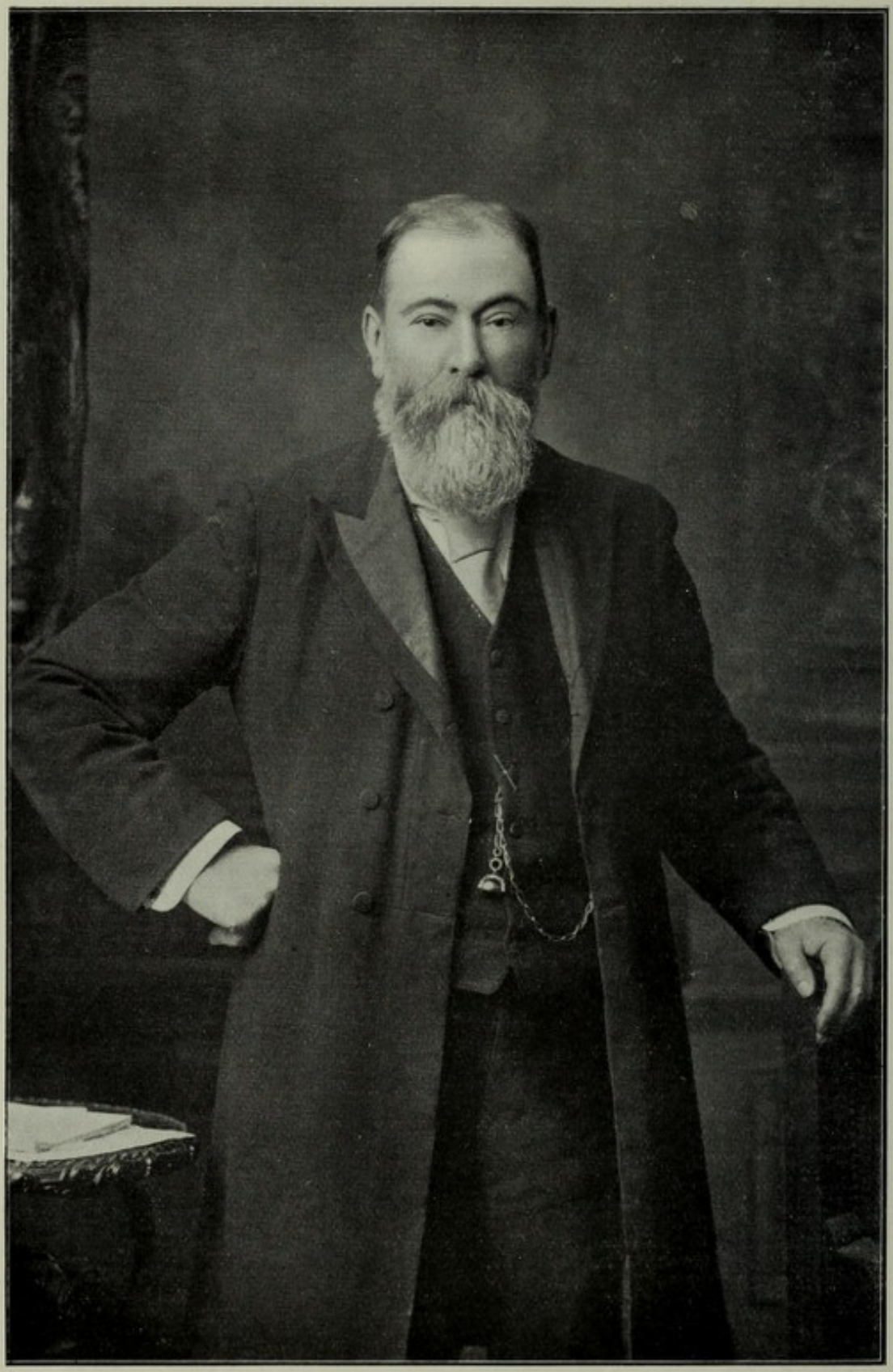
The four sludge tanks have a capacity of 365 tons, and this sludge can be discharged through the vessel's bottom in as short a period as six minutes. This is effected by fitting large watertight disc valves, one on the bottom of each tank communicating with a trunk leading to the outside shell of the vessel. These valves are provided with powerful screw gearing, capable of being operated by hand from the level of the upper deck.

Besides the sludge tanks, two filth tanks are provided on the upper deck; these also are built into the vessel against the bulwarks, and are intended for conveying to sea the filth and rubbish caught by the screens. Large flap doors are fitted to these filth tanks, and these are actuated by hand levers from the vessel's deck, so that the filth may slide out into the sea when the discharge ground is reached. The sanitary arrangements for the purpose of washing out the sludge tanks are of the most complete kind. Besides the ordinary hose nozzles fitted on deck, a large $3\frac{1}{2}$ inch branch is conducted into each sludge compartment and each is provided with a $3\frac{1}{2}$ inch cock and nozzle to take hose, the cock being arranged to work from the upper deck. This system is connected with a powerful steam pump in the Engine room capable of discharging 200 tons of water per hour.

The accommodation provided for the officers and crew is ample, comfortable, and up-to-date in every respect. Amidships under the bridge, and in a steel house which is a continuation of the engine and boiler casings, are the captain's room and officers' dining room. These rooms are well appointed, have lofty roofs, and are each fitted up in hard woods in a tasteful style. Steam heating is provided for use in winter.

The propelling machinery has been supplied to a very full specification by Messrs. David Rowan and Co., of Glasgow, and consists of two sets of compound inverted marine engines working twin screws. Each engine has cylinders 14 inches and 29 inches by 21 inches stroke, and these are supplied with steam at 120 lbs. working pressure from a large three furnace cylindrical marine type boiler 13 feet 6 inches diameter by 10 feet 6 inches long.

In designing the vessel her builders were at considerable pains to fully investigate the actual requirements of the Corporation, and having obtained these, the contract was carried through on broad and generous lines, with the result that the "Shamrock" is a vessel eminently suited for the work in which she is engaged. She has a powerful yet graceful appearance, and, by reason of her twin screws and ample rudder area, is well adapted to manœuvre in and out of the tide-swept entrance to the Pigeon House Harbour, in which her loading berth is situated.



SIR CHARLES A. CAMERON, C.B., M.D.
Chief Medical Officer of Health and Public Analyst.

MEMORANDUM ON

THE SANITATION OF DUBLIN,

1879 TO 1906.

By SIR CHARLES A. CAMERON,

Medical and Executive Officer of Health.

IN the year 1879, in which I was appointed Medical Superintendent Officer of Health, the death rate in the Dublin Metropolitan area was 34·6 per 1,000 persons living and the zymotic death rate was 5·6 per 1,000. In the City the death rate was 37·5 and the zymotic death rate 6·2. In 1880 the death rate was 35 per 1,000 persons living in the metropolitan registration area, and, the zymotic death rate was 7·2. In the City the two rates were 37·8 and 7·9. I attribute those enormous rates largely to the bad condition of the tenement houses in which more than one third of the population of Dublin resided, and to the existence of many thousands of privies, mostly close to houses and generally in a very unclean and ill-kept condition.

Two important objects to be obtained were:—1st, to effect the betterment of the tenement houses; 2nd, to abolish the privies. To what extent these objects have been obtained may be deduced from the following statistics.

Death rate from all causes and from zymotic (preventable) diseases, per 1,000 of the population.

		Deaths from all causes.		Deaths from zymotic diseases.
Dublin Registration Area	1877-1880	31·3	...	5·8
City of Dublin ...	do.	35·7	...	6·1
Registration Area ...	1881-1890	27·0	...	2·9
City	do.	29·7	...	3·3
Registration Area ...	1891-1900	27·0	...	2·8
City	do.	29·7	...	3·3
Registration Area ...	1901-1905	23·2	...	1·9
City	do.	24·8	...	2·2
Registration Area,	first half of 1906	22·0	...	0·7
City	do.	23·4	...	0·8

INSANITARY HOUSES.

The work of getting Magistrates' orders to close insanitary houses, rooms, and cellar dwellings commenced 31st August, 1879, and up to the 31st December, 1881, 1,049 houses, 161 rooms in other houses, and

303 cellars in other houses were detenanted and closed. These houses were inhabited by more than 6,000 persons. Up to the 31st December, 1905, 3,658 houses, 877 rooms in other houses, and 1,090 kitchen dwellings were closed.

About one third of the closed houses were repaired or rebuilt, and reopened, the remainder, including a large number of narrow courts and alleys, have permanently disappeared ; but a considerable number of the houses, more or less ruinous, are extant. It is to be hoped that at some time not too distant, these ruins will be replaced by healthful dwellings, as at present they constitute serious eye-sores in many of our streets.

DWELLINGS FOR THE WORKING CLASSES.

In 1881 the Corporation adopted a report of mine, recommending the erection of dwellings for the working classes, under the provisions of the Act of Parliament relating to the housing of the working classes. Since then the Corporation have spent £300,000 in clearing two unhealthy sites, on which the Dublin Dwellings' Company subsequently erected dwellings for the working classes, and on the clearing of other unhealthy areas, on which the Corporation built Dwellings and a Nightly Lodging House. At present the Corporation dwellings afford accommodation for 1,182 families.

There is also a large nightly lodging house affording accomodation for 100 lodgers.

The Corporation have erected dwellings for the working classes in the following places :—

	Cost of Scheme, made up to 31st March, 1906.			Number of families provided for.
	£	s.	d.	
Benburb Street ...	27,920	1	7	144
Bow Lane	10,334	19	0	86
Blackhall Place Area ...	12,077	12	0	85
St. Joseph's Place ...	26,224	0	6	80
Elizabeth Street ...	2,226	14	2	14
Bride's Alley Area ..	92,916	13	4	138
Clontarf	8,209	18	2	57
Donnycarney	1,279	16	0	8
Foley Street Area* ...	47,389	11	9	460
	£228,579	6	6	
Kilmainham Dwellings nearly completed ...	11,296	6	3	110
	£239,875	12	9	1,182

* Only partially occupied, the Scheme not being quite completed.

The estimated expenditure for the Foley Street Scheme was £70,900, of which only £47,389 has been expended.

The above sum of £239,875 12s. 9d. does not include the clearing two unhealthy sites (the Coombe and Plunket Street) at a cost of £51,700.

THE WATER CARRIAGE SYSTEM OF FILTH REMOVAL.

A study of the vital statistics of English towns has convinced me that their general and zymotic death rates are higher in those in which the filth conservancy (privies and middens) system obtains, than in the water-closet towns. Immediately after my appointment as Medical Superintendent Officer of Health, I resolved to make a determined effort to abolish the privies and replace them by water-closets.

In 1882 I had an enumeration made of all the privies and water-closets in the City. It was found that there were 15,531 water-closets and 11,269 privies. There was hardly a single water-closet in a tenement house. Many of the privies were placed against the back walls of the houses, and were in communication with ash-pits, generally of large size and uncovered. Enormous difficulty was encountered in the effort to abolish the privies, but so successful has it been that practically the City of Dublin, exclusive of the lately-added areas, is completely a water-closet city.

The introduction of the portable ash-bin enabled the sanitary department to get all the offensive ash-pits abolished, and there are now but a small proportion of houses using ash-pits.

THE TENEMENT HOUSES.

Whilst the condition of the tenement houses is not what one could wish it to be, yet it has been greatly improved by the efforts of the sanitary staff. Formerly many of them had no sanitary accommodation whatever, the occupants being obliged to make use of the sanitary accommodation of other houses. A large number of houses had sanitary accommodation provided for them in yards situated at considerable distances from the houses. A large proportion of the tenement houses had no water directly supplied to them. All this unsatisfactory state of things has been immensely improved. Still, in many instances, the tenants exhibit great indifference to the filthy state of their abodes, and when good modern sanitary appliances are provided, they misuse them. In the present state of the law, tenants cannot be made responsible for certain insanitary conditions in their dwellings created by themselves. The large staff of Sanitary Inspectors find ample employment in the

inspection of tenement houses, and in taking the steps requisite to remedy the insanitary conditions they discover in them. About 15,000 notices to abate nuisances are annually given, and from 700 to 800 summons to the Police Court have to be annually issued to enforce the observance of the notices. Beside Mr. Charles Travers, Superintendent of Sanitary Officers, there are 28 Sanitary Sub-officers engaged in inspectorial work.

A means of improving the health of the City, the Corporation have provided cheap swimming and reclining baths, a wash-house, medicated baths, free disinfection, ambulances for the conveyance of the sick and wounded to hospital, six open spaces and recreation grounds, the inspection of food, the detection of adulteration of food, etc.

The dispensary Physicians, who are *ex-officio* Medical Officers of Health for the district, make inspections, and of course I frequently inspect insanitary dwellings.

POLLUTION OF THE RIVER LIFFEY.

The introduction of the water-closet system into the tenement houses largely increased the pollution of the river, as has already been said. I have examined the sewage taken at different points and with the following results :—

COMPOSITION OF DUBLIN SEWAGE, Taken July, 1902.

A gallon of each contains in Grains :—

——	Smithfield. 1.	Watling Street. 2.	Fitzwilliam Street. 3.	Cardiffs Lane. 4.	Seville Place. 5.	Drum-condra. 6.	Rainsford Street.	
							Brewery Discharge. 7.	Street Sewer. 8.
Suspended matter	35·28	12·08	17·92	15 12	40·04	25·76	3·30	36·80
Solids in solution	40·88	132·72	46·48	162·24	63·28	33·60	56·30	104·36
Total Solids	76·16	144·80	64·40	177·36	103·32	59·36	59·60	141·36
Organic and volatile matter in suspended matter.	18·00	2·80	3·68	6·72	7·15	17·20	—	16·20
Fixed mineral substances ditto	17·28	9·28	14·24	8 80	32·89	8·56	—	16·60
Organic and volatile substances in soluble solids.	12·88	32·48	19·68	29·68	7·28	13·44	20·00	28·36
Fixed mineral matter in soluble solids.	28.00	100·24	26·80	132·16	56·00	20·16	36·30	90·40
Chlorine	5·96	48·70	10·48	18·39	19·38	6·96	1·50	1·59
Nitrates	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.	Traces.
Albuminoid ammonia	3·57	1·78	2·10	3·50	3·50	6·10	0·40	1·50
Saline ammonia	0·25	6·15	1·20	1·40	1·75	1·40	0·17	0·25
Oxygen absorbed in moist combustion.	5·43	5·24	5.63	4·75	6·05	5·78	5·48	10·84

OBSERVATIONS.

No. 1. Smithfield Street.—Sewer at Haymarket.—Odour of sulphuretted hydrogen.

No. 2. Watling Street.—Sewer at Coke Lane.—Odour of sulphuretted hydrogen: not much suspended matter. One-third of the solid matter is chlorine. This chlorine as sodium chloride is probably derived from the gut factories in the neighbourhood, as the intestines of animals in these factories are liberally treated with salt. The suspended matter included 3·5 grains of cellulose and distinct traces of starch.

No. 3. Fitzwilliam Street.—Sewer at Baggot Street.—Odour of sulphuretted hydrogen.

No. 4. Sewer at junction of Cardiff's Lane and Misery Hill.—Odour of sulphuretted hydrogen. A very large amount of solid matters. Traces of hydro-carbons present.

No. 5. Sewer at Seville Place, opposite Cobourg Place.—Odour of sulphuretted hydrogen. Much suspended matter.

No. 6.—Drumcondra Tanks.—Slight odour of sulphuretted hydrogen. Total solids not large in amount.

No. 7. Rainsford Street.—Syphon pipe, discharge from brewery. Almost no odour. Nearly clear, yellow colour. Very few large suspended particles. It contained 2 grains of cellulose per gallon and traces of starch.

No. 8. Rainsford Street Sewer.—Very dark-coloured. Numerous large particles. Much suspended matter. Very bad odour of sulphuretted hydrogen. Contained 5 grains of oxide of iron.

Memorandum of Items of Interest in Connection with the Dublin Main Drainage.

4TH MAY, 1891.

At the Council meeting held on this date, the following resolution was, on the motion of the late Councillor J. L. Robinson, C.E., seconded by James Shanks, the High Sheriff of that year, carried unanimously, viz :—

> That inasmuch as the present condition of the River Liffey renders it a public nuisance owing to the constant discharge of sewage from the City and some of the Townships into it, and as the recent consolidation of the City debt places the Corporation in a favourable position to deal with the pollution of the river and the Main Drainage of the City, that a Main Drainage Committee be appointed to make inquiries as to the best scheme of Main Drainage for the City of Dublin, and report to Council with as little delay as possible. That the Committee consist of :— The Right Honourable the Lord Mayor (Alderman Joseph Meade), Councillor Shanks, High Sheriff (Lord Mayor 1893), Councillor Robinson, C.E. ; Aldermen Toole and Meagher, J .P., Mulligan, Pile, (Lord Mayor, 1900) ; Sexton J.P., Councillors Bulger, O'Meara, Doherty, C.E., J.P. ; Mayne, Brown, J.P. F.C.A. ; Hutchinson (Lord Mayor, 1904 and 1905), and Smyth.

Of these fifteen original members of the Main Drainage Special Committee eight are now dead, five have retired from the Council, and two, viz :— Councillors O'Meara and Hutchinson, are still members of the Corporation.

The following members also subsequently acted on the Main Drainage Special Committee during the intervening years between 1891 and the formation of the Improvements Committee in 1901 :—

Councillor Lenehan, Councillor Clinch, Councillor Maguire, Alderman Gill, Councillor Tallon, Lord Mayor 1898 and 1899 ; Councillor Walker, J.P. ; Alderman Dillon, Lord Mayor 1894 and 1895 ; Councillor Clancy, Councillor Reilly, Councillor McCoy, Lord Mayor 1896 and 1897 ; Alderman O'Reilly, Councillor Little, Alderman Cummins, J.P. ; Alderman Dowd, Councillor Cox, Alderman Flanagan, J.P. ; Councillor Doctor Kennedy, Alderman Davin, Alderman Gerald O'Reilly.

In addition to the foregoing the following members have held office

on the Improvements Committee from 1901, in accordance with the system of rotation or interchange :—

Councillor Richard Jones, J.P., Chairman Improvements Committeee, 1901 and 1902.
Alderman Ireland, J.P., Chairman, 1903.
Councillor Crimmins.
Councillor Noble.
Councillor Harrington, M.P., B.L., Lord Mayor 1901, 1902, and 1903.
Councillor C. Kelly.
Councillor Cox.
Alderman Russell
Councillor Clancy.
Councillor Altman.
Alderman Delahunt.
Alderman Reigh.
Councillor McKenna.
Councillor M. J. Lord.
Councillor Patrick Murray.
Councillor Patrick White, M.P.
Alderman Farrell, Chairman, 1905.
Councillor Dawson.
Alderman Healy, J.P.
Councillor J. Cahill.
Councillor Crowe.
Alderman Thomas Kelly, Chairman 1904.
Councillor Grimes.
Councillor P. T. Daly.
Alderman George Tickell.
Councillor William Partridge.

Of these additional members of the Main Drainage Special Committee, and those who constituted the Improvements Committee since 1901, eight are dead and nineteen have retired from the Council.

8TH MAY, 1891.

At its first meeting, which was held on this date, the Committee appointed the Lord Mayor (Alderman Joseph Meade) Chairman, and Councillor Robinson, C.E., Deputy Chairman. The Town Clerk (Mr. John Beveridge) was appointed Secretary to the Committee.

10TH JULY, 1891.

Mr. George Chatterton, M.I.C.E., who had been strongly recommended by Sir Benjamin Baker, was engaged to examine the various schemes and estimates submitted by other engineers, to advise the Committee, and also prepare plans and estimates.

24TH SEPTEMBER, 1891.

Mr. Chatterton's report presented to the Committee recommending the adoption of the Whitebank Scheme, and the Committee having considered this report, it was resolved :—

> That a Sub-Committee, consisting of the Lord Mayor and the High Sheriff, Alderman Meagher, J.P., Alderman Toole, Councillor Robinson, C.E., Councillor Mayne, Councillor Clinch, Councillor Hutchinson, Councillor Brown, J.P., F.C.A., and Councillor Doherty, C.E., J.P., be instructed to examine the most recent example of precipitation that Mr. Chatterton may indicate, such as Richmond, near London, and report to this Committee, and that the Sub-Committee be accompanied by the Town Clerk and the City Engineer, and that the further consideration of Mr. Chatterton's report be deferred until the report of the Sub-Committee is disposed of.

12TH NOVEMBER, 1891.

The Committee decided to send up a report to Council recommending the adoption of Mr. Chatterton's plan for the Main Drainage of the City (*vide* Report 151/1891).

15TH JANUARY, 1892.

The Committee ordered the Scheme to be divided into five or six sections for contract. In connection with the inquiry into the application for provisional order and loan, etc., Mr. Chatterton recommended the retention as witnesses of Messrs. Binnie or Crimp, Mansergh, Sir Benjamin Baker, Dr. Dupre, and Sir Charles Cameron. Mr. W. G Strype was also retained as a witness in support of the Scheme.

24TH MARCH, 1892.

Mr. Chatterton, reporting on a communication from the Fisheries Department, states that Dr. Dupre is quite positive that the discharge effluent can have no effect on the salmon fishing, and that it will be quite harmless to the fish on account of the enormous dilution it will receive.

9TH MAY, 1892.

The Committee agreed to the printed clause submitted by the Chief Secretary for Ireland releasing the expenditure on the Main Drainage Works from the restrictions as to borrowing powers contained in Section 238, Sub-section 2 of the Public Health Act, 1878.

27TH MAY, 1892.

Mr. H. H. Hellins, recommended by Mr. Chatterton for the position of Resident Engineer, and recommendation agreed to by Committee. Mr. Chatterton reported that Mr. Hellins had been his Resident Engineer on the Rhonda Valley Main Sewerage Works, and has had considerable experience in the preparation of Main Drainage Drawings.

JUNE, 1892.

Petition against the Main Drainage Bill lodged by the Rathmines and Pembroke Main Drainage Board.

The following are the names of the Parliamentary Committee on the Main Drainage Bill :—

Mr. Hingley, Chairman ; Sir Algernon Borthwick, Mr. Seaper Hunt, Mr. Victor Cavendish, and Mr. Bonham Carlie (Referee).

27TH JUNE, 1892.

The Confirming Bill received the Royal Assent on this date at the same time as the Electric Lighting Order.

15TH SEPTEMBER, 1892.

Colonel Bell wrote in reference to the objections of the War Department, and asked if the Corporation would be prepared to re-buy the site of the Pigeon House Fort, which he stated was purchased by the Board of Ordnance in 1813 for a sum of £100,183.

16TH NOVEMBER, 1892.

At their meeting on this date the Committee received several objections to the Scheme, amongst the objectors being the Rathmines and Pembroke Main Drainage Board, and the War Department and some private interests. The Committee referred the objections to the Consulting Engineer, Mr. Chatterton, and, at the same time requested the War Office to give particulars of their reasons for objecting, and if the same could be met by any modifications.

2ND DECEMBER, 1892.

Deputation, on the recommendation of Mr. Chatterton, appointed to wait on Mr. John Morley and Lord Wolseley in reference to the objections of the War Department.

Mr. Chatterton, in the course of a report relative to an interview which he had with General Grant, Inspector-General of Fortifications, intimated that the Sanitary Engineer to the War Department approves of the Scheme, and says it will not injure the War Department property.

22ND DECEMBER, 1892.

Report of Deputation which waited on Mr. Morley and Lord Wolseley. The Deputation feel that the War Department want to get rid of the Pigeon House Fort, hence their objection to the Scheme, which they, the Deputation, consider is not based on the objection of the War Department Sanitary Engineer.

20TH JANUARY, 1893.

The consent of the Board of Trade is recorded so far as their jurisdiction for the protection of navigation is concerned.

15TH MARCH, 1893.

The statutable approval of the Port and Docks Board is recorded.

21ST JUNE, 1893.

Report from Army Sanitary Committee that the Scheme proposed by the Corporation is not satisfactory in its present state, and making certain recommendations for its modification, and also recommending that the Corporation should acquire the Pigeon House Fort.

At this stage it would appear that the Committee decided to open up negotiations with the War Department for the purchase of the Pigeon House Fort.

24th August, 1893.

It is recorded that the Port and Docks Board do not object to the Syphon under the Liffey.

13th September, 1893.

Long letter written by the direction of the Secretary of State for War, Sir Henry Campbell-Bannerman, following interview of Deputation with him, and embodying the following terms, which would be acceptable to the War Department:—

a. The Corporation to pay the sum of £65,000 for the Pigeon House Fort.

b. The Corporation to provide a sufficient Wharf accommodation on the navigable part of the river for War Department requirements.

c. The War Department to retain the Submarine Establishment, to have the use of the small harbour, and to retain the chamber at the Pigeon House Fort.

d. The War Department to retain a small piece of land to the east of Pigeon House Fort as a site for a battery of quick-firing guns.

4th December, 1894.

The Committee had before them a report giving the result of a deputation consisting of representatives of the Corporation, Mr. Wigham, President of the Chamber of Commerce, Messrs. Sexton, Clancy, Field, and Dr. Kenny, M.P.'s, to the Secretary of State for War, viz.:—that he had arranged to sell the Pigeon House Fort and buildings as they are to the Corporation for £65,000, giving up full possession.

1st July, 1895.

The Local Government Board notify they have made a provisional order extending the time within which the borrowing power for Main Drainage purposes may be exercised, and as to the application of the money so borrowed.

22nd July, 1895.

Report from Mr. Harty stating the portions of the work now recommended to be taken up are those that have been prepared under Contracts Nos. 1 and 2. Contract No. 1 comprises the intercepting sewers and other works on the South Quays, the branch to Kilmainham, the branch to Island Bridge, the branches to intercept the sewage from

the Poddle. No. 2 Contract comprises the intercepting sewers and other works on the Northern Quays.

9th January, 1896.

The tenders of Messrs. H. & J. Martin, Limited, were accepted for Contracts Nos. 1 and 2—the amounts being £36,066 and £26,668 respectively.

9th October, 1896.

The Local Government Board's Chief Engineering Inspector, Mr. Cotton, held an inquiry into an application for a loan of £350,000.

16th October, 1896.

Letter from the Local Government Board sanctioning the immediate borrowing of the sum of £150,000, and a future loan of £200,000, when required.

24th February, 1897.

The War Office officially notify the acceptance by the Secretary of State for War of the sum of £65,000 for the Pigeon House Fort, including all its buildings, harbour, boat-slip, and all other accessories and the Submarine Mining Establishment, provided that permission be given at all times for troops, etc., to pass through the Fort or to the Battery Site in the locality; that the Department shall be at liberty to remove the cranes; and, further, that the transfer shall be subject to the rights already conferred on the Rathmines and Pembroke Main Drainage Board.

14th July, 1898.

Mr. Hellins reported the sewers had been completed in the private properties between Kingsbridge Station and Old Kilmainham.

22nd August, 1899.

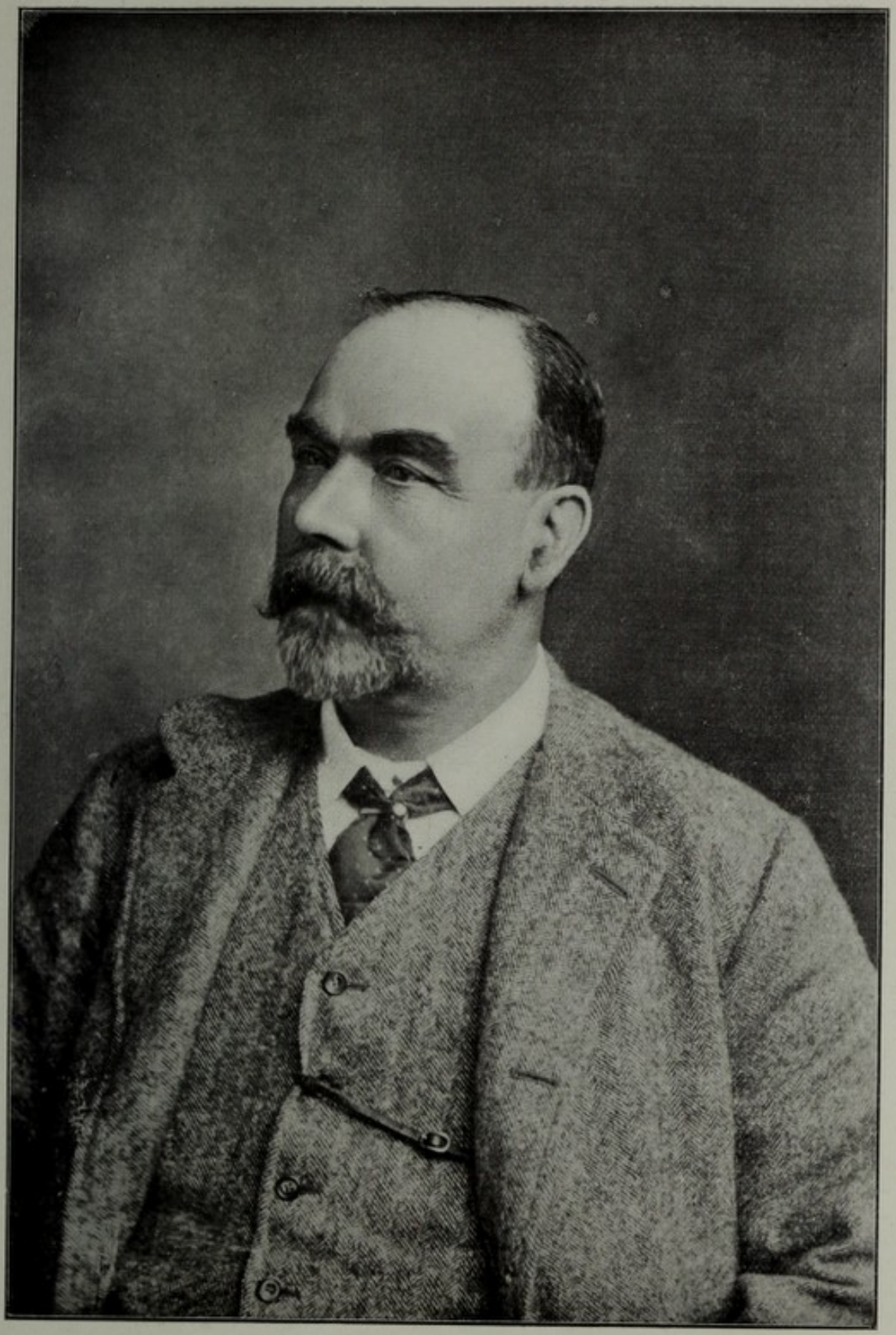
The Committee decided to recommend the tender of Messrs. Pearson and Son for Contract No. 4 for the sum of £94,003 14s. 9d.

Note.—This sum was subsequently increased to £103,963, owing to alterations in portion of tanks and requirements of Port Board.

This contract consists of the High Level 8 feet Sewer from the Pumping Station on Ringsend Road to Pigeon House, and 18 Precipitation Tanks, and other works in connection therewith.

6th October, 1899.

The Town Clerk notified the following order of Council, adopted on the 15th September, 1899, on the consideration of the Report of the



JAMES MARTIN (Messrs. H. & J. Martin, Ltd.),
One of the Contractors for the Works.

Main Drainage Committee, recommending the execution of the Contract No. 4, be entrusted to Messrs. Pearson :—

> That the contract with Pearson be modified in accordance with the memorandum now submitted; that subject to this amendment the Report 118 be adopted, and that the best thanks of the Council be accorded to Councillor Pile and the Borough Surveyor, Mr. Harty, for their valuable services to the Corporation in satisfactorily arranging the contract with Messrs. Pearson and Son.

28TH AUGUST, 1900.

Foundation Stone of Outfall Works laid at the old Pigeon House Fort in Dublin Bay by Lady Pile, Lady Mayoress of Dublin.

3RD AUGUST, 1900.

The Town Clerk notified the death of Alderman Meade, Chairman of the Committee.

7TH SEPTEMBER, 1900.

The Committee elected Councillor Sir Thomas D. Pile, Bart., Lord Mayor, Chairman in room of Alderman Meade.

In consequence of the operation of the Dublin Boundaries Act, 1900, the Main Drainage Committee was amalgamated with the Improvements Committee, and on the

5TH FEBRUARY, 1901

The first meeting of the Improvements Committee took place, at which Councillor Richard Jones, J.P., was elected Chairman, and Alderman Ireland, J.P., Deputy-Chairman.

4TH FEBRUARY, 1901.

The Municipal Council adopted the Report of the Main Drainage Committee recommending the acceptance of the tender of Messrs. H. & J. Martin, Limited, for the construction of the Low Level Outfall Sewer and the Syphon under the Liffey, for £125,993, which was subsequently increased to £136,000, per resolution of Council of 3rd May, 1901.

2ND APRIL, 1901.

The Committee recommended the acceptance of the tender of Messrs. Gwynne, 81 Cannon Street, London, for engines and pumps for the sum of £11,014, and that of Messrs. D. Stewart & Co., London Road Iron Works, Glasgow, for Lancashire boilers, for £4,620.

In accepting the tenders of Messrs. Gwynne for engines and pumps,

and Stewart's for boilers, the Municipal Council passed the following resolution :—

> That this report be adopted, and that local artisans be employed in every possible instance in connection with the carrying out of the work provided for in this report.

3rd September, 1901.

In connection with the construction of the sewer on the South Quays, the Contractors report that they unexpectedly encountered a great deal of rock, the tunnelling through which greatly increased the estimated cost of the work.

25th April, 1902.

Sir Benjamin Baker engaged to examine the works, and he subsequently recommended certain modifications in the plans, in order to ensure greater stability, and the Committee directed a deputation consisting of the Lord Mayor (Councillor Harrington, M.P., B.L.)., the Chairman (Councillor Jones, J.P.), Messrs. Harty and Hellins, to proceed to London for the purpose of conferring with Sir Benjamin as to the steps to be taken with regard to the modification in the contract drawings.

20th June, 1902.

The Deputation, consisting of the foregoing members and Engineers, with Mr. Chatterton, interviewed Sir Benjamin, who recommended an increase in the thickness of the concrete floors from a minimum of 12 inches to a uniform thickness of 3 feet 3 inches over all, which proposal he assured the deputation would effectually provide the permanent stability under the altered conditions which were found to prevail during the construction of the works. The probable additional cost was estimated at £17,000. The Deputation also interviewed Sir Weetman Pearson as to the best class of concrete to be used, and they stipulated that the concrete should not be of a less weight than that at present in use on the works.

7th July, 1902.

Mr. Hellins reported the completion of the Syphon under the Liffey, and also the rising leg to Burgh Quay.

7th August, 1902.

First intimation of Messrs. Pearson's claim for extra pumping at the Pigeon House Fort, received by the Committee, and referred to the Law Agent and Counsel.

10TH MARCH, 1903 :—

The Improvements Committee adopted the following resolution—

> That in pursuance of recommendation No. 19 of Report 214, 1902, of the Departmental Inquiry Committee, that for the purpose of safeguarding the future of the Main Drainage Scheme, one of the permanent Engineers of the Corporation should be immediately brought into contact with the work, we hereby appoint Mr. Buckley to act under the Committee on the Main Drainage Works in order that he shall become acquainted with their construction and development.

19TH OCTOBER, 1903.

Contract No. 7, for the construction of a Pumping Station, Dwelling-house and various auxiliary works, placed with Messrs. H. & J. Martin, Limited, for the sum of £29,466.

1ST DECEMBER, 1904.

Contract No. 8, for the construction of the " Shamrock," finally placed with the Dublin Dockyard Company, for the sum of £11,085.

19TH APRIL, 1905.

Contract No. 9, for the supply and erection of two electric motors at the Main Drainage Pump House at the Pigeon House Fort, placed with Messrs. Johnson & Phillips, Old Charlton, Kent, for £197 10s. 0d.

17TH JULY, 1905.

Sir Alexander Binnie retained by the Municipal Council to inspect the works, and report on their stability.

22ND JULY, 1905.

Sir Alexander Binnie inspected the works.

5TH DECEMBER, 1905.

Inquiry opened by the Chief Engineering Inspector to the Local Government Board (Mr. P. C. Cowan, M. Inst. C.E.) into the application of the Corporation for a supplemental loan of £42,000 to complete the works. After receiving Mr. Chatterton's evidence, Mr. Cowan intimated that before he could close the inquiry expert evidence should be produced to satisfy him with regard to the efficiency of the chemical treatment, and the general capacity of the works to meet the requirements of the City, and also the drainage of the added areas. He, therefore, adjourned the inquiry until the 13th February, 1906. Professor Blount, F.I.C., Sir Alexander Binnie, Mr. MacDonald (City Engineer of Glasgow) and Mr. Hellins, late Resident Engineer on the Works, were retained as witnesses on behalf of the Corporation. After the adjourned inquiry the Local Government Board sanctioned the supplemental loan.

2nd April, 1906.

Contract No. 10, for the erection of the Liming Plant, placed with Messrs. H. & J. Martin for the sum of £12,712.

25th June, 1906.

Contract No. 11, for the supply, delivery and erection of tidal flap valves placed with Messrs. Kennan & Sons, for the sum of £490.

13th August, 1906.

Contract No. 12, for the supply of 23 self-acting shutters, placed with Messrs. Kennan, at £4 3s. each.

Contract for wiring the Main Drainage in connection with the lighting of the Pumping Station, placed with Messrs. Dockrell & Sons, for the sum of £402 1s. 7d.

Great Head Shield.

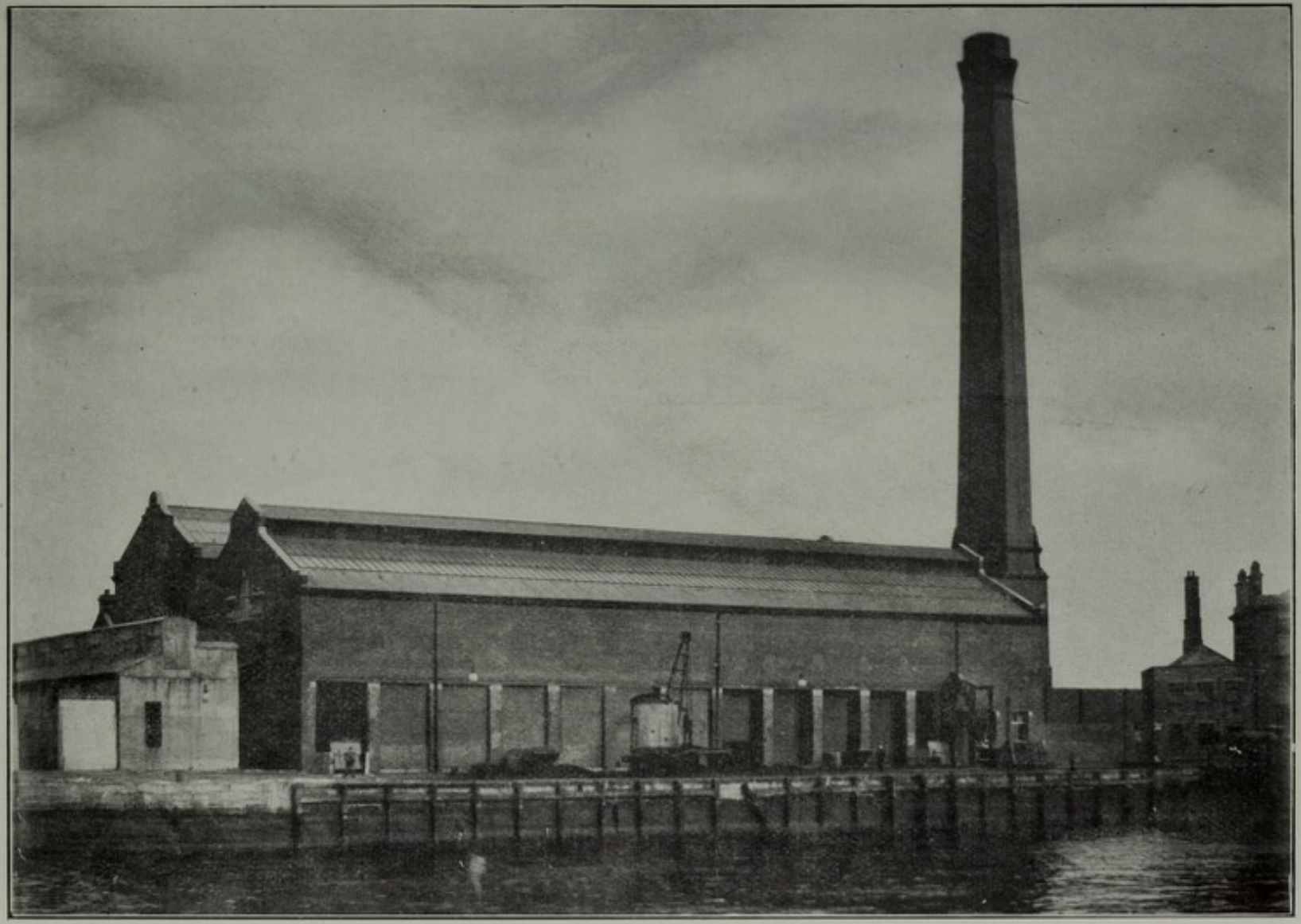
The 8-foot sewer between the Pumping Station and the Grand Canal at Gas Works, was carried out by this new process of tunnelling The compressed air in the tunnel had the effect of keeping the water out as the work proceeded, thus obviating the necessity of any pumping. This section took more than $2\frac{1}{4}$ years to complete. The distance is well over 5,000 feet, and the rate of progress averaged 7 feet per working day.

Corporation Property at the Pigeon House.

The entire acreage of Corporation property, including what is under buildings and works is 72 acres, 1 rood and 1 perch. About 11 acres of this, purchased for £710 from Lord Pembroke, is a field lying between the Coastguard Station and the Pigeon House, and which is likely to become a valuable site in time to come. All this land is included in the new City of Dublin.

The Main Drainage and Electricity Works.

Have involved close on one million of capital outlay, which has been taken up principally within the last 10 years. Both schemes have necessarily contributed largely to doubling, within that period, the annual provision for interest and sinking fund, which comes out of rates each year. This annual provision may be assumed to have now reached high water mark, and (from an expenditure point of view) absorbs about half the consolidated rate of the city. The entire purchase-money (£65,000) paid to the Government for the Pigeon House Fort, is charged exclusively against the Main Drainage Undertaking, but by a settlement arrived at between the Improvements Committee and the Lighting Committee, the latter body contribute a rental of £600 per annum in



CORPORATION ELECTRICITY POWER HOUSE.

relief of the Capital Charge. This equitable arrangement has also the effect of bringing the Lighting Committee's undertaking more within the range of commercial principles.

Secretaries to the Main Drainage Scheme.

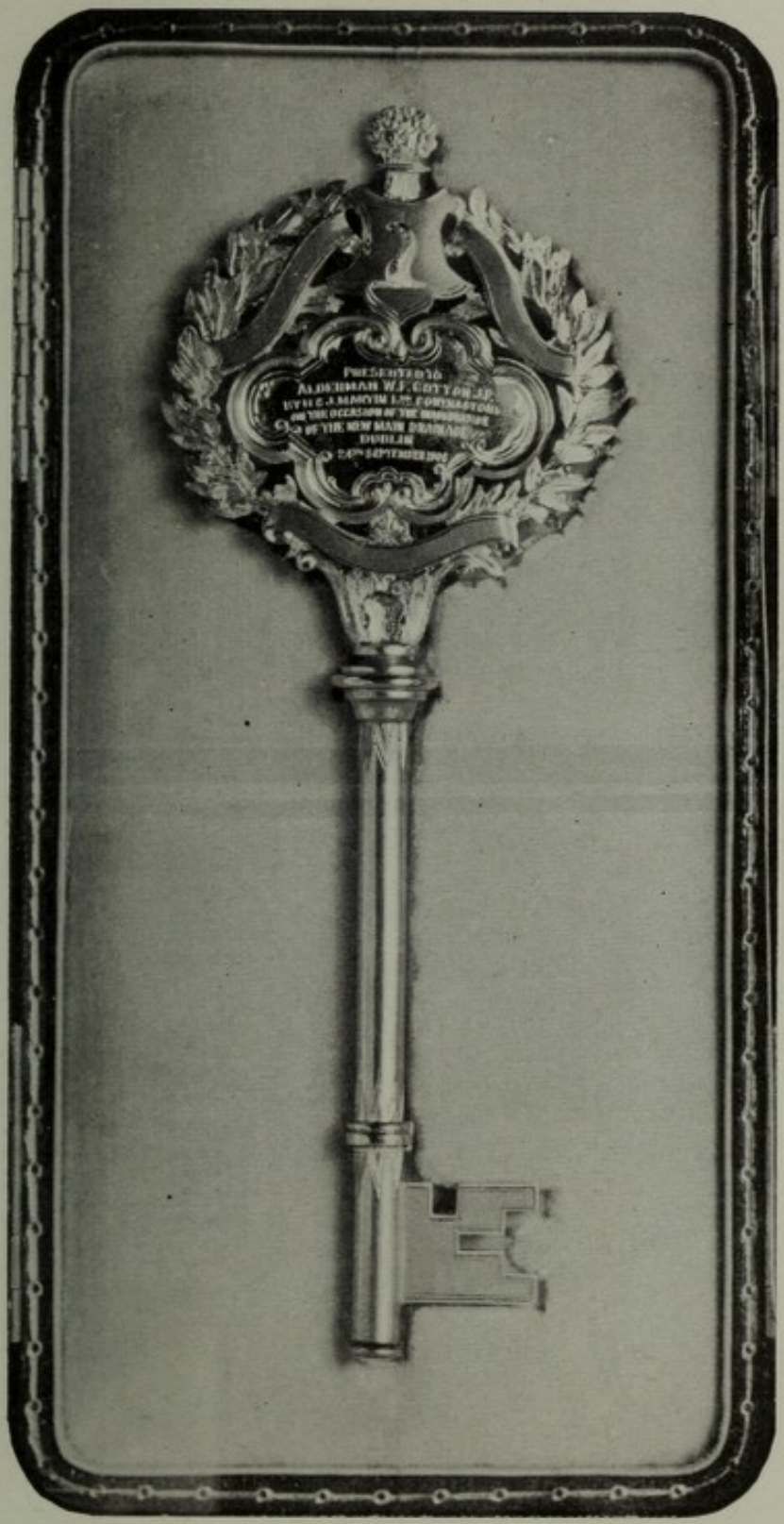
During the earlier efforts of the Corporation to deal with the Main Drainage of the City, and since the scheme assumed practical shape, the following officers of the Corporation acted as secretaries to the various committees having charge of the scheme :—

William Joseph Henry (Town Clerk), from 1864 to 1878.
John Beveridge (Town Clerk), from 1878 to 1893.
Henry Campbell (Town Clerk), from 1893 to 1900, inclusive.
M. M. O'Reilly (Secretary, Improvements Committee), 1901 to 1903.
Patrick Tobin (Secretary, Improvements Committee), 1903 to the present date.

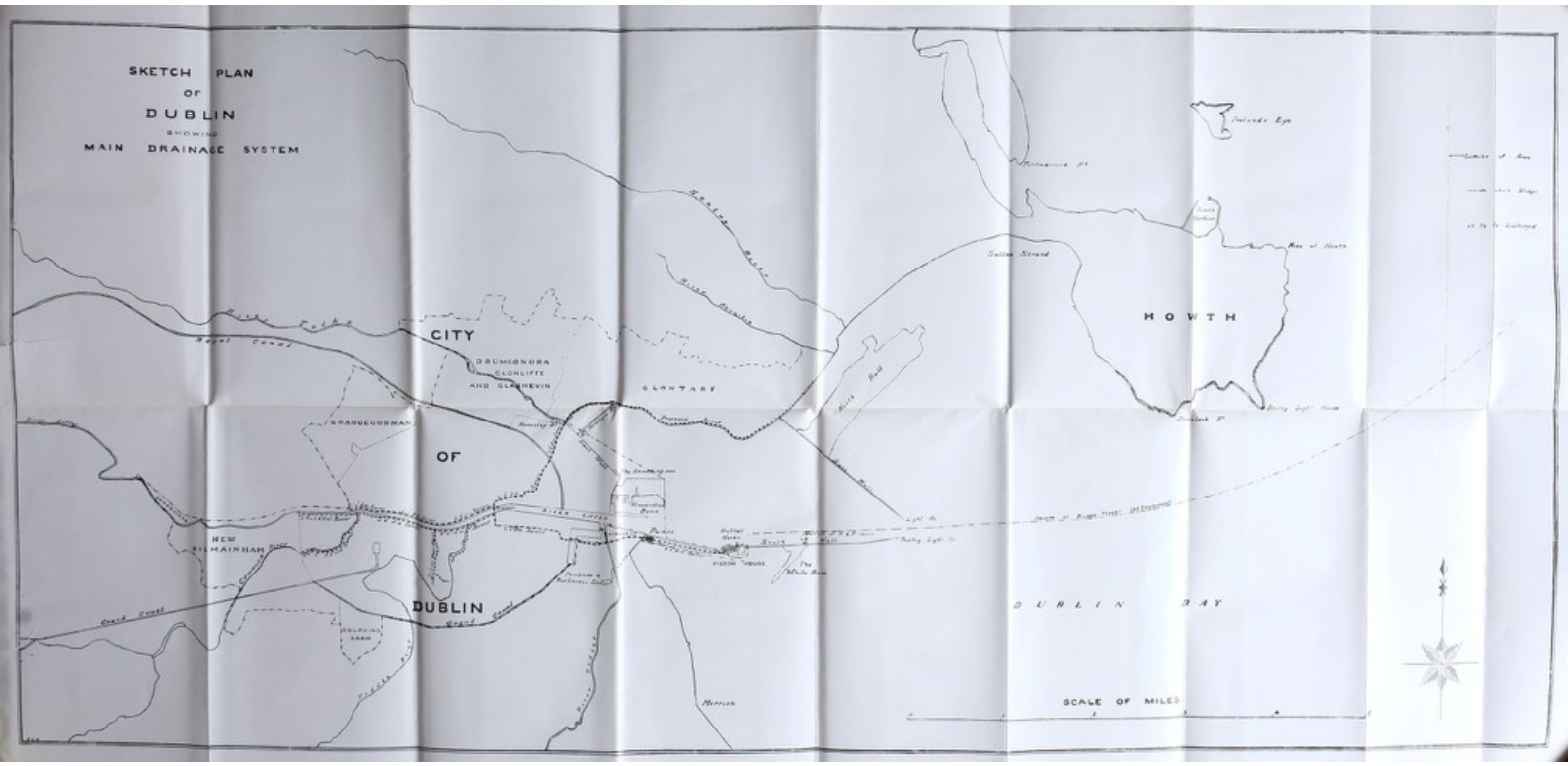
Assistant Engineers and Clerks of Works Employed during the Progress of the Scheme.

The Assistant Engineers engaged superintending the various sections of the Works during their progress were :—Messrs. J. Newbigging, P. Wakeford, J. O'Donnell, G. D. Gray, and G. S. Harty, B.A., B.A.I. (Dub.)

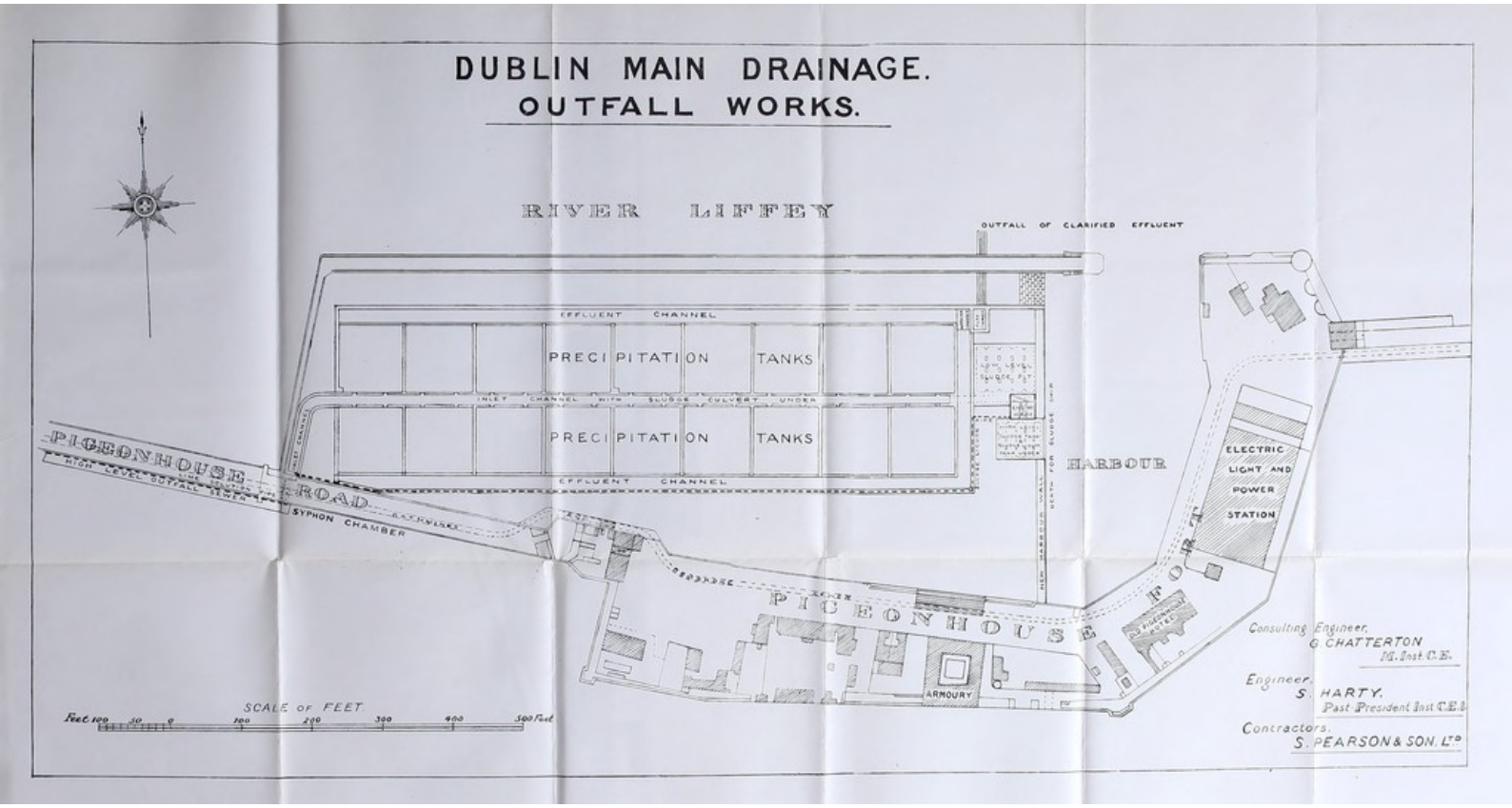
Under these the following Inspectors were employed on the various contracts —Messrs. W. Farrell, M. Dowd, M. Quigley, T. Rochfort, J. Comerford, E. O'Byrne, P. Walsh, J. S. Gray, and Michael Kelly.



Fac-simile of the Gold Key which was presented to Alderman Cotton by the Contractors (Messrs. H. & J. Martin), on the occasion of the Inauguration of the Works.


SKETCH PLAN
OF
DUBLIN
SHOWING
MAIN DRAINAGE SYSTEM
CITY
OF
DUBLIN
DRUMCONDRA
CLONLIFFE
AND GLASNEVIN
GLASNEVIN
GRANGEGORMAN
NEW
KILMAINHAM
HOWTH
DUBLIN BAY
SCALE OF MILES

DUBLIN MAIN DRAINAGE.
OUTFALL WORKS.



Consulting Engineer.
G. CHATTERTON
M. Inst. C.E.

Engineer.
S. HARTY.
Past President Inst. C.E.I.

Contractors.
S. PEARSON & SON. Ltd