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FIRST REPORT

OF

THE COMMISSIONERS

APPOINTED IN 1868 TO INQUIRE INTO

THE BEST MEANS OF PREVENTING THE POLLUTION OF RIVERS.

(MERSEY AND RIBBLE BASINS.)

VOL. II.

EVIDENCE.

Presented to both Houses of Parliament by Command of Her Majesty.

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EVIDENCE.—PART I.

QUERIES (SERIES 1.—GENERAL. 2.—SEWERAGE. 3.—SEWAGE WORKS. 4.—WATER SUPPLY) RELATING TO CITIES, BOROUGHS, TOWNS, AND DISTRICTS SITUATE IN BASINS OF THE MERSEY, RIBBLE, AND THEIR TRIBUTARIES.

Series No. 1.—General.——Queries.——1. Name and area of the City, Borough, Town, or District?——2. Population at last census, and probable yearly increase to the present date?——3. Number of houses, and rate of yearly increase?——4. The rateable value?——5. When was the Borough incorporated, or the Public Health or Local Government Act adopted?——6. State number of public works that have been executed by the governing body? If water works, the cost? If gas works, the cost? If sewerage works, the cost?——7. How were the costs defrayed, by rates, or if by loan, from whom borrowed?——8. Has the Corporation or the Local Board jurisdiction over the river flowing by or through the Town?——9. What are the powers, and the Local Act or Acts of Parliament conferring them?——10. To what extent have those powers been exercised?——11. Describe the past and present condition (within your knowledge) of that part of the river or stream flowing by or through the Town, and give the name of the river or stream?——12. to what bed of the river or stream silted up, if so, to what cause do you attribute it?——13. Is the property situate on either bank of the river affected by floods, and to what cause do you attribute the floods?——14. Is the river or stream polluted by town sewage, liquid refuse from manufactures, chemical works, gas works, dye and bleach works, calico and silk printworks, tan-yards, and from mines, and to what extent?——15. Is the river or stream polluted by scoria from iron works, slag, cinders, small coal, or any other solid refuse?——16. Are encroachments on the river or stream prevented?——17. Is the condition of the river, streams, or canals, passing by or through the Town, a source of ill-health or discomfort?——18. Are there cellar dwellings in the Town, if so, how many?——19. Have the sewerage works or other works of town improvement influenced the rate of mortality, and in what manner and degree?——20. State the rate of mortality per 1,000 in the town or Local Board district, each year from 1857 to 1867.——21. Are there any districts of the Town especially unhealthy; if so, to what cause is this attributed?——22. Are they liable to be flooded occasionally?——23. How is this flooding caused?——24. Have you any suggestions to offer as to the best means of avoiding pollution in future?——25. Have you any suggestions to offer as to the conservancy of rivers and streams?

Series No. 2.—Sewerage.——Queries.——1. Have sewerage works been carried out in the town?——2. When were they commenced?——3. When completed?——4. Describe them and state cost?——5. Are the sewers ventilated; if so, describe mode of ventilation?——6. Are they flushed; if so, state how often and by what mode?——7. How many waterclosets, trough or tankclosets, or self-acting tumbler tanks are there in the town?——8. Are they all connected with the sewers?——9. Are the sinks and gullies of houses connected with the sewers?——10. Are there any cesspools; if so, is the overflow from them connected with the sewers?——11. Are there any cesspools, privies, middens, or ash-pits within dwelling-houses?——12. What number of privies, middens, or ash-pits are there?——13. Are the privies, middens, or ash-pits connected with the sewers?——14. Are they cleansed systematically, and at what intervals?——15. By whom?——16. What is the cost annually?——17. If done by local authority, what amount is obtained for the refuse?——18. What weight of refuse is removed annually?——19. To what purpose is the refuse devoted?——20. Is there a ready sale for the refuse, and does the amount received for it exceed the cost of cleansing the privies, middens, and ash-pits and removing refuse; or does it only cover the cost; or is there an annual deficiency; State the amount in either case?——21. To what extent is the refuse employed?——22. Is the cleansing of the privies, middens, and ash-pits complained of as a nuisance affecting the health and comfort of the inhabitants?——23. Are disinfectants used; if so, state them, and are they efficient in preventing smell?——24. Is sickness attributed to those privies, middens, and ash-pits?

Series No. 3.—Sewage Works.——Queries.——1. Describe the works; state where they are situate, and how far distant from the town?——2. How is the sewage treated; by lime, perchloride of iron, or by any other disinfectant; if so, in what proportion?——3. Is the sewage filtered; if so, describe process, and the state of the effluent water?——4. Where is the effluent water discharged?——5. Is steam, hot or warm water, conveyed into the sewers?——6. Were many springs tapped during the execution of the sewerage works; if so, state about the volume of water thus entering the sewers daily?——7. Is the level of the well water in the town affected by the sewers; and to what extent is it depressed?——8. Has irrigation of land with sewage of the town been contemplated by the governing body, or by any other persons?——9. Is there land available for irrigation over which the sewage of the town might be passed?——10. Are there any difficulties in the way of irrigation; if so, state them?

If Irrigation Works are established.——11. Describe them, and state the cost?——12. State the area of land to which sewage is applied?——13. The volume of sewage used every 24 hours?——14. What is the condition of the effluent water; and where is it discharged?——15. State the extent and kind of crops (grass, grain crops, and green crops), which have been sewaged, and the amount of produce in the several cases?——16. The total working expenses per annum?——17. The profit or loss per annum?

Series No. 4.—Water Supply.——Queries.——1. How is the town supplied with water for domestic purposes?——2. From what source is the

water at present obtained, from wells, river or stream, or both?——3. When were the waterworks for the town first established?——4. To whom do they belong?——5. Where are the reservoirs or pumping stations situate.——6. If pumped or abstracted from river, give the daily volume pumped or abstracted?

If Impounding Reservoirs.——7. What is the area of gathering ground?——8. What is the area of reservoir; if more than one, give area of each separate?——9. What the maximum depth?——10. How many gallons of water will each contain?——11. Is the water polluted before entering the reservoirs; if so, state the nature of pollution?——12. Is the water filtered?——13. Describe the filtering medium?——14. Is the water pumped to a high-service reservoir or reservoirs; if so, describe machinery?——15. What is the area of the high-service reservoir?——16. What the maximum depth?——17. How many gallons of water will it contain?——18. Is the high-service reservoir built entirely above the surrounding ground or only partially so, and is it a covered one?——19. State the total cost of pumping, including labour, fuel, and materials?

If Supply is obtained from Wells.——20. Describe geological character of the water-bearing stratum into which the well is sunk?——21. Diameter and depth of well?——22. Diameter and depth of bore hole?——23. State the volume of water pumped each hour, and for how many hours daily?——24. The area and maximum depth of service reservoir?——25. How many gallons o water will it contain?——26. Is the service reservoir built entirely above the surrounding ground, or only partially so, and is it a covered one?——27. Describe pumping machinery?——28. State annual working cost, including labour, fuel, and materials?——29. State the area of the district supplied?——30. How many houses are supplied, and for what purpose?——31. How many works or manufactories are supplied?——32. Is the supply constant or intermittent; if the latter, how many hours daily are the service mains kept charged?——33. What volume of water in gallons is supplied to the district daily, for trade and for domestic purposes?——34. What volume of water in gallons is supplied daily for watering of streets and flushing of sewers, and during what months?——35. Are the houses furnished with cisterns, or is the water supplied direct from the mains; if the former, is the overflow pipe from cisterns connected with the soil pipe from watercloset or with the sewer?——36. What is the rate of charge for water?——37. Is the present supply adequate to the requirements of the town or district?——38. What steps are taken to prevent waste?——39. From what source was the town or district supplied previous to the establishment of the waterworks?——40. What have the waterworks cost?——41. What effect has the improved water supply had upon the health of the inhabitants?——42. Has the water been analysed; if so, state by whom, and furnish copy of the analysis?

ANSWERS TO QUERIES RELATING TO CITIES, BOROUGHS, TOWNS, AND DISTRICTS SITUATE IN THE BASINS OF THE RIVERS MERSEY, RIBBLE, AND THEIR TRIBUTARIES.

SERIES No. 1, GENERAL.

Queries——1. Name and area of the City, Borough, Town, or District?——2. Population at last census, and probable yearly increase to the present date?——3. Number of houses, and rate of yearly increase?——4. The rateable value?——5. When was the Borough incorporated, or the Public Health or Local Government Act adopted?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow Tributary of the Mersey.
Hollingworth	The Answers to Queries have not been received from this Local Board of Health.
Glossop	Borough of. Area, 3,033 acres. Population, 16,000 to 17,000. Rateable value, 38,082*l.* 5*s.* 5*d.* Incorporated 19th October 1867. Local Government Act adopted in the year 1868.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Local Government Board District. Area, about 1,320 acres. Population at the last census, 1,050; annual increase, about 30. Houses, 246; increase, about 4 per annum. Rateable value, 4,506*l.* 14*s.* 7*d.* Local Government Act of 1858 adopted 30th December 1862.
	Watershed of the Tame, Tributary of the Mersey.
Hyde	Local Board of Health District. Area, 889 statute acres. Population, 13,722; increase about 200 a year. Houses, 2,830; increase about 40 per year. Rateable value, 42,000*l.* Public Health Act adopted on the 2nd September 1863.
Denton	Local Board of Health District. Area, 1,706 acres. Population in 1861, 3,335; probable yearly increase, 200. Houses, 934; yearly increase, about 40. Rateable value, 13,936*l.* 2*s.* Public Health Act adopted in 1857.
Dukinfield	Local Board of Health District. Area, 1,782 acres. Population in 1861, 15,024; no increase. Houses, 3,384; increase one or two each year. Rateable value, 42,744*l.* 19*s.* Public Health Act adopted in 1857.
Stalybridge	Borough. Area of 883 statute acres, or thereabouts. Population at last census 24,921; there has not been any increase. Houses 5,123; 77 built during the last seven years. Rateable value, 70,598*l.* Incorporated on the 5th March 1857.
Ashton-under-Lyne	Borough. Area, 1,391 acres. Population at last census, 34,894; yearly increase, about 500. Houses, 6,665; yearly increase, about 80. Rateable value, 91,240*l.* 8*s.* Incorporated in 1847. Present Improvement Act obtained 1849.
Hurst	Local Board of Health District. Population, 6,000. Houses, 1,200. Rateable value, 11,157*l.* 13*s.* 4*d.* Public Health Act adopted 1861.
Mossley	Local Board of Health District. Population, 13,000. Houses, 2,100; average yearly increase, about 50. Rateable value, 28,000*l.* Public Health Act adopted, March 1864.
	Watershed of the Mersey Proper.
Liverpool	Borough. Area, 5,210½ acres. [B.E.] Population 1861, 443,938; estimated population, 1868, 500,676. This estimate rests on the theory that the rate of increase is the same as from 1851 to 1861, viz., 18 per cent. in the decenniad, or 1·68 per cent. yearly. [M.O.] Number of houses 1861, 75,159, in 1867, 86,176. The average rate of yearly increase in the seven years, 1,573; in the 27 years from 1841 to 1867 inclusive, the average annual increase was 1,552. Rateable value, 2,356,925*l.* [B.E.] Incorporated by several ancient charters. The present town council is constituted under the Municipal Corporations Act, 1835. [T.C.]
Waterloo - with - Seaforth.	Local Board of Health District. Area, 688 acres or thereabouts. Estimated population (18th January 1869) about 6,500. Houses, 1,020; average yearly increase, 45. Rateable value, 48,507*l.* 10*s.* Public Health Act adopted 23d June 1856.
Great Crosby	Local Board of Health District. Area, 1,849 statute acres. The district formed part of the township of Great Crosby (at the last census), and the proportion of population then within the district cannot now be distinguished. Houses, 543; average annual increase about 40. Rateable value, 15,990*l.* The Public Health Act adopted May 1863.
Litherland	Local Government Board District. Area, 850 acres. Population, about 2,300, and increase about 10 per cent. per annum. Houses, 416; increase about 5 per cent. per annum. Rateable value, 8,598*l.* Local Government Act adopted June 1863.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby - -	Local Board of Health District. Area, 5,561 acres, or thereabouts. Population at last census, 16,215; probable average yearly increase, 1,260. The number of houses, 4,543. Average rate of yearly increase, 223. Rateable value, 137,403. Public Health Act adopted 23rd of January 1860.
Walton-on-the-Hill.	Local Government Board District. Area, about 1,910 acres. Population, 3,601; increase about 100 yearly, exclusive of the West Derby Union workhouse which has an average population of about 1,000. Houses, 680; average yearly increase for the last three years, 32. Rateable value, 27,772*l.* Local Government Act adopted 1863.
Toxteth Park -	The Local Board of Health District. Area, 1,450 statute acres. Population at the last census about 3,500; now about 5,120, or an annual increase of about 202. Houses, 636; average, 33 yearly increase. Rateable value, 41,586*l.* Public Health Act adopted in 1857.
Wavertree - -	Local Board of Health District. Area, about 1,799 acres. Population at last census, 5,392; estimate 1868, 6,700. Houses, 1,349; rate of yearly increase, about 41. Rateable value, 48,697*l.* 10*s.* Public Health Act adopted 25th June 1851.
Little Woolton -	Local Board of Health District. Population, 1,062. Number of houses, 139. Rateable value, 10,500*l.* Public Health Act adopted 22nd November 1866.
Much Woolton -	Local Board of Health District. Area, about 970 acres. Population, 3,586; probable yearly increase, 51. Houses, 813; rate of yearly increase about 20. Rateable value, 15,858*l.* 2*s.* 7*d.* Public Health Act adopted 1866.
Garston - -	Local Board of Health District. Area, about 1,625 acres. Population, 4,516 at last census; yearly increase about 500 per annum. Houses about 1,000; yearly increase about 50. Rateable value, 40,210*l.* 10*s.* Public Health Act adopted in August 1854.
Widnes - - -	Local Board of Health District. Area, about 3,039 acres. Population in 1861, 6,905; present population about 12,000. Houses, 2,009; increase, 47 houses last year. Rateable value, 32,170*l.* 4*s.* 6*d.* Public Health Act adopted 9th August 1865.
Sutton - - -	Local Board of Health District. Rateable value, 48,000*l.* Public Health Act adopted 1863.
Prescot - - -	Local Board of Health District. Area, 303 a. 0 r. 9 p. Population, 6,066; no increase. Houses, 1,181; no increase. Rateable value, 9,101*l.* 16*s.* 3*d.* Public Health Act adopted in 1867.
Parr - - -	Local Government Board District. Area, about 1,466 acres. Present population, 5,500. Houses, 1,031; yearly increase, 5 per cent. Rateable value, 14,077*l.* 15*s.* 9*d.* Local Government Act, 1858, adopted June 1865.
St. Helens - -	Borough. Area, about 6,580 acres. Population, about 40,000; probable yearly increase, 2½ per cent. Houses, 7,920; yearly rate of increase, about 300. Rateable value, 140,000*l.* Incorporated 5th March 1868.
Newton-in-Mackerfield.	Local Government Board District. Area, about 3,103 acres. Population in 1861, 5,905; increase, 120 annually. Houses, about 1,100; increase, about 40 annually. Rateable value, 27,401*l.* Special Act obtained in 1855.
Warrington - -	Borough. Area in Lancashire, 1,050; in Cheshire, 290: total, 1,340 statute acres. Population in 1861, 26,431; estimated present population, 30,000. Houses, 6,000; increase, about 200 per year. Rateable value, 71,086*l.* Incorporated 1847, Public Health Act adopted 1866.
Pennington - -	Local Government Board District. Area, about 1,482 acres. Population at last census, 5,015; probable yearly increase, 50. Number of houses, 1,100; rate of yearly increase, 10. Rateable value, 14,135*l.* 6*s.* 10*d.* Local Government Act adopted October 1863.
Westleigh - -	Local Government Board District. Area, about 1,882 acres. Population at last census, 4,431; probable yearly increase, 100. Houses, 1,105; rate of yearly increase, 20. Rateable value, 21,297*l.* 10*s.* Local Government Act adopted 1863.
Hindley - -	Local Board of Health District. Area, 2,527 acres. Population, 8,477; increase, about 200 per annum. Houses, 1,680; increase, about 40 per annum. Rateable value, 27,382*l.* 5*s.* 5*d.* Public Health Act adopted 1867.
Atherton - -	Local Board of Health District. Area, about 2,426 acres. Population in 1861, 5,907; probable yearly increase, 140. Houses, 1,400; yearly increase, 30. Rateable value, 27,208*l.* 15*s.* Public Health Act adopted 19th December 1863.
Tyldesley-with-Shakerley.	Local Government Board District. Area, 2,490 acres. Population in 1861, 6,029; 100 a year increase. Houses, 1,323; yearly increase, about 15. Rateable value, 24,843*l.* Local Government Act, 1858, adopted 24th September 1863.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Rusholme - -	Local Board of Health District. Comprises the township of Rusholme, part of the township of Moss Side, and part of the township of Withington. Area, about 1,160 acres. Population at last census, 6,090; estimated yearly increase, 119. Houses, 1,400; rate of yearly increase, about 30. Rateable value, 44,665*l.* Public Health Act adopted on the 11th February 1851 so far as regards the township of Rusholme, and on the 20th May 1856 as to the parts of Moss Side and Withington.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	Borough. Area, about 2,178 statute acres. Population, 54,682. Houses, about 12,000. Rateable value, 136,000*l.* Incorporated in 1835. Local Board of Health Act adopted 26th August 1863.
Bredbury - -	Local Board of Health District. Area, 2,523 acres. Population in 1861, 3,408; increase, 10 to 20 yearly. Houses, 779; increase, five or six yearly. Rateable value, 14,949*l.* Public Health Act adopted November 1864.
Wallasey - -	Local Board of Health District. Area, 3,000 acres. Population at last census, 10,723; probable yearly increase, 300. Houses, 2,200; probable yearly increase, 30. Rateable value, 58,656*l.* Public Health Act adopted 9th May 1853.
Birkenhead - -	Local Board of Improvement Commissioners. Area, 1,684 acres, including the township of Claughton, and exclusive of any part of the river Mersey. Population at last census, 37,796; probable yearly increase 2,300. Houses, 7,600; rate of yearly increase, 30. Rateable value, 221,749*l.*, being the assessment to the improvement rate for the year 1868. The board of improvement commissioners, first constituted by the Local Act, 3 Will. 4. c. 63., intituled "An Act for lighting, watching, "cleansing, and otherwise improving the Township or Chapelry of Birkenhead "in the County of Chester, for regulating the Police thereof, and for establishing "a Market therein," with further enlarged powers conferred by subsequent Acts.
Oxton - - -	Local Board of Health District. Population, 2,670. Houses, 507; only six houses have been built within the last four years. Rateable value, 14,572*l.* Public Health Act adopted in May 1863.
Tranmere - -	Local Government Board District. Area, 1,059 acres, exclusive of the foreshore of the river Mersey, which is 115 acres 1 rood and 27 perches. Population, 9,607 at last census; probable yearly increase, 700. Houses, 2,906; yearly increase, 120. Rateable value, 51,556*l.* Local Government Act, 1858, adopted in February 1860.
Higher Bebington -	Local Government Board District. Area, 840 acres. Population in 1861, 2,086; probable increase, 400 or 500. There are 453 houses; increase, about 5 per cent. Rateable value 15,000*l.* Local Government Act, 1858, adopted 17th February 1859.
Runcorn - -	Local Board of Health District. Township includes part of Halton. Area, 1,490 acres. The town is governed under The Runcorn Improvement Act, 1852. Population, Runcorn, 10,063; part of Halton, 371; probable increase, 4,000. In the year 1858 there were 2,145 houses; in 1868, 2,620: average increase, 47 per year. Rateable value, 34,108*l.* 5*s.* 2*d.* Public Health Act, so far as it relates to water, adopted 1856.
Lymm - - -	Local Board of Health District. Area, 4,284 acres. Population, 3,767; probable yearly increase about 2 per cent. Houses in 1861, 758. Rateable value, 19,368*l.* 9*s.* 6*d.* Public Health Act adopted 12th May 1863.
Altrincham - -	Local Board of Health District. Area, 657 statute acres. Population at last census, 6,628; probable yearly increase, 200. Number of houses, 1,542; yearly increase, about 40. Rateable value, 27,591*l.* 6*s.* 1*d.* Public Health Act adopted in 1851.
Sale - - -	Local Government Board District. Area, about 1,981 acres. Population in 1861, 3,026; probable yearly increase, 225. Number of houses in 1861, 607; 1868, 921; rate of yearly increase, 45. Rateable value, 28,701*l.* 10*s.* 11*d.* Local Government Act adopted 15th Nov. 1866.

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, & Monton.	Local Board of Health District. Area, 2,261 acres. Population in 1861, 11,146; yearly increase, about 250. Houses in 1861, 2,295; probable number at present, 3,000. Rateable value, 37,600*l.* Public Health Act adopted August 1854.
Stretford - -	Local Board of Health District. Area, 3,140 acres. Population at last census, 8,757: probable increase, 500 to 750 per annum. Houses, 2,250; yearly increase, 70. Rateable value, 58,146*l.* Public Health Act adopted in 1868.
Moss Side - -	Local Board of Health District. Area, 420 acres. Population last census, 2,692; estimated present population, 3,800. Houses, between 700 and 800; rate of yearly increase about 35 per cent. Rateable value, 23,405*l.* 19*s.* 5*d.* Public Health Act adopted in August 1856.
Salford - -	Borough, comprising Salford district, area 1,329, Broughton district, 1,426, and Pendleton district, 2,453; total, 5,208 acres. Population at last census, 102,414; estimated at present date, 133,623; yearly increase, 12·20 per cent. Houses in

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Salford—*cont.*	Salford, Broughton, and Pendleton districts, 25,555; average yearly increase for the last four years, 693. Rateable value of Salford, Broughton, and Pendleton districts, 422,786*l.* 5*s.* In 1844 the township of Salford with so much of Broughton as was on the south side of the river Irwell was incorporated, but in 1853 the borough was extended by including the remainder of the township of Broughton, the whole of the township of Pendleton, and the detached portion of the township of Pendlebury; by this means the limits of the municipal borough were made co-extensive with those of the Parliamentary borough. The borough is under local Acts, namely, Salford Improvement Act, 1862, ditto 1867.
Manchester	The city comprises within the municipal boundary, the townships of Manchester, Cheetham, Hulme, Chorlton-upon-Medlock, Ardwick, Beswick. Area, 4,203 a. 1 r. 27 p. The population, 1861, 338,722. The estimate of the population for 1867, 362,823. Probable annual increase, 4,000. The estimated number of inhabited houses in 1861, 61,487; in 1867, 70,000. Estimated rate of increase per annum, 1,600. The net annual value in 1867, 1,471,331*l.* 16*s.* 0*d.* The city, at that time called the borough, was incorporated by Royal charter, which bears date the 23rd day of October 1838. The Public Health Act is not in force within the city. Many Local Acts have been obtained since the incorporation; the titles will indicate, to a certain extent, the nature of the Acts, and in one or other of them, most, if not all, of the provisions contained in the Public Health Acts will be found.
Prestwich	Local Government Board District. Area, 1,906 acres. The population in 1861 was 5,288, it is now about 7,000. Houses, at the present time, about 1,300 and there is a continual increase. Rateable value on the 25th March last, 21,884*l.* Local Government Act, 1858, adopted November 1866.
Swinton	Local Board of Health District. Area, about 2,165 acres. Population about 12,000. Houses, 2,200; 150 yearly increase. Rateable value, 37,000*l.* Public Health Act adopted 1867.
Kearsley	Local Board of Health District. Area, about 996 acres. Population in 1861, 5,005; yearly increase, very small. Number of houses, 1,022; yearly increase, 15. Rateable value, 18,909*l.* 4*s.* 6*d.* Public Health Act adopted 31st August 1865.
Farnworth	Local Board of Health District. Area, 1,502 acres. Population, 8,751 last census; yearly increase, 500. Houses, 1,771 last census; 2,196 present number; 61 yearly increase. Rateable value, 33,489*l.* 15*s.* Local Government Act adopted August 1863.
Bolton	Parliamentary and municipal Borough. Until the Boundary Act, 1868, the limits of the borough adopted for both parliamentary and municipal purposes were coterminous. Area, 1,840 acres. Population in 1861, 70,395; present population about 77,000; increase at the rate of 1,000 per annum. Under the Boundary Act, 1868, the parliamentary limits have been extended, and comprise an area of 2,393 acres with an estimated population of 86,000. "The Borough" must be understood as meaning the area hitherto adopted for municipal purposes. There are 15,154 houses (including 383 cellar dwellings), the yearly increase about 250. Rateable value, 212,980*l.* 8*s.* 6*d.* Incorporated in 1838, and the Public Health Act adopted in 1850.
Astley Bridge	Local Government Board District; comprises the higher division of the Township of Little Bolton and the lower division of the Township of Sharples. Area in statute acres, 1,211. Population at last census, probably 3,775; and the yearly increase up to the present time, about 60. Houses, 860; yearly average, about 15. Rateable value, 15,669*l.* 5*s.* Local Government Act adopted 7th February 1864.
Halliwell	Local Government Board District. Area in statute acres, 2,479. Population at the last census, 5,953, probable yearly increase to the present date about 150. Houses, about 1,584; yearly increase, about 30. Rateable value, 24,584*l.* 5*s.* Local Government Act adopted 12th December 1863.
Radcliffe	Local Board of Health District. Area, 2,533 acres. Population at last census, 8,840; present population amounts to 10,500. Houses, 2,000; yearly increase, about 50. Rateable value, 38,061*l.* 10*s.* Public Health Act adopted 31st May 1866.
Whitefield	Local Board of Health District. Area about 2,058 statute acres. Population, 8,417; increase, nil. Houses, 1,737; increase, nil. Rateable value, 26,500*l.* Public Health Act adopted February 1st, 1866.
Bury	Local Board of Improvement Commissioners. Area, 3,079 statute acres. Population, 30,000; a slight increase yearly. Houses, 5,750. Rateable value, 116,764*l.* It has not been incorporated, but is governed under the Bury Improvement Act, 1846.
Ramsbottom	Local Government Board District. Area, 298 statute acres. Population, 4,134 a last census; probable yearly increase, 400 per annum. Houses, 1,100; yearly increase about 30. Rateable value, 12,400*l.* The Local Government Act was adopted in 1864.
Bacup	Local Government Board District. Area, 1,600 acres. Estimated population, 17,600. Number of houses, 3,200; rate of yearly increase, 27. Rateable value, 42,184*l.* 19*s.* 3*d.* Local Government Act adopted December 1863.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Heywood	Local Board of Health District. Area, 3,260 acres. Population, 17,250; yearly increase about 600. Houses, 4,477; yearly increase about 2 per cent. Rateable value, 72,000*l.* Public Health Act adopted in 1864.
Rochdale	Borough, the limits of which are a circle with a radius of three-quarters of a mile. Area, 1,131 statute acres. Population, 38,164; probable yearly increase about 1,000. Houses, nearly 9,000; yearly increase, about 200. Rateable value, 152,794*l.* 8*s.* Incorporated, September 1853. The powers and provisions of the Rochdale Improvement Commissioners, under the Rochdale Improvement Act, 1853, were transferred to the Corporation in January 1858.
Crumpsall	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath	Local Board of Health District. Area, about 1,500 acres. Population, 14,000; increase from 300 to 400 per year. Houses, 3,750; average yearly increase for the last eight years, 94. Rateable value, 38,801*l.* 2*s.* Public Health Act adopted December 1853.
Failsworth	Local Government Board District. Area, 1,073 acres. Population, 5,109, last census; probable yearly increase, 72. Houses, 1,221; increase, about 2 per cent. Rateable value 15,223*l.* 1*s.* 3*d.* Local Government Act adopted December 1863.
Bedford near Manchester.	Local Board of Health District. Area, 2,826 acres. Population, 6,558; no increase. Houses, 1,372; about 12 yearly. Rateable value, 15,761*l.* 18*s.* Public Health Act adopted 1863.
Bradford	Local Board of Health District. Population, 1861, 3,524; increase, 200 per year. Houses, 1,200; yearly increase, 45. Rateable value, 15,410*l.* 10*s.* Public Health Act adopted, by Order in Council, 29th December 1856.
Openshaw	Local Government Board District. Area, 560 acres. Population, 1861, 10,240; probable yearly increase, 150. Houses, No. 2,241; yearly increase, average 60. Rateable value, 32,480*l.* 15*s.* Local Government Act adopted 19th November 1863.
Gorton	Local Board of Health District. Area about 1,184 statute acres. Population, 9,897; annual increase, about 1,000. Houses, 3,920. Rateable value, 52,131*l.* 10*s.* Local Government Act adopted October 1863.
Droylsden	Local Government Board District. Area, 1,144 acres. Population about 7,000. Probable yearly increase, 55. Houses, 1,445; yearly increase, about 10. Rateable value, 18,012*l.* Local Government Act adopted 1st October 1863.
Oldham	Borough. Area about 4,665 acres. Population in 1861, 72,334; in 1867, 81,259. Houses, 1861, 14,243; in 1867, 16,294. Rateable value, 1861, 151,253*l.*; in 1868, 273,595*l.* Incorporated in 1848.
Crompton	Local Government Board District. Area, 2,676 acres or thereabouts. Population, 7,032; probable yearly increase since the termination of the cotton panic, 100 persons. Houses, 1,574; yearly average increase, 10 houses. Rateable value, 17,905*l.* 2*s.* Local Government Act adopted 23rd January 1864.
Royton	Local Board of Health District. Area, 1,210 acres. Population, 7,489; increase 50 per annum. Houses, 1,500, probably increase 20 yearly. Rateable value, 16,876*l.* 5*s.* 6*d.* Public Health Act adopted 16th October 1863.
Lees	Local Government Board District. Area, 202 statute acres. Population 2,800. Houses about 700. Rateable value, 6,350*l.* Local Government Act adopted 1859.
Watershed of the Bollin, Tributary of the Mersey.	
Chorley	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield	Borough. Comprising the townships of Macclesfield, 2,365, Sutton (part of) 359, Hurdsfield (part of) 290, total area, 3,014 acres. Population at census 1861, Macclesfield, 27,472; Sutton (part of), 5,328; Hurdsfield (part of), 3,315; decrease of 2,950 from 1851 to 1861, and it continued to decrease at the rate of 200 a year, from 1861 to Midsummer 1867; from the latter period it has increased, and it is believed to be approximating the census of 1861. Houses 10,102; the increase has been very slight indeed. Rateable value, 61,473*l.* Incorporated by Edward the Black Prince, Earl of Chester, and the Public Health Act was adopted in 1852 on the passing of the Macclesfield Improvement Act, in which it was incorporated.
Bollington	Local Board of Health District. Area, about 1,600 acres. Population, 4,100; no increase. Houses, about 869. Public Health Act adopted 3rd June 1862.
Watershed of the Weaver, Tributary of the Mersey.	
Northwich	Local Government Board District. Area, 6 acres. Population, 1,187. Decrease if anything. Houses, 280; no increase. Rateable value, 4,159*l.* Local Government Act adopted 4th August 1863.
Witton-cum-Twambrookes.	Local Government Board District. Area, 482 acres. Population, 3,677; rather decreases. Number of houses about 900. Rateable value, 9,711*l.* 6*s.* Local Government Act adopted 22nd August 1863.

MERSEY BASIN—(RIVER WEAVER).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued*.

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
SANDBACH - -	Local Government Board District. Population, 4,987; increase trifling. Houses, 1,120; increase nominal. Rateable value, 17,096*l*. Local Government Act adopted April 1862.
MONKS COPPENHALL	Local Board of Health District. Area, 1,318 acres. Population last census, 8,159; present population about 16,000. Houses, 3,160; yearly increase about 250. Rateable value, 38,514*l*. Public Health Act adopted 1860.
TARPORLEY - -	Local Board of Health District. Population, 2,632; probable yearly increase of 50. Houses, 558; rate of yearly increase, 8. Rateable value, 12,439*l*. 4*s*. 11*d*. Public Health Act adopted 1st June 1863.
NANTWICH - -	Local Board of Health District. Area, 802 acres. Population, 6,225; increase, 64 per annum. Houses, 1,400; increase, 20 per annum. Rateable value, 13,142*l*. 5*s*. 10*d*. Public Health Act adopted 1854.
CONGLETON - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
SOUTHPORT - -	Borough. Area 1,933 statute acres. Population in 1861 of Southport proper, 10,091; of North Meols, including Birkdale, 8,694. Houses, 3,050; yearly increase about 100. Rateable value, 80,060*l*. Incorporated February 1867.
KIRKHAM - -	The Answers to Queries have not been received from this Local Board of Health.
FULWOOD - -	Local Board of Health District. Area, about 2,116 acres. Population, 875, Fulwood Barrack, 1,450, total 2,325. Increase, exclusive of the Barrack population, 35 per annum. Houses, 210; yearly increase, 6. Rateable value, 8,138*l*., exclusive of Barrack, which is not rated. Public Health Act adopted 1863.
PRESTON - -	Borough. Area, 2,819 acres. Population, census 1861, 82,985; in 1868, 93,000; average yearly increase, 1,430. Houses, in 1861, 15,454; in 1868, 17,241; average yearly increase about 255. Rateable value, 209,819*l*. Preston has been a borough from a very remote period. The Public Health Act was adopted in 1850.
LEYLAND - -	Local Board of Health District. Area, about 3,362 acres. Population, 3,755; not very much increase. Houses, 725; there has been little or no increase until within the last 12 months. Rateable value, 16,313*l*. 14*s*. 6*d*. Public Health Act adopted in 1863.
CLITHEROE - -	Borough. Area, 2,127 acres. Population, 7,000; probable yearly increase, 60. Houses, 1,680; increase about 15 a year. Rateable value, 20,501*l*. The borough is an ancient one. Public Health Act adopted in 1850.
	Watershed of the Calder, Tributary of the Ribble.
CLAYTON-LE-MOORS -	Local Government Board District. Area, 1,158 acres. Population; 1861, 4,682; probable yearly increase, 200. Houses, 1,135; rate of yearly increase for the last four years 36. Rateable value, 11,525*l*. 10*s*. Local Government Act, 1858, adopted in January 1864.
OSWALDTWISTLE -	Local Government Board District. Population, 9,246; yearly increase about 180. Houses, 1,691 in 1861; increase about 30 annually. Rateable value, 23,500*l*. Local Government Act adopted June 1863.
ACCRINGTON - -	Local Board of Health District. Area, 3,425 acres. Population, 17,688; probable yearly increase, 800. Houses, about 4,400; yearly increase about 150. Rateable value, 55,000*l*. Public Health Act adopted September 1853.
BURNLEY - -	Borough. Area, 1,131 acres. Population last census, 28,793; now estimated 30,546. Houses, 5,738; increase during the past year 87. Rateable value, 70,698*l*. Incorporated by Royal charter in 1861. The town was previously governed by a body of Improvement Commissioners under the Burnley Improvement Act, 1854, (which repealed a Local Act, 9 & 10 Vict. c. 119,) who, in 1862, transferred by deed under 20 & 21 Vict. c. 50. all their rights, property, powers, including their Act, to the Corporation, and ceased to exist.
BRIERFIELD - -	Local Board of Health District. Area, about 1,017 acres. Population estimated at last census to be 2,500, now estimated to be 3,000; there has been no separate census taken of the district. Houses, 622; yearly increase about 12. Rateable value, 8,130*l*. 18*s*. 6*d*. Public Health Act adopted July 1868.
NELSON - -	Local Government Board District. Area, about 720 statute acres. Population estimated at 4,500. Houses, 1,046; yearly increase 50. Rateable value, 10,488*l*. Local Government Act adopted in 1864.

RIBBLE BASIN—(RIVER DARWEN).

Series No. 1, General.—Answers to Queries 1 to 5, page 1—*continued*.

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	Watershed of the Darwen, Tributary of the Ribble.
BLACKBURN - -	Borough. Area, 3,680 statute acres. Population, 63,000; yearly increase about five per cent.; now about 75,000. Houses, about 15,000; yearly increase about five per cent. Rateable value in 1868, 152,000*l*. Incorporated in 1851, and a special Act obtained in 1854, transferring the powers of the old Improvement Commissioners to the Corporation.
GREAT HARWOOD -	Local Board of Health District. Population in 1861, 4,070, now about 5,000. Houses, 850; yearly increase, 30. Rateable value, 8,710*l*. Public Health Act adopted August 1863.
OVER DARWEN -	Local Board of Health District. Area, 5,120 statute acres. Population at the last census, 16,492; it is now (1869) about 24,000, and is rapidly increasing. Houses, 5,210. Rateable value, 49,967*l*. The Public Health Act adopted in 1854.
	Watershed of the Douglas, Tributary of the Ribble.
CROSTON - -	Local Government Board District. Area, about 2,273 acres. Population, 1,790. Houses, 354. Rateable value, 7,063*l*. 17*s*. 2*d*. Local Government Act adopted in 1862.
CHORLEY - -	Local Board of Improvement Commissioners. Area, 3,613 statute acres. Population, 1861, 15,013; yearly increase about 500. Houses, 3,500; yearly increase, about 100. Rateable value, 45,702*l*. Private Improvement Act obtained in 1853.
ORMSKIRK - -	Local Board of Health District. Area, 572 statute acres. Population, 6,427. Houses, 1,250. Rateable value, 11,020*l*. 8*s*. 6*d*.
WIGAN - - -	Borough. Area, 2,170 acres. Population, 1861, 37,658; now about 41,000. Houses, 6,700. Rateable value, 89,728*l*. 1*s*. 8*d*. The Borough was incorporated in 1849.

SERIES No. 1, GENERAL.—QUERIES——6. State number of Public Works that have been executed by the governing body? If Waterworks, the cost? If Gasworks, the cost? If Sewerage works, the cost?——7. How were the costs defrayed, by rates, or, if by loan, from whom borrowed?

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
HOLLINGWORTH -	The Answers to Queries have not been received from this Local Board of Health.
GLOSSOP - -	No public works executed.
	Watershed of the Goyt, Tributary of the Mersey.
YEARDSLEY - CUM - WHALEY.	No public works executed.
	Watershed of the Tame, Tributary of the Mersey.
HYDE - - -	In addition to an expenditure of about 12,000*l*. in public sewerage works, the Local Board have also expended about 14,000*l*. in sewering, paving, flagging, and channelling private streets; the latter sum being repayable by the property owners. These sums, amounting to 28,990*l*., were advanced by the Public Works Loan Commissioners under the Public Works (Manufacturing Districts) Acts.
DENTON - - -	Sewerage works 52,952*l*. 2*s*. 11*d*., defrayed by monies borrowed from the Public Works Loan Commissioners.
DUKINFIELD - -	Waterworks. 23,280*l*. Cost defrayed by loan borrowed from the Public Works Loan Commissioners.
STALYBRIDGE -	The Borough along with the Dukinfield Board of Health purchased the Waterworks belonging to the Dukinfield Waterworks Company in April 1867, at 16,700*l*.; and also, in conjunction with the Borough of Ashton-under-Lyne, is constructing another waterworks at Swineshaw about a mile from Stalybridge at an estimate of 125,000*l*. The Gasworks belong to an incorporated company. The sewerage works cost about 21,000*l*. The purchase of the Dukinfield Waterworks was defrayed by loans from private sources. The other costs were obtained as loans from the Public Works Loan Commissioners.

Mersey Basin—(River Tame).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Ashton - under - Lyne.	Waterworks were purchased in 1855 for 33,000*l.*, which have cost, including extensions, 50,000*l.* Additional waterworks are now being constructed at Swineshaw at a cost of about 65,000*l.* Public cemetery cost about 20,000*l.* Sewerage works cost about 25,000*l.* Street improvements about 75,000*l.* Market and town hall constructed before incorporation, but since extended. The waterworks, cemetery, market, and town hall, have been paid for principally by loans from the Public Works Loan Commissioners and from private individuals. The sewerage works and street improvement have been, or will be, paid for by the owners of the property adjoining the streets sewered and improved.
Hurst - - -	Paving and sewerage works, 2,608*l.*; costs defrayed by sums borrowed from Public Works Loan Commissioners and private individuals.
Mossley - -	Paving and sewerage works; cost, 5,000*l.*, defrayed by loans borrowed from Public Works Loan Commissioners and private individuals.

Watershed of the Mersey Proper.

Liverpool - -	The waterworks have cost about two millions [W.E.]. The cost of sewerage works up to 1846 was estimated at 186,160*l.* [B.E.] Cost of new sewerage works and of reconstructions from the same date, of repairs and maintenance, including interest on borrowed money and sinking fund is 721,354*l.* The costs of the waterworks and sewers have been defrayed out of moneys borrowed on security of rates leviable respectively under the Water Acts and the Sanitary Acts [T.C.].
Waterloo - with - Seaforth.	Sewerage works have cost 9,500*l.*, defrayed by loans borrowed from private individuals.
Great Crosby -	Main drainage works, at a cost of 9,000*l.* Road works, at a cost of 5,000*l.* By loans from the Liverpool and London and Globe Insurance Company.
Litherland - -	Main outfall sewer through the district, cost 6,000*l.* Defrayed by loan from Royal Insurance Company.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby -	Sewerage works. The amount paid in respect of these works to the 2nd December 1868 is 38,410*l.* 13*s.* 11*d.* The costs have been defrayed partly by money voted by the West Derby Waste Land Commissioners for Permanent Works, partly by money paid by the London and North-western Railway Company, being towards the cost of making the main sewer an additional depth to pass under their railway; and the remainder by loans borrowed on mortgage of the district rates from the Liverpool and London Insurance Company, and from the Economic Life Assurance Society respectively.
Walton - on - the - Hill.	Several roads have been re-constructed and one sewered; costs defrayed partly by rates and partly by loan of 4,000*l.* borrowed from the Norwich Fire and Life Assurance Office.
Toxteth Park -	Sewerage works cost 7,011*l.* Defrayed principally by loan, borrowed from the Royal Insurance Company, Liverpool, repayable by equal annual instalments.
Wavertree - -	Sewerage works in a portion of the district called the inside or village district, cost 5,267*l.* 10*s.* 4*d.* Defrayed by loans from private individuals on the credit of special rates redeemable in 30 years.
Little Woolton -	No public works.
Much Woolton -	The district is being thoroughly sewered at a cost of about 13,000*l.* Defrayed by loan from the Economic Life Assurance Society.
Garston - -	Sewerage works, at a cost of 11,931*l.* 18*s.* 8*d.*; defrayed by loan from private individuals on security of the rates.
Widnes - - -	Waterworks in course of construction. Gasworks are established by a private company.
Sutton - - -	No public works executed.
Prescot - -	No public works executed.
Parr - - -	There are no sewerage works in the district, but they are very much needed.
St. Helens - -	Waterworks, 28,443*l.* 19*s.* 5*d.* Sewerage works, 4,723*l.* 13*s.*; of these amounts 1,230*l.* 16*s.* 5*d.* was paid out of sewers rate, and 3,492*l.* 16*s.* 7*d.* was paid by owners of property, the work being constructed by the governing body.
Newton-in-Mackerfield.	Gasworks cost 6,000*l.* Sewerage works cost 6,000*l.*, defrayed by loans from the Public Loan Commissioners and private persons. The extension of gasworks by rates and profits.
Warrington - -	Sewerage works about 20,200*l.*, defrayed by loans borrowed from private capitalists.
Pennington - -	Sewering, 3,000*l.*, paving, 8,685*l.*, defrayed by a loan from the Public Works Loan Commissioners.
Westleigh - -	Sewering and paving cost 5,312*l.*, defrayed by a loan of 5,312*l.* from the Public Works Loan Commissioners.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Hindley - -	Just commenced sewering a portion of the district. Cost to the present time 250*l.*, defrayed by rates.
Atherton - -	Sewering and paving cost 5,216*l.* Water supply estimated to cost 7,414*l.* Additional sewering 542*l.*, paving, 7,396*l.* Purchase and alteration of Atherton Public Hall, estimated at 650*l.* Total expended, and to be expended on works, 21,218*l.*, defrayed by loans from the Public Works Loan Commissioners.
Tyldesley - with - Shakerley.	Waterworks cost 5,862*l.* 6*s.* 8*d.* Gas works cost 10,762*l.* 15*s.* 9*d.* Sewerage works cost 582*l.* 1*s.* 1*d.*, defrayed by loans from the Public Works Loan Commissioners and from private individuals.
Rusholme - -	Sewerage works cost 2,887*l.* 13*s.* 3*d.*, defrayed by loan froms private parties, repayable in 20 years by annual instalments set apart from the rates.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	Gasworks, 86,000*l.* Sewerage works, 29,000*l.* Waterworks do not belong to the Corporation or Local Board; costs defrayed partly by rates and by a loan from Public Works Loan Commissioners.
Bredbury - -	No public works executed.
Wallasey - -	Waterworks, 40,941*l.* Gasworks, 23,626*l.* Sewerage works, 12,816*l.* Costs defrayed by loan from the Public Works Loan Commissioners and from private individuals.
Birkenhead - -	Market. Slaughterhouses. Park of 120 acres, which is devoted to public recreation. Police court and lock-ups. Free library. Cemetery. Station and approaches at Woodside Ferry, New Road, under an Act passed in 1863. The waterworks and gasworks were constructed by the Birkenhead and Claughton Gas and Water Company in the year 1845, and transferred to the Birkenhead Improvement Commissioners by Act 1858, the purchase money being 220,000*l.*; since that date about 100,000*l.* has been expended in extensions. The sewers have been principally constructed by or at the expense of landowners as streets have been laid out; the amount expended by the Commissioners and charged to capital account for sewerage works being about 3,681*l.*, defrayed by loan from private sources.
Oxton - - -	Not any public works executed.
Tranmere - -	Waterworks, 38,250*l.* Sewerage works, 11,760*l.* Costs defrayed by loans borrowed from an Insurance Company and others on security of mortgages of the general district rates.
Higher Bebington	Main sewerage works cost about 3,232*l.*, defrayed by a loan of 2,961*l.*, borrowed from the Public Works Loan Commissioners, and 271*l.* paid out of the General District Rates.
Runcorn - -	A Market Hall and weighing machine. Slaughter-houses. Sewers. The costs were defrayed by loan from various private individuals.
Lymm - - -	No public works have been carried out by the Local Board, except some sewerage works at a cost of about 100*l.* The Board have now entered into a contract for the drainage of the whole of the district.
Altrincham - -	Sewage works, 3,600*l.* Costs defrayed by loans,—3,000*l.* from the Provident Life Office and 600*l.* from Wm. Cuncliffe Brooks, Esq.
Sale - - -	Not answered.

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, & Monton.	Main sewerage, 3,900*l.*; defrayed partly by rates and by a sum of 3,000*l.* borrowed from the Public Works Loan Commissioners.
Stretford - -	Not answered.
Moss Side - -	Not any public works executed.
Salford - -	The public works executed by the Corporation of Salford are, **1st,** waterworks, formerly Manchester and Salford, were supplied with water by the Manchester and Salford Waterworks Company. The Corporation of Manchester in or about the year 1849 bought up that company, and in the year 1850 transferred their estate and interest in the mains, pipes, and other works and stock in trade in Salford to the Corporation of Salford in consideration of an annuity of 1,000*l.*, and at the same time arrangements were made under which the Corporation of Manchester was to supply the Corporation of Salford with water in bulk at a given price for distribution in the Salford district. The water supply in the Broughton and Pendleton districts of the Borough of Salford respectively belongs to and is under the management of the Corporation of Manchester. The expenditure since 1850 on mains, pipes, and other works in the Salford district has been 19,707*l.* **2nd,** gasworks, No. 1 station, erected many years ago, transferred in 1859 from the old to the extended Borough in consideration of an annuity of 2,530*l.* The expenditure on this station, including mains, has been 112,340*l.* No. 2 station erected since 1859 at a cost, including the land, of

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Salford—*cont.*	53,725*l.*; land adjoining this station has just been purchased at a cost of 18,000*l.*, on which additional works will be erected at considerable cost. **3rd,** sewerage works; expenditure for the under-mentioned years:—

—	1863.	1864.	1865.	1866.	1867.	Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Salford - - - -	333 7 6	1,505 8 7	232 6 9	1,532 19 5	559 0 11	4,153 3 2
Pendleton - - - -	517 2 9	7,406 11 6	5,450 0 8	1,009 3 11	2,358 7 10	16,732 6 8
Broughton - - - -	454 17 0	549 8 2	1,867 19 8	2,236 12 9	414 12 9	5,533 10 4
Total - - -	1,305 7 3	9,461 8 3	7,550 7 1	4,769 16 1	3,332 1 6	26,419 0 2

4th, paving and flagging, and repairs of and alterations and improvements in streets; expenditure in the under-mentioned years:—

—	1863.	1864.	1865.	1866.	1867.	Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Salford - - - -	8,769 7 6	11,446 9 4	2,561 17 9	14,909 9 8	21,465 11 7	59,152 15 10
Pendleton - - - -	2,160 2 7	7,047 17 4	9,054 7 1	9,226 11 8	6,815 2 5	34,304 1 1
Broughton - - - -	2,071 17 0	3,626 13 11	5,985 0 2	4,595 8 4	3,851 5 9	20,130 5 2
Total - - -	12,001 7 1	22,121 0 7	17,601 5 0	28,731 9 8	32,131 19 9	113,587 2 1

5th, cattle market, belonging to the Salford district; present value, 16,078*l.* The rights of the Crown in relation to the markets and fairs were purchased by the Corporation in the year 1866 for 4,481*l.* **6th,** Salford town hall, 29,483*l.*; Broughton town hall, 4,223*l.*; Pendleton town hall, 15,000*l.* **7th,** Peel park and the free public museum and library therein, 29,486*l.* **8th,** manure and nightsoil depôt. Land bought in the year 1862, and basin communicating with the river and works connected therewith, 25,948*l.* 4*s.* 8*d.* **9th,** cemetery. Laying out grounds and building chapels, 18,367*l.* Costs defrayed partly by rates, by loan from the Public Works Loan Commissioners, and by mortgages raised under the borrowing powers of the Local Acts.

Manchester -	The Corporation have constructed waterworks at a cost of about 1,780,000*l.*; gasworks, 800,000*l.*; sewerage works, 340,000*l.* In addition, new streets have been formed and improvements made in many of the old ones, at a cost of upwards of one million sterling; the expense of the latter has been defrayed out of the gas profits, which are to be so applied. Several bridges and tunnels have been built over the rivers *Irwell*, *Medlock*, and *Irk*; improvement of the river *Medlock* is now in progress. Town Halls have been built in the townships of Manchester, Hulme, Chorlton-upon-Medlock, and Ardwick; the City Gaol (at a cost of 120,000*l.* or thereabouts) and several police and fire stations. The Alexandra Park, now being formed, containing 60 acres, will cost about 50,000*l.* Public cemetery, containing 21a. 1r. 39p., at a cost of 74,000*l.* or thereabouts. In May 1846 the market rights were purchased by the Corporation from Sir O. Mosley for the sum of 200,000*l.*; since that time improvements in the markets have been made. In addition, the Corporation have constructed several public Weighing machines, Nightsoil and scavenging yards, five Free Libraries, and are now erecting a new Court house, and also a large and magnificent new Town Hall. The costs are defrayed by monies borrowed from the Bank of England, other public bodies, and from private individuals. A portion of all monies borrowed is required to be annually paid off, usually 5*l.* per cent. of the amount; and the rates or sources from which such liquidation has to be provided, depend upon the situation and character of the works upon which the money borrowed has been expended.
Prestwich - -	Sewage works are in course of construction; the estimate for the works is 13,330*l.* to be paid for out of a loan agreed to be advanced by the Public Works Loan Commissioners.
Swinton - -	There are none.
Kearsley - -	Public paving, 510*l.* 1*s.* 6*d.*, public sewering, 408*l.* 0*s.* 6*d.*, cost defrayed by loans from private individuals to be repaid by sinking fund yearly, set apart from district rate.
Farnworth - -	Sewerage works cost 5,000*l.*, defrayed by loan from Public Works Loan Commissioners.
Bolton - - -	Waterworks, those established and now in operation cost 231,629*l.* 11*s.* 2*d.*; those now in progress 150,000*l.* Sewerage works, 24,458*l.* 12*s.* 3*d.* The bed of the river *Croal*, which flows through the borough, has been partly paved and otherwise improved, 3,554*l.* Markets, 96,610*l.* 13*s.* 3*d.* Cemetery, 17,085*l.* 6*s.* Public park and recreation grounds, 42,078*l.* 6*s.* 4*d.* Town Hall, now in progress of erection, is estimated to cost 100,000*l.* The several amounts have, or will, be defrayed by rates, by loans from the Public Works Loan Commissioners, and by private sources.
Astley Bridge -	Sewerage and paving, at a cost of 4,852*l.* 19*s.* 10*d.*; defrayed by loan upon the credit of the general district rates, borrowed from the Royal Exchange Assurance Corporation, London.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Halliwell - -	Precipitating tanks for the purification of the sewage and sewerage works cost 1,646*l.* 16*s.* 10*d.*, defrayed by loan borrowed from the Public Works Loan Commissioners, and from a private sources.
Radcliffe - -	The Board are now engaged in carrying out the sewerage works of the district, and have power to borrow 26,200*l.*
Whitefield - -	Lighting the district at a cost of 400*l.*, defrayed by a loan from private individual.
Bury - - -	The waterworks were made by and belong to the Bury and Radcliffe Waterworks Company, and cost 142,137*l.* Gasworks, 74,000*l.* Sewerage works, 25,000*l.* The cost of the gasworks and sewers were defrayed by loans borrowed on the security of the rates and the property of the Commissioners. There is a sewer rate not to exceed 6*d.* in the pound laid upon the owners of the property. About 3*d.* in the pound is the usual amount of sewer rate, and is expended in repayment of loans by instalments, and in repairs and sundries.
Ramsbottom - -	Sewerage works, paving and flagging of the public streets cost 2,901*l.* 13*s.* 2*d.*, defrayed by loan from Public Works Loan Commissioners.
Bacup - - -	Sewerage works, sewage tanks, and market house; cost of sewerage works and tanks, 12,500*l.*, market house, 7,000*l.*; borrowed from Public Works Loan Commissioners and private sources to be repaid by rates.
Heywood - -	Sewerage works cost 22,000*l.* Street paving and flagging cost 9,333*l.*, defrayed by loans from Public Works Loan Commissioners.
Rochdale - -	Waterworks cost about 7,000*l.*, and annuities amounting to 7,459*l.* 4*s.* Gasworks, 82,413*l.* Sewerage works, 6,492*l.* Improvement to high-ways, 5,000*l.* Widening streets and bridge, 34,000*l.* Cemetery, 12,593*l.* Baths, 7,000*l.* Town hall, now being erected, cost up to now, 40,000*l.*; this work will take a large sum to complete it. Land is taken from the Ecclesiastical Commissioners for recreation ground, at the yearly rent of 38*l.*; the conveyance has only just been executed and the laying out of the grounds has yet to be done. These several amounts have been defrayed partly by rates and loans and profits arising from the gasworks under the Rochdale Improvement Act, 1853, except the waterworks, which were purchased under the Rochdale Waterworks Act, 1866.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	Sewerage works cost 7,121*l.* 8*s.* 2*d.*, defrayed by loans on mortgage of the general district rates, viz.: Economic Life Assurance Society, 11,000*l.*, Royal Insurance Company, 4,000*l.*
Failsworth - -	Sewerage works have been executed at a cost of about 1,630*l.*; costs defrayed by loan from the Public Works Loan Commissioners.
Bedford near Manchester.	Paving and sewerage works; at a cost of 4,000*l.*; cost defrayed by loan from Public Works Loan Commissioners and by rates.
Bradford - -	No public works have been executed.
Openshaw - -	Not answered.
Gorton - - -	Sewerage works cost 9,500*l.*, defrayed by loans borrowed from the Public Works Loan Commissioners.
Droylesden - -	Sewerage works, 5,473*l.* 17*s.* Cost defrayed by loan, the money being borrowed from the Public Works Loan Commissioners.
Oldham - -	Waterworks, 229,000*l.* Gasworks, 122,000*l.* The total cost of the sewers executed since 1863 is 20,976*l.* 7*s.* 4*d.*; 5,470*l.* 8*s.* of which has been paid out of the rates, the remainder being money borrowed under the Public Works (Manufacturing Districts) Acts, 1863–4, from the Public Works Loan Commissioners.
Crompton - -	The widening, paving, and draining the highway at Strawside and Millcroft; costs defrayed partly by rates and partly by loan from the Public Works Loan Commissioners.
Royton - - -	Paving and sewering about 3,000*l.*, defrayed by loans from Public Works Loan Commissioners.
Lees - - -	No public works have been executed.

Watershed of the Bollin, Tributary of the Mersey.

Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	New waterworks to supplement the old have been erected at a cost of 50,000*l.* The gasworks were purchased in 1860 from a private company for 50,000*l.*, and they have been extended since. The borough has been partly sewered at a cost of 33,234*l.* A new cemetery, comprising 21 acres. A public park, of 16 acres, has been completed, and many town and street improvements have been effected. Loans from private persons were obtained for the waterworks. The other works were executed by means partly of loans under the Public Works (Manufacturing Districts) Act, and partly by rates.

Mersey Basin—(River Bollin).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bollington	Gasworks, cost 9,116*l.* 2*s.* 3*d.*, and sewerage works, cost 952*l.* 13*s.* 9*d.*; defrayed by loans from Public Works Loan Commissioners and private persons.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich and Witton-cum-Twambrookes.	No public works have been executed.
Sandbach	No public works have been executed by the Local Board beyond the laying down of a good main drain at the cost of some 700*l.* defrayed by a loan of 500*l.* borrowed from the Exchequer Loan Commissioners, the rest was given by private individuals.
Monks Coppenhall	Two intersecting outfall sewers about 1½ miles long, each 2 ft. 10 in. × 3 ft. 6 in., egg-shape. Water mains laid within the district only. Cost of sewerage works, 7,850*l.*; water mains, 4,850*l.*; defrayed by loan from the Royal Exchange Assurance Company.
Tarporley	Gasworks erected by a private company.
Nantwich	Waterworks and sewerage works. No separate account has been kept of the cost, which in the aggregate amounts to about 14,000*l.*, defrayed by loans from Sir R. Pendlebury of Stockport, and from Public Works Loan Commissioners.
Congleton	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport	Gasworks, cost, 20,000*l.* Cemetery, 7,500*l.* Park, 12,000*l.* Town Hall and land, 9,000*l.* Markets, 4,130*l.* Slaughter-houses, 500*l.* Sewerage, 15,000*l.*; general improvements, 20,000*l.* The costs of these several works defrayed by loans from private individuals, mortgages on the security of the rates, and by rates.
Kirkham	The answers to queries have not been received from this Local Board of Health.
Fulwood	Sewerage works were executed by the owners of the land before the constitution of the district. The only work done by the board is providing the populous portion with street pillars for gas and lamps.
Preston	The waterworks, 234,000*l.* Gasworks are the property of a private company. Sewerage works, 50,000*l.* Public parks and pleasure grounds, cattle market, public quays and wharfs, additional market accommodation, town hall, baths and wash-houses. In addition to these permanent public works, the Local Board have at the expense of the owners of property paved, flagged, sewered, and channelled about 29 miles of private streets at 40,000*l.*; they have also drained 10,500 houses at 20,000*l.*, making with those done by owners themselves a total of 16,200 houses in the borough thoroughly drained. The public works have been executed out of loans borrowed on security of the rates and property of the borough; 135,225*l.* for the purchase of the waterworks was borrowed in small loans of from 100*l.* to 10,000*l.* 63,239*l.* was borrowed under the Public Works Act, 1862, from the Public Works Loan Commissioners for the laying out of the parks, the forming of new and repaving old streets; of this amount 55,715*l.* is now owing to the Commissioners; all other loans have been in small amounts from private individuals. The mortgage debt is to be reduced by sinking funds in from 30 to 50 years from the time of borrowing.
Leyland	No public works have been executed.
Clitheroe	The Local Board have made certain street improvements, and flagged the footpaths in the principal streets, but have executed no other public works.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	Sewerage works, 4,891*l.* 12*s.* 10*d.*, defrayed by loan under the Public Works (Manufacturing Districts) Act, 1863.
Oswaldtwistle	Waterworks cost 26,338*l.* 2*s.* 1*d.* Sewerage works cost 4,519*l.* 17*s.* 6*d.* 410 yards - - - - - 24-inch brick sewer. 862 „ - - - - - 21-inch pipe „ 2,500 „ - - - - - 12-inch do. „ 4,500 „ - - - - - Under 12 ins. do. „ defrayed by loans of 22,738*l.* borrowed under the Public Works (Manufacturing Districts) Act, 1863, from the Public Works Loan Commissioners, and 13,530*l.* borrowed from private persons.
Accrington	Sewerage works, 6,340*l.*, defrayed by loan of 4,073*l.* from the Liverpool and London and Globe Insurance Company, and 3,000*l.* from the Public Works Loan Commissioners.

Ribble Basin—(River Calder).

Series No. 1, General.—Answers to Queries 6 and 7, page 7—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Burnley	The Waterworks and Gasworks were purchased by the late Burnley Improvement Commissioners and their predecessors, and have since been transferred to the Corporation. The waterworks cost 76,735*l.* The gasworks 59,000*l.* In 1864 the Corporation borrowed under the Public Works (Manufacturing Districts) Act, 1863, from the Public Works Loan Commissioners the sum of 17,060*l.*, which has been expended in Paving and Sewering new streets.
Brierfield	No public works have been executed.
Nelson	The Local Board are now constructing waterworks, the outlay upon which to the present time is 13,486*l.* 7*s.* 2*d.* They have purchased gasworks at a cost to the present time of 11,316*l.* 12*s.* 11½*d.* No works of sewerage commenced. Costs of works defrayed by loan from private individuals under the powers of a Special Act obtained by the Local Board in the year 1866, entitled "The Nelson Water and Gas Act, 1866."
	Watershed of the Darwin, Tributary of the Ribble.
Blackburn	Sewering and draining of the Borough, sewage deodorizing works, pitching part of the bed of the river, paving of about 20 miles of streets, erection of town hall, market house, public baths, fire-engine station, and forming public park, with lodges. The waterworks and gasworks belong to private companies. The sewerage works cost about 90,000*l.* Cost of the public works defrayed by a loan of 143,000*l.*, borrowed under the powers of the Public Works (Manufacturing Districts) Act, and by rates and monies borrowed on mortgage of such rates from private individuals.
Great Harwood	Sewerage works at a cost of 4,966*l.* 7*s.*, defrayed by loan from the Public Works Loan Commissioners under the "Public Works Act, 1863."
Over Darwen	The gas and water works are proprietary. The sewerage works cost between 7,000*l.* and 8,000*l.*, defrayed by loan on mortgage of the general district rates; the money was borrowed from private individuals.
	Watershed of the Douglas, Tributary of the Ribble.
Croston	No public works have been executed.
Chorley	Four public slaughter-houses erected. The town thoroughly sewered and drained. Public cemetery made. New roads made and streets paved and improved. Cost of sewerage works, 12,000*l.*, borrowed from private individuals and from Public Works Loan Commissioners.
Ormskirk	Waterworks have cost 9,280*l.* Sewerage works and town improvements have cost 8,120*l.*; defrayed by loan borrowed from private individuals.
Wigan	Waterworks, 172,230*l.* 2*s.* 7*d.* Sewerage works, 24,269*l.* 19*s.* 9½*d.* Costs defrayed by loans from various persons.

Series No. 1, General—Queries.——8. Has the Corporation or the Local Board jurisdiction over the river flowing by or through the town?——9. What are the powers, and the Local Act, or Acts of Parliament conferring them?——10. To what extent have those powers been exercised?——11. Describe the past and present condition (within your knowledge) of that part of the river or stream flowing by or through the Town, and give the name of the river or stream?——12. Has the bed of the river or stream silted up, if so, to what cause do you attribute it?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth	The Answers to Queries have not been received from this Local Board of Health.
Glossop	None, except the general Acts of Parliament. The Sanitary Inspector exercises the duties of his office if requisite, but this is seldom the case. The rivers and streams which flow past or through the town are the *Shelf Brook*, *Glossop Brook*, *River Etherow*, *Charlestown*, *Charnall*, and *Lees Hall Brooks*. Are not aware that the beds of the streams have silted up. A survey of all our mountain streams passing through the borough would take some time.

Mersey Basin—(River Goyt).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum-Whaley.	No jurisdiction over the river *Goyt*; the condition is much the same now as 25 years ago. It is occasionally polluted by chemical refuse from Botany bleach works in the township of Jaxal, by Cadster and Shallcross's mill, by water from the colliery, chemical, barytes, and other works in Whaley Bridge, and by refuse from leather works, at Bridge Mont, near Whaley Bridge.
Hyde - - -	The Local Board has no jurisdiction over the river *Tame;* it contains a good deal of impurity on account of flowing by or through Stalybridge, Ashton-under-Lyne, Dukinfield, &c., which are all large manufacturing towns, caused by refuse thrown in from manufactories.
	Watershed of the Tame, Tributary of the Mersey.
Denton - -	No jurisdiction and no powers whatever. The river *Tame* skirts the Denton district only for about half a mile. It is polluted by the sewage of the town of Hyde, and of other places higher up the stream. It has been so, to some extent, for many years, but is now worse than it formerly was. In dry hot weather it has an offensive smell.
Dukinfield -	No jurisdiction. The river *Tame* is at times offensive, particularly in dry weather. It is in much the same condition as it has been for some years; it has silted up. We attribute the cause to the discharge of engine ashes and other refuse into the stream.
Stalybridge -	No jurisdiction; but by the Local Act of Parliament passed in the *9th year of Geo. 4. cap. 26. sec. 32.*, the Gas Company is liable to a penalty of 200*l.* for conveying washings into any sewer or stream, and by *sect. 52.* a penalty not exceeding 40*s.* is imposed for casting rubbish in the river. No proceedings have been necessary to be taken against the Gas Company for fouling the water, but proceedings have in some cases been taken against persons for casting rubbish into the river. Some years ago this provision of the Local Act was not strictly enforced, but for some years past it has been generally carried out. At the present time (22 August 1868) from the great scarcity of water, consequent on the long drought, the river *Tame* is in a worse condition than it has been for years. In ordinary times from its rapid flow it is comparatively clean, except so far as it is discoloured by the Hartshead Printworks just outside the borough. The water was much clearer previous to the establishment of these works about 18 years ago. In some places the bed of the river has silted up; the cause has been undoubtedly from ashes and rubbish thrown into it.
Ashton - under - Lyne.	No jurisdiction over the river *Tame*, which flows along the southern boundary of the borough for a distance of about two miles. It has been very impure for many years; the bed of the river has not silted up except where the ancient weirs are placed. No weirs have been constructed for many years.
Hurst - - -	No river flowing through the district.
Mossley - -	The river *Tame* flows through the district, but the Local Board has no special jurisdiction over the same. At times it is coloured with dye works higher up the stream, and the refuse of the district of Upper Mill is turned into it; also the refuse of tanyards. In some instances the bed has silted up; the cause is supposed to be the erection of weirs.
	Watershed of the Mersey Proper.
Liverpool - -	The Corporation have no jurisdiction over the river except in cases of smoke nuisances. By the *Statute 5 & 6 Vict. c.* 110. (An Act for better preserving the Navigation of the River *Mersey*), the conservancy of the river and of its banks and shores from Warrington and Frodsham bridges to the sea is vested in three Commissioners, viz., the First Lord of the Admiralty, the Chancellor of the Duchy of Lancaster, and the Chief Commissioner of Public Works. The Commissioners are empowered to appoint an acting conservator, an office now held by Admiral Evans. Not aware of any change of the condition of the river Mersey as it flows past Liverpool. Twenty years ago it was filtered for the use of St. George's Pierhead Baths, and, by passing it through sand and gravel, deprived of the matters in suspension, rendered quite pellucid, and it is the same now. The river has deepened opposite the town [B.E.].
Waterloo - with - Seaforth.	The Local Board of Health has no jurisdiction over any river. The past and present condition of the estuary of the *Mersey*, and of the only stream flowing by or through the district called *Primrose brook*, is at present, and always has been, considered good and free from offensive settlements injurious to the health of the inhabitants.
Great Crosby -	The sea and in part the estuary of the River *Mersey* form the western boundary of the district, but the Local Board claim no jurisdiction over the river.
Latherland - -	The district does not abut upon the river.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby -	The Board has powers only under the *Public Health, Local Government, and Nuisance Removal Acts.* The *Brook*, a small stream, flows through the district, and also through the townships of Walton-on-the-Hill and Fazakerly. From the township of Walton-on-the-Hill it receives sewage matter. It then re-enters the district of the board at its northern extremity, and discharges itself into the river *Alt.* It takes the watershed from the western portion of the district and has hitherto received the sewage from the same portion, but in consequence of the construction of sewerage works by this board, less sewage is now turned into the *Brook* than formerly, and when the works are completed, by the construction of the outfall into the sea, the brook will be freed from sewage so far as this district is concerned. It has been, especially in hot and dry weather, foul and offensive. The river *Alt*, a small river, flows along the eastern boundary of the district, and receives the watershed from the eastern portion of the district. It has hitherto taken and still takes the sewage from the same portion.
Walton - on - the - Hill.	No jurisdiction except under the *Public Health and Local Government Acts.* The *Brook*, formerly a stream of pure water, is now polluted to a considerable extent by the sewage of the western portion of West Derby being discharged into it by a sewer of 5′ 3″ × 3′ 6″ from a drainage area of 1,650 acres, thickly populated, as well as the sewage from a portion of the Walton district; from this cause the bed of the stream has silted up.
Toxteth Park -	Only so far as prescribed by the *Public Health* and *Local Government Acts.* The river *Mersey* forms the south-west boundary of the district and is a rapid tide-way. The banks of the river where not of rock and unprotected by walls are, and for many years past have been, subject to very great waste; the rise of high water continually advances inland, and during spring tides the strand is usually covered with a thin coating of mud, which during the neaps is dried up and dissipated by the wind. The St. Michael's outlet sewer within the district has been carried down to low water where the contents are discharged into the river, and so likewise is the southern outfall sewer of the Borough of Liverpool, which is formed on the boundary between the borough and the rural district; but there are numerous private drains which discharge their contents upon the shore at the time of high water, and they and the mud before mentioned greatly interfere with the use of the strand as a public resort, and must tend to impair the purity of both the river and the atmosphere. There is no doubt that portions of the river and of the sea channels are being silted up, but there is considerable difference of opinion as to the cause, some believing that the silt is brought up by the flood tide, others that it is brought down by the ebb, and is in a great measure the result of the wash of the banks and the scour of the beds and of the refuse of Manchester and other towns adjacent to the river.
Wavertree - -	No river flows by or through the district.
Little Woolton -	No river flowing by or through the district, but a small brook divides this township and that of Tarboch, and is called *Tarboch brook.* It is a clear stream of water, and is principally supplied by drains from agricultural land. The bed has not silted up.
Much Woolton -	No powers. Two small streams (without the district) have hitherto taken the drainage from a large portion of the district, and have been in a very polluted state; complaints have been made at various times respecting them, but it is believed the nuisance will be abated when the sewerage works are completed; both of the streams discharge into the *Mersey*, one at Garston and the other at Ditton.
Garston - -	No special jurisdiction over the river *Mersey.* Flows on the west side of the district.
Widnes - - -	No jurisdiction over the river *Mersey.*
Sutton - - -	The Board has no jurisdiction over the *Sankey brook;* it is filthy, very unhealthy, and a disgrace to the neighbourhood.
Prescot - -	No river flows by or through the district.
Parr - -	No jurisdiction. Have known the *Sankey brook* for 12 years, and during the whole of that time it has been largely impregnated with refuse matter from copper, chemical, soap, and other works; also by collieries. The water is thick and foul, and smells most offensive, and is unquestionably injurious to both human and vegetable life. No silting up.
St. Helen's - -	The *St. Helen's Improvement Act, 1855, sec. 42*, gives power to cleanse, cover in, and otherwise improve the *Sankey brook* or any part thereof, and any stream flowing into the same. In the more central portion of the town, and to the extent of about 750 yards, the bed of the brook has been pitched and otherwise regulated at a cost of 274*l.*, and that portion so pitched has been cleansed from week to week. The past condition of the brook was very much better than the present (except that portion in which the pitched invert has been made), the discharge of the whole sewage of the borough combined with the refuse from alkali and other works, as also from deposits of alkali waste, has added greatly from year to year to the pollution of *Sankey brook*

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
St. Helen's—*cont.*	No perceptible silting up has been observed, but doubtless this has been the case from the heaping up of cinders and alkali waste on the banks of the stream.
Newton-in-Mackerfield.	No powers. *Sankey brook*, which was about 20 years ago a beautiful trout stream, the water of which was used for brewing and domestic purposes, is now so seriously polluted by chemical and other manufactories in the neighbourhood of St. Helen's as to be most offensive to the townships through which it passes. The bed has silted up by sand and refuse from the glass-works and chemical works in the neighbourhood of St. Helen's, and by land slips on the banks of the brook caused by floods and overflows of the *Sankey* canal.
Warrington - -	No jurisdiction. Twenty-five years ago the river *Mersey* abounded with fish, and was quite clear; now the river is very foul. Not silted up to any great extent.
Pennington - -	Not any jurisdiction. The stream flowing on the south side of the town of Leigh within the district of Pennington is called *Pennington brook*, another stream flowing on the north side of the town is *Stoch Platt ditch*, which empties itself into *Bedford brook*, which is also the north boundary of the district, both being situate between Atherton and Pennington, and contiguous to Westleigh. All these streams have become more polluted than they were in years past, consequent upon the greater quantity of sewage which is now emptied into them. The bed of *Pennington brook* has silted up in consequence of the sides of the brook being washed in. No sufficient measures having been taken by scouring the bottom and by removing the trees and bushes which impede the current.
Westleigh - -	No powers. *Leigh brook* has not silted up to any appreciable extent.
Hindley - -	Not answered.
Atherton - -	No jurisdiction over *Chanters brook*, which passes through the town of Chowbent, it is in much the same state as it has been for years past. *Stock Platt ditch*, a stream between Atherton and Pennington and Westleigh, also is considerably more contaminated with sewage than it used to be, consequent upon the drainage of Atherton, Pennington, and Westleigh being turned into it in greater quantities; the beds have not silted up.
Tyldesley-with-Shakerley.	No powers. *Hindsford brook.* It has not silted up. The outlet sewer has been removed below the town.
Rusholme - -	The district is crossed by several small streams which eventually find their way into the rivers *Irwell* or *Mersey*. The Board has no jurisdiction over these streams which are used for carrying off the sewage of the district, and which are all more or less offensive. 1st. The *Black brook* on the north boundary of the district. 2nd. A stream from Victoria Park through Heald Grove. 3rd. Stream through Brighton Grove. 4th. *Fallowfield brook.* 5th. *Ley brook.* The 1st, 4th, and 5th are foul when entering, but all are made worse in passing through the district. Not silted up materially.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	The Corporation has no jurisdiction over the rivers. The *Goyt* and the *Tame* flow through the borough, at their junction they form the *Mersey*, and that river flows on to Liverpool. The beds have been raised by throwing cinders and all sorts of solid matters into the rivers.
Bredbury - -	No powers. The river *Mersey* or *Goyt* is the south and south-west boundary of the township and district, and the river *Tame* is the boundary of the district on the north side. Both rivers are polluted, but not so much as formerly.
Wallasey - -	No jurisdiction over the river *Mersey.*
Birkenhead - -	No jurisdiction over the estuary of the *Mersey.* The condition of the river *Mersey* is yearly reported on by the acting conservator.
Oxton - - -	No river flowing by or through the town.
Tranmere - -	No jurisdiction. Part of the river *Mersey* flows by the district. There has been no change in its condition during the last eight years. It is not foul, nor does it cause any nuisance to the district. There are changes or shiftings in the sand-banks.
Higher Bebington	The Higher Bebington District is bounded on the east by the estuary of the *Mersey*, over which the Local Board have no jurisdiction.
Runcorn - -	No jurisdiction. Thomas Ward, aged 77, a flatman from his youth, acquainted with the river in all its navigable parts for the last 45 years, was Harbour Master for the Trustees of the Duke of Bridgewater (now superannuated), says the river Mersey was clear about Runcorn 65 years ago, and abounded with salmon sparlings, flukes, soles, whitings, eels, and all sorts of fish; the river began to get muddy at Runcorn about 45 years ago, and has continued to get worse. It has not silted up at Runcorn; the banks do not appear so high as they formerly were on the Liverpool side of Runcorn, but on the Warrington side they are a little higher than they were. I attribute this to the dirt coming down the river from Manchester and elsewhere.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Lymm - - -	The Board has no jurisdiction over the river *Mersey*, which flows at about half a mile distant from the village. For a very long time the river has been a very foul stream, but within the past two years it has become still more so, from the fact of a great portion of the sewage and refuse of Manchester and its neighbourhood having been diverted from the canal into the river. The bed of the river has silted up; this is attributable to solid matter thrown into the stream.
Altrincham -	There is no river flowing through the town.
Sale - - -	No powers. The Local Board District has always drained into the river *Mersey.* There is no perceptible difference within the last 20 years; the river is tolerably clear and not impregnated with sewage to any perceptible extent, and the bed has not silted up.

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, and Monton.	No powers. The *Irwell* flows through and bounds this district on the south. At no remote distance in the past, fish abounded in this river, but at present it is so polluted by the refuse from manufactures of all descriptions turned into it in Manchester, Salford, and other towns, that nothing could live in the stream. It is certain that the bed of the river has silted up, and that cinders and other matters are turned into it, and when the river is in flood the cinders, gravel, and other substances composing the embankment are washed into it.
Stretford - -	The Local Board has no jurisdiction over the rivers *Irwell* and *Mersey;* the condition of the *Irwell* at Manchester is well known; the *Mersey* is tolerably pure in its passage through Stretford. The bed of the *Irwell* has silted up, caused by sewage and solid refuse thrown into it.
Moss Side - -	A stream flows through a portion of the district of the Board called the *Corn Brook*, over which the Board have control by powers conferred by the *Local Government Act.* The *Corn Brook* has until recently been an open drain. The portion flowing through the district of Moss Side is now covered over; it has not silted up.
Salford - -	Yes, under the *Salford Improvement Act, 1862, secs. 220 to 227*, both inclusive, and the *Mersey and Irwell Protection Act, 1862.* The Corporation have appointed an officer, called the River Inspector, whose whole time is devoted to watching the river in order to prevent encroachments and to detect persons guilty of contravening any of the provisions of these Acts, and proceedings have been taken before the justices, with a view of enforcing penalties. The Corporation have also served many notices on parties to remove obstructions and encroachments. Present condition of the *River Irwell* is (in the words of Sir Robert Kane) "the hardest-worked stream in "the world." It has long been considered the proper receptacle for everything which could not otherwise be disposed of. It is comparatively much cleaner higher up than at the confluence of the *Medlock* and the *Irk* therewith, which latter are little better than common sewers. Past condition: this cannot be described very accurately, but persons are still living who remember the time when fish were able to live in it. The bed has unquestionably silted up, and the cause is partly attributable to refuse having been thrown in within the borough, but principally to débris brought down in times of flood, consisting of refuse from excavations and of cinders and other materials cast by parties higher up the stream into the river and its tributaries for the express purpose of their being carried away by flood. The débris is deposited on the subsidence of the floods, and especially above two private weirs and in the navigable portion of the river, where the water becomes comparatively stagnant.
Manchester - -	The Corporation has no special jurisdiction over any of the rivers flowing through the city, except as regards the river *Medlock.* Special powers for improving the bed or channel of that river, so far as within the limits of the city, have been obtained by the *Local Act, 28 Vict. c. 90.* Various provisions exist in the Local Acts for the purpose of preventing nuisances, and, by the *103d* clause of the *Borough Police Act*, any person throwing or depositing rubbish, dust, or offensive matter in any stream or watercourse, is made liable to a penalty. Powers also are given by *The Mersey, &c. Protection Act, 1862*, for preventing the throwing or depositing of cinders or other solid substances in the bed of the river *Irwell*, and any of its tributaries; and, so far as the rivers exist within the city, the council endeavours to carry out, as far as practicable, the powers referred to. The rivers passing through the city are the *Irwell* the *Irk*, and the *Medlock.* They are very tortuous in their courses, and the beds are gradually rising. In the cases of the *Medlock*, the Corporation are now (under the special powers obtained by the 28 Vict. c. 90., and at an expense of about 25,000*l.*, which is to be repaid by the owners and by the Corporation in the proportions fixed by the Act), engaged in materially improving the channel, making it, as far as practicable, of uniform width through the city, and excavating the bed so as to give it an uniform fall from weir to weir. In addition to these rivers, *Shooter's brook*, *Cornbrook*, and *Moston brook*, flow through the city; *Shooter's brook* emptying itself into the river *Medlock*, *Cornbrook* into the river *Irwell*, and *Moston brook* into the river *Irk.* All the sewers within the city empty themselves into the rivers and brooks; the drainage areas of each being shown on the plan the particulars of which are set forth

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester—*cont.*	in the tabular statement relating to the sewerage, both of which have been forwarded to the Commissioners. The beds of all the rivers have silted up to a considerable extent, caused principally by the obstructions to the flow of the streams by the various weirs, and by the refuse thrown into them from the banks.
Prestwich - -	It is believed the Board has jurisdiction over the rivers to some extent; there is no special reservation to them. The river *Irwell* is much worse now than it formerly was. No doubt it has silted up to some extent, which may be attributed to rubbish being thrown in from the works on the banks of the river without the district.
Swinton - -	No powers. The river *Irwell* is backed up by Douglas weir at Pendleton. No doubt a large quantity of silt is prevented from passing down the river in consequence of the weir.
Kearsley - -	No powers. Thirty years ago there were fish in the river. It is now impossible for any to exist therein.
Farnworth - -	No powers. The *Croal* flows by the north-east side of the town at such a distance from the populated part as not to have any effect upon the public health of the district.
Bolton - - -	The Corporation, which is the Local Board of Health, exercises a partial jurisdiction over the river *Croal* as well as other streams within the borough; that jurisdiction consists of the powers with respect to nuisances conferred by the *Nuisances Removal Acts*, and also of certain powers contained in the *Bolton Improvement Act, 1854*, (see *secs. 119, 120*), which authorize the Corporation to cleanse, improve, and cover the river and its tributaries within the borough, and the same Act (*sec. 131.*) also prohibits the deposit of ashes and other refuse in them. Under those powers the bed of the river to the extent of about 1,200 yards in length has been lowered, cleansed, and paved, and some attempts have been made to prevent nuisances in the stream. The *Croal* is the principal stream within the borough. It flows through the centre of the town, and receives the waters of the following tributaries:—*Gilnow brook, Halliwell brook*, the *Jenny beck*, and the *Tonge*. The past condition of the *Croal, Halliwell brook*, and the *Tonge* has always (within living memory) been foul and offensive, and they continue so without improvement except at the paved portions of the *Croal*. The *Jenny beck* is fouled by sewage. *Gilnow brook* has been and still is free from pollution. In many places the beds of the river have silted up through ill-constructed weirs, which check the natural flow of the stream and retain the solid matters thrown into them, and also through the constant washing away of earth from unprotected banks.
Astley Bridge -	The Local Board has no jurisdiction over the *Raveden* and *Astley brook*, which flows by the township on the south and south-west, or over *Eagley brook*, which flows by on the east side. Within our knowledge the condition of the streams have little changed, and the beds have not silted up.
Halliwell - -	No jurisdiction over *Deane brook*. Condition good. Silted up very little in consequence of a few cinders being thrown in.
Radcliffe - -	Have no power and no special Act, but the *Local Government Act*. River *Irwell*. There is not much difference within the last 30 years.
Whitefield -	No jurisdiction over the River *Irwell*, which is more polluted than formerly by extension of works. The bed has silted up.
Bury - -	The Improvement Commissioners have no jurisdiction over the river (excepting some powers vested in them as well as other corporate bodies by the *Mersey and Irwell Protection Act, 1862*, which they have never exercised. These powers extend only to solid refuse, and that Act is practically inoperative). About the years 1825 and 1826 the Rivers *Roch and Irwell* were not much polluted; fish were plentiful; but these rivers have by the sewers and increase of manufactories become so foul that no fish, even of the coarsest description, can now exist in them. During the last dry summer they (the *Roch* especially) gave out much offensive and noxious gases, and but for the putting in of ashes and cinders, which tend to purify the water, they would have been still more offensive. The recently made sewerage works at Bury and Heywood have much increased the pollution and the offensive smell of these rivers. The bed has silted up in some places, but not to any great extent. The chief deposits take place in the flatter part of the river, below Manchester. Cinders and ashes thrown into the rivers; being light, they are gradually washed out to the sea. But at Bacup and in the upper portions of the river vast quantities of soil, clay, and foundations are very improperly thrown into the river and carried down, where they fill up the goits and reservoirs of the manufacturers below.
Ramsbottom - -	No special powers but those given by the *Public Health Act, 1848*, and the *Local Government Act, 1858*, with the subsequent amendments. The *Irwell* flows through the town and forms the boundary on one side. There has been no material alteration in the condition of the river for many years. No sensible pollution of the stream by the works in the district exists. The pollution arises before the river reaches Ramsbottom. The bed has not silted up.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bacup - - -	The Local Government Board has powers under *Mersey and Irwell Protection Act, 1862*, and the *21 & 22 Vict. sect. 32. cap. 98*. The bed of streams has been lowered by taking out stones, ashes, and other rubbish. The rivers *Irwell* and *Greave*, and *Clough brooks*, previous to the adoption of Local Government Act, were in such a filled up state that in certain instances archways of bridges were blocked, sufficient room not being left to take storm waters, and parts of the town were flooded; since lowering the bed, and ashes, stones, and other rubbish prevented by the Board from being tipped into the streams, no flooding has occurred.
Heywood - -	No jurisdiction over the river *Roch*, which flows through this district. 28 years ago it was a pure stream, and fish might be caught, but now it is polluted by town sewage refuse from fulling mills, bleach works, print works, and dye works; the bed has silted up, but not to any considerable extent, caused by millowners and others emptying ashes and other refuse into the stream, now prohibited by the *Mersey and Irwell Protection Act.*
Rochdale - -	The Corporation have power to cleanse the river *Roch*. The Act conferring the powers is *The Rochdale Improvement Act, 1853, ss. 97. and 112*. Certain portions of the river have from time to time been cleansed. The river *Roch* flows through the centre of the town from east to west; the *Hey brook* flows into it on the easterly side, and the river *Spodden* on the westerly side of the borough. The river Roch is the natural drainage of the valley in which the town of Rochdale is situated.
Crumpsall -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	The Local Board of Health has no jurisdiction over the streams flowing near the town, except by the *Public Health* and *Local Government Acts*. *Shooters brook* is a rapidly flowing brook with a very tortuous course, formerly receiving only land drainage, but now used as the main sewer for numerous new streets in its course. It is also much injured by deposits of cinders and other rubbish, causing a gradual rise of its bed, and occasional flooding of the cellars in several houses, and requires periodical deepening. *Newton brook.*—A small brook; owing to the large amount of house drainage it receives it is now a foul main sewer, very injurious to health; it has a good natural fall, but damaged in several places by small and bad culverts, causing flooding in one or two cellars; the portions of it which are still open are used as depositories for cinders and rubbish, thus further impeding its flow. *Moston brook.*—A large and rapid stream, is used by several dyeworks, and also for water power. Does not receive much sewage, and is still a tolerably pure stream. The river *Medlock* skirts the southern boundary of the district, and receives some of its drainage. All the beds have silted up, owing to the deposit of cinders and rubbish and the discharge of sewage into the streams.
Failsworth - -	There is no river flowing through this district. There are two streams on the northern and southern boundaries, but the Board has no power over them. The *Moston brook* on the northern boundary is the principal outlet for the sewage of the district; there has been no perceptible change in the bed of it for the last 30 years. The brook on the southern boundary is a tributary of the river *Medlock*, and joins that river at a point near to Clayton Vale. It is a perfectly clear stream; no visible change in the bed of it for the last 30 years.
Bedford near Manchester.	The Local Board has no jurisdiction over *Bedford brook*. The bed has not silted up.
Bradford - -	The Local Board has no jurisdiction over the river *Medlock*, which forms the northern boundary of the district, and is at all times free from any emanations injurious to health. At present it is a strong stream about three feet deep; during the summer months it is very shallow and almost dry. The bed of the river has not silted up since 1860.
Openshaw - -	No jurisdiction. *Gorton brook*, which forms the boundary between Openshaw and Gorton, was and is polluted by dye water, but not so as to be prejudicial to health. *Clayton brook*, which forms the boundary between Openshaw and Bradford, was and is strongly impregnated with matter from chemical and dye works; it has been arched over. *Black brook* is much purer than the two preceding, and has been arched over by the Local Board. Not silted up to any appreciable extent, having ample fall.
Gorton - -	No jurisdiction. *Gorton* and *Gore brooks* flow through the township; the former is much polluted by refuse from dye and chemical works situate in adjoining townships, and the latter is tolerably clean and fresh, excepting in dry and hot weather, when, from the house drainage it receives, it becomes offensive; they are not polluted by solid refuse.
Droylsden - -	No jurisdiction. The river *Medlock* abuts upon the agricultural part of the district for about five-sixths of a mile. It is in much the same condition that it has been for about 40 years. It has not silted up.
Oldham - -	The Corporation has not any jurisdiction over the river. Have not known the streams in any other condition than they are at present; one is called *Sheepwashes brook*, another *Bower brook*, and the river *Medlock*. Not silted up to any great extent.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Crompton - -	The Local Board has no jurisdiction over the river *Beal*. It has in 40 years silted up 3 feet, caused principally by loose soil and other refuse from the highways and collieries on or near to the banks thereof, washing therein.
Royton - - -	No powers. The river *Irk* is generally clear, it used to be a fish stream; not many fish in it now. Attributed to the hot water from several mills flowing in. It is polluted by sewage, but not to a great extent.
Lees - - - -	No powers. It is simply a brook, a tributary of the river *Medlock*. The bed has not materially silted up.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	Have jurisdiction over the river. The *Macclesfield Improvement Act, 1852*, which incorporated the *Public Health Act, 1848, and the Towns Improvement Clauses Act*, have exercised the powers by preventing as far as possible the discharge of refuse into the river, and in periodically cleansing the bed of it. Previous to 1850 the river *Bollin* was the receptacle for all descriptions of refuse and ashes. The former Local Commissioners cleansed the bed, and lowered it 18 inches. Since the Local Board was formed precautions have been taken by their inspector to prevent persons discharging refuse into it; and the dyers of late years have not thrown into the stream the quantity of solid refuse which they formerly did. The construction of the new waterworks at Langley, and the compensation supply of water to the mill-owners, has given to the river a constant supply of water at all seasons, which very much contributes to the purification of the stream. The bed of the river slowly but regularly silts up, and it is chiefly caused by the weirs. If they were perfectly constructed and sluice gates fixed in the centre of the stream the flow of water would scour out the bed. The river is occasionally cleansed, and the silt carted away.
Bollington - -	No jurisdiction over the river *Dean*, the condition of which has not varied within the knowledge of the Board; it is not polluted and does not cause ill-health; the bed has not silted up.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	The *Weaver*. Past and present condition good, the stream flowing rapid and clear. The bed has not silted up.
Witton-cum-Twambrookes.	No jurisdiction over river *Weaver*, which is navigable through the township.
Sandbach - -	No jurisdiction over the streams. Until within the last 4 or 5 years the outfall of the sewage of the town was in a large pool impounded for manufacturing purposes. In summer this was most offensive, and the bottom required to be frequently cleansed. The outfall of the main drain is now in the brook, which is thereby very much fouled and greatly complained of. The brook has no particular name; it runs into a small stream called the *Wheelock*, which flows into the *Weaver* and thence into the *Mersey*.
Monks Coppenhall	No jurisdiction. The stream has no name, being simply a large rivulet or brook forming a small tributary to the River *Weaver*. The stream was very much polluted by the sewage of the town and the works of the London and North-western Railway Company previous to the outfall sewers being made. It is now comparatively clear, through the town at least; the stream averages about 12 to 14 feet wide and from 1 to 6 feet deep, according to the season. Its bed has not silted up.
Tarporley - -	There is no river either flowing by or through this district.
Nantwich - -	No powers. The river *Weaver* receives the sewage of the district at a point about a quarter of a mile below the town.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	There is no river flowing through the town.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	No powers but under the *Public Health Act* and the *Acts* incorporated therewith. *Eaves brook* being the boundary of the two districts is first polluted by the partial waste from the barracks, by the sewage of the populous portion of the district, to a limited extent from the cattle market belonging to the Corporation of Preston. *Savock brook* to the north is altogether fouled by the drainage from the Fulwood Barracks, and will be further fouled by the drainage of the Union Workhouse (constructed to hold 900 inmates) and just ready for occupation. These streams unite and join the river *Ribble* about four miles below the town of Preston.

Ribble Basin—(River Ribble).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Preston - -	The Corporation are the owners of the river *Ribble* to the centre thereof, so far as the borough extends. The Corporation do not possess any jurisdiction over the river under any Local Act. The river *Ribble* flows past the borough of Preston; it was formerly a pure clear stream, it is now much polluted by sewage and other refuse discharged into it and its tributaries. The bed has not silted up, but the fresh water in the river at Preston is lower than formerly, arising from the works of the *Ribble* Navigation Company; these works, however, have much improved the navigation of the river.
Leyland - -	No jurisdiction over the *Lostock;* present condition good on the whole; never knew it otherwise. Not aware that the bed has silted up.
Clitheroe - -	The Corporation has no jurisdiction over the brook. *Wilkin or Shaw brook*, is pretty much in the same state as it has been for several years past.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	No powers. The *Hyndburn brook* flows by the town, and its condition within my knowledge (four years' residence) is and has been such as to render it totally unfit for any kind of domestic purposes. The bed has silted up to the extent of two or three feet, occasioned by the debris thrown into it in its course from Accrington.
Oswaldtwistle -	No jurisdiction over the river or streams called *Cocker Brook, Jack House Brook, Cocker Lumb, or Tinker Brook;* it is very clear until it passes the Foxhill Bank Print Works near Church. The bed has silted up in consequence of weirs being erected at different places.
Accrington -	No jurisdiction over the river *Hyndburn*. Past condition very bad. Present a little better. The bed has silted up by refuse turned in.
Burnley - -	The Corporation has jurisdiction over the river *Calder* from Hand Bridge to the entrance to Towneley Park, and over the *Brun* from the Canal, below Bank Hall. *The Burnley Improvement Act, 1854; Sects. 156, 157, 158, 196, and 200*, give powers for cleansing, for throwing dirt, &c., and preventing encroachments in the rivers. Several persons have been summoned for throwing ashes, refuse, &c. into the rivers, and penalties enforced. The depositing of ashes in the river being a personal offence only, *sec.* (157), the Act is inoperative in all cases where the offenders are not seen committing the offence. It fails to meet such cases as the following, viz.: where mill-owners on the banks of the rivers throw their ashes through windows into the rivers, or put them into a large sewer constructed ostensibly for other purposes, and wash them into the rivers. It also failed to meet a recent case where a butcher induced a little boy to throw into the river a quantity of putrid offal. The magistrates, by inflicting the highest penalty on the boy, viz., 40s. and costs, or in default 14 days' imprisonment, indirectly reached the guilty party (the butcher), who paid the penalty rather than incur the public odium of allowing the boy to be sent to prison. The occupier of premises from which ashes, offal, &c. are turned or thrown into the rivers should be made liable to the penalties. The Corporation have cleansed the river *Calder*, and lowered the bed, which had silted up and obstructed the sewer outlets. The condition of both rivers is gradually becoming worse; during the summer months and dry weather the stench from them is great. The beds have silted up to a considerable extent, the cause is attributable to large quantities of excavations being thrown in, also to the clinkers, ashes, and other refuse from iron foundries, mills, &c., for which the rivers were formerly a general receptacle. Another cause has been the forming of weirs across the streams.
Brierfield - -	No jurisdiction over the *Pendle water*. The condition is pretty fair. Has not changed for years. The bed has not silted up.
Nelson - -	The Local Board has jurisdiction under Special Act over the streams, *Pendle water* and *Walverden*, and prevent throwing in of rubbish; this prohibition is enforced by a penalty of not exceeding 20*l.* on conviction, but it has not been found necessary to enforce the penalty. The condition of both *Walverden* and *Pendle water* is fair, and has not much deteriorated since the formation of the place called Nelson, which came into existence about 20 years ago. Not many works are yet erected on the streams. Only at one place has the bed silted up, caused by the erection eight or nine years ago of a weir, 22 inches in height, across the *Walverden stream*, in connexion with a Bradley Corn Mill.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	The Corporation has absolute power over the river flowing through the town, subject to compensation for private rights if interfered with. The Acts conferring the powers are *Blackburn Improvement Act, 1854, Secs. 46 to 49, Consolidation Act of 1847*, partly incorporated with Special Act. The bed of the river has been pitched, an old weir and mill-dam purchased and abolished, and three new bridges erected. Sewage that formerly flowed into the river from the sewers has been diverted, the river course in several places straightened, and a breast wall upon each side erected. The River *Blakewater* was fifteen years ago very filthy, the sewage of the whole

Ribble Basin—(River Darwen).

Series No. 1, General.—Answers to Queries 8 to 12, page 13—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Blackburn—*cont.*	borough flowed into it at various places; it is now polluted by the manufactories and works on the banks. The water is used for condensing and generating steam, but the pollution from this cause is slight, the water generally in dry weather flowing down the river at a temperature of about 80 degrees. The bed has silted up, but when it was pitched it was excavated to about its original level.
Great Harwood -	The Local Board has no jurisdiction over the *river Hyndburn*, which is a very dirty stream. The bed has not, within our knowledge, silted up.
Over Darwen -	The Local Board has no jurisdiction over the river *Darwen*. The river has for a great number of years been fouled by the refuse from the various cotton and paper mills and other manufactories, and the bed from this cause has silted up from two to three feet.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	The Commissioners of the Croston Drainage incorporated by Act of Parliament have a jurisdiction as respects obstructions. The river *Yarrow*, flowing through the town, has been for a number of years in a very foul state, owing to the discharge of fluid refuse into it from various works above Croston, and from the town of Chorley, and during the dry season of last summer it was very offensive. The Drainage Commissioners have prevented the bed silting up.
Chorley - -	The Chorley Commissioners have certain powers under *Sect. 24.* of the Towns Improvement Clauses Act, 1847, incorporated with the Chorley Improvement Act, 1853, by *Sect. 27.* of that Act. *Sect. 28.* of the last-named Act extends the construction of the incorporated clause. The town sewage has flowed into the river ever since the completion of the sewerage works. The river *Chor*, so called, is only a small brook.
Ormskirk - -	No river flowing by or through the town.
Wigan - - -	No jurisdiction over the river *Douglas;* the bed has silted up, but not materially. The stream is a rapid one.

Series No. 1, General.—Queries——13. Is the property situate on either bank of the river affected by floods, and to what cause do you attribute the floods?——14. Is the river or stream polluted by town sewage, liquid refuse from manufactures, chemical works, gas works, dye and bleach works, calico and silk printworks, tanyards, and from mines, and to what extent?——15. Is the river or stream polluted by scoria from iron works, slags, cinders, small coal, or any other solid refuse?——16. Are encroachments on the river or stream prevented? ——17. Is the condition of the river, streams, or canals, passing by or through the town, a source of ill-health or discomfort?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	Not often affected by floods. There are no ironworks. The mill-owners ought not to put cinders in the river.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Not affected by floods. Encroachments are prevented by the owner of the adjoining land. The condition of the river water is a source of ill-health.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	The property on banks of river is not affected by floods. The river is polluted to a considerable extent, but not by scoria from ironworks. The river is the boundary of the town; and but few houses are in close proximity to it, and, therefore, we think it is not a source of ill health or discomfort to the inhabitants.
Denton - -	The district is not so affected by floods. The river is polluted by town sewage, and extensively by hat manufactories, wool washing, and hat dyeing. There are no chemical works, gasworks, bleachworks, or tan yards in Denton. Encroachments not prevented. The state of the river is not a source of ill-health.

Mersey Basin—(River Tame).

Series No. 1, General.—Answers to Queries 13 to 17, page 22—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Dukinfield - -	District affected by floods to some extent. We attribute this to obstructions and to the existence of weirs. The river is polluted to some extent by all kinds of fluid refuse, except chemical works, of which there are none in the neighbourhood. It is not poluted by scoria; we have no smelting of iron in the district. Encroachments not prevented. In dry weather the condition of the river is a source of ill-health and discomfort.
Stalybridge - -	In some cases the cause of the floods is attributable to sudden and heavy rainfall on the adjoining hills. The river is polluted by town sewage, but not to a considerable extent. The manufactories on the stream are principally cotton mills, from which no liquid refuse flows; it is not polluted by scoria and slags. In some places the encroachments have not been prevented. It is believed that the river with its occasional floods is in a sanitary point of view a source of advantage rather than of ill-health and discomfort.
Ashton - under - Lyne.	Floods do not seriously affect the property on either side of the river. The river is largely polluted by town sewage, liquid refuse from manufactories, dyeworks, and bleachworks, and calico printworks above the borough, and the sewage of Stalybridge, Ashton, and Dukinfield, and other towns flows into the river; it was formerly polluted by all kinds of solid refuse. A tan yard has recently been established in the borough in spite of threats of the Corporation. Encroachments are prevented. In dry weather the river and canals are a source of discomfort if not of ill-health.
Hurst - - -	Not answered.
Mossley - -	Some of the property is affected by floods. The reason is supposed to be the narrowing of the stream in places by manufactures. Encroachments are not altogether prevented.
	Watershed of the Mersey Proper.
Liverpool - -	None of the property in Liverpool is affected by floods in the *Mersey*. Cellars along the margin of the river sunk in made ground to a depth considerably below high-water mark are sometimes, though rarely, flooded by infiltration.—[B.E.] On the 21st November 1867 the Medical Officer made a special report to the *Rivers Pollution Commission* on the subject of this question (*see Part IV.*). There is no refuse from gasworks sent into the sewers or the river. There are no mines, and no calico and silk printworks within the borough. The Medical Officer has never been able to trace any perceptible pollution of the waters of the estuary, either from the sewage of the town or the inconsiderable liquid refuse of the manufacturers, chemical works, tan yards, &c. The river is not polluted by solid refuse.—[M.O.] Occasional complaints have been made of the condition of the *Leeds* and *Liverpool canal*, both as regards the health and comfort of the inhabitants, but the Medical Officer has never been able to trace disease to this cause.—[M.O.]
Waterloo - with - Seaforth.	Not affected by floods. There is no pollution of this description known to affect the river *Mersey* (which is a tidal one) so far as it concerns the district of Waterloo-with-Seaforth, but with respect to *Primrose brook*, as it flows through a part of the district, complaints have lately been made of the pollution of its water by the refuse proceeding from a tan yard situated between 300 and 400 yards eastwardly of it. A sewer or drain, however, has very recently been constructed which it is expected will remove the cause of such complaints. In other respects this stream is supposed to be unpolluted by any of the means here referred to.
Great Crosby -	Not affected by floods; and see answer, p. 14.
Litherland - -	Not affected by floods. Sewage from Liverpool and all the surrounding districts is discharged into the river *Mersey*, but no solid refuse; there is no encroachment in this neighbourhood, and the state of the river is not a source of ill-health.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby - -	Not affected by floods. The streams are polluted by town sewage only, but not by solid refuse. The condition of the brook has been offensive and a source of discomfort and probably ill-health, but this state of affairs has been to a great extent and is being remedied, by the sewerage works of this board; the condition of the *Alt* has also occasioned discomfort, but this is also being remedied by the works of the board.
Walton - on - the - Hill.	No houses at present abut on the stream, but the land is occasionally flooded. The stream is largely polluted by town sewage, but not by solid refuse; no manufactories drain into it. Encroachments are prevented. The Local Board consider the state of the stream prejudicial to health.
Toxteth Park -	Property is not affected by floods. The river is largely infected with impurity of various kinds, and were it not for tidal influence the results would be extremely prejudicial. The sewage of nearly 2,000,000 of persons, inhabitants of Stockport, Manchester, Salford, Warrington, Runcorn, Liverpool, and Birkenhead, besides those of many other places of less magnitude, together with the refuse of numerous works and private residences, is all discharged into the *Mersey* and its tributaries. Probably, however, there is not any place on the course of the river where the effects are less

Mersey Basin—(Mersey Proper).

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Toxteth Park—*cont.*	prejudicial than the Toxteth Park, as the greatest width of stream is in this neighbourhood. The viscidity of the river water before admixture with tidal water is so great that the froth created by the sluices at Woolston Weir, four miles above Warrington, or by the water wheels in that neighbourhood, is carried in considerable bulk not only past the district but through the whole river frontage of the borough of Liverpool. Fisheries which formerly existed within the district have been abandoned for some years. The river is polluted to some extent by the cinders and ashes from the steamboats of various kinds. Previous to the passing of the Mersey Conservancy Act encroachments were made as detailed in the report of Mr. Edward Eyes to the Duchy of Lancaster, in 1828, which was revised in 1839 for the Corporation of Liverpool. The survey covered the whole of the tidal water of the Mersey. The condition of the river is not one of ill-health, but of very great discomfort.
Wavertree - -	No river flows by or through the district.
Little Woolton -	Not affected by floods.
Much Woolton -	Not affected by floods. Both the streams are polluted by town sewage, and the refuse from the gas works. The condition of the river does not cause ill-health.
Garston - -	The property on the banks is not affected by floods. The river is under the superintendence of the Mersey Conservancy Board.
Widnes - - -	Polluted by liquid refuse from chemical and other works, to some slight extent, but not by solid refuse. Encroachments prevented. We do not attribute ill-health to the state of the river.
Sutton - - -	Not affected by floods. The *brook* is polluted by town sewage, manufactories, chemical works, mines, and, worst of all, from waste laid down from chemical works and to an extent sufficient to make it a very great nuisance.
Prescot - -	Not answered.
Parr - - -	The property on either side of the *brook* is affected at times by floods, but we do not attribute this overflowing to any obstruction, but from incapacity of the sectional area of the *brook* itself. The *brook* is polluted largely by town sewage from St. Helen's, which lies to the west of Parr, and refuse from manufactories, chemical works, copper works, gasworks, and collieries, but not by solid refuse. The condition of the *brook* and *canal* is a source of ill-health and discomfort.
St. Helen's - -	No parts affected by floods. Encroachments are not prevented ; as already stated parliamentary power was given to improve, or regulate, or cover in the *brook ;* but the extent or width vested in the governing body for such covering in or improvement was not defined, and meanwhile proprietors of the property on each margin of the *brook* have claimed a right to the soil and freehold of one-half of it, and, whether entitled to it or not, they have claimed and exercised the right. The condition of the *brook* is a source of discomfort, and is especially so throughout that portion where the proprietors of the lands on each margin have hitherto refused to so straighten its course or to permit the governing body to permanently wall its side, and pitch the invert.
Newton-in-Mackerfield.	Affected by floods caused by the irregular flow of the stream and by silt. The lands on each side of the brook in this district called the Water Meadows were formerly assessed at the rateable value of 109*l.* 10s., but owing to the frequent overflows of the polluted stream it is now reduced to 15*l.* 5*s.* The river is entirely polluted, chiefly by chemical works, and also by solid refuse. Encroachments, so far as we know, are prevented. The state of the stream is a considerable source of discomfort and ill-health.
Warrington - -	The low parts of the town are affected by floods. The river is polluted by town sewage, liquid refuse from manufactories, chemical works, tanyards, but not by solid refuse within borough. The condition of the river and canal is both a source of ill-health and discomfort.
Pennington - -	No property is built on the side of *Pennington brook ;* the land on each side of the stream is liable to be periodically flooded. This flooding we attribute to the tortuous course of the brook, to the insufficient size of Breaston bridge in Bedford, and because the bed of the stream is not properly attended to. The sewage of the town of Leigh is emptied into *Pennington brook*, and the stream before coming into Pennington is polluted by the liquid refuse from chemical, bleach and dye works, and also water from mines. *Stock Platt ditch* and *Bedford brook* are also polluted by the sewage of Atherton, Westleigh, and Pennington. The brooks are polluted by solid refuse. There are no encroachments. In the case of *Stock Platt ditch*, it is a source of ill-health. In the case of *Pennington brook*, the flooding is a source of ill-health and discomfort.
Westleigh - -	Have known the property on the east side of the brook to be flooded at Westleigh mill, but this has only occurred at rare intervals. This flooding is caused by the weir to the goyt of Westleigh mill. The brook is polluted by the refuse from bleach works, chemical works, and coal mines, but not to any considerable extent. There have been no encroachments. The state of the stream is not considered a cause of ill-health.

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Hindley - -	Not answered.
Atherton -	No part affected by floods. There have been no encroachments. The condition of Stock Platt ditch is a source of ill-health and discomfort.
Tyldesley - with-Shakerley.	Not affected by floods. The stream is polluted by town sewage, not by solid refuse. Encroachments are not prevented. The state of the river is not a source of ill-health.
Rusholme - -	The streams are polluted by town sewage and the refuse from dye and calico-print works before entering the district to an extent to make them more or less offensive. The condition of the rivers is to some extent a source of ill-health and discomfort, and as the district increases in population the evil increases in proportion.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	Not affected by floods. All kinds of pollution take place above, very little in Stockport. Encroachments are not prevented. The dirtiness of the stream must be a loss and discomfort to the inhabitants; their health, if they do not drink the water, cannot be affected thereby.
Bredbury - -	Not affected by floods; there is less water flowing down the river *Mersey* or *Goyt* on account of the impounding of the water at Woodhead by the Manchester Corporation. The rivers and the streams are polluted by print works, cotton and paper mills. They are also polluted by solid refuse, but not so much as formerly. No encroachments. The state of the river is not a source of ill-health.
Wallasey - -	Not affected by floods. The river is polluted by town sewage. Encroachments are prevented, except as regards the works of the dock boards. The condition of the river is not a source of ill-health.
Birkenhead - -	Not affected by floods, the sewers discharge into the river ; it is not polluted by scoria and slag. The river *Mersey*, from Warrington and Frodsham bridges to the sea, is under the jurisdiction of the Conservancy Board.
Oxton - - -	Not answered.
Tranmere - -	The property in the district is not affected by floods. There is no apparent pollution. The sewage from part of the district flows through a pipe sewer into the river ; but no solid refuse. We are not aware of any encroachments in the river. The state of the river is not a cause of ill-health.
Higher Bebington	The property in Higher Bebington is not affected by floods. The river is probably polluted by town sewage from Liverpool and other places on the Lancashire coast, and also by various works on that side of the river. The public sewer of Higher Bebington is carried down to low-water mark, and the river may possibly be said to be thereby polluted, but it can only be so to a very small and imperceptible extent. All attempted encroachments would naturally be watched and prevented by the Conservators of the *Mersey*. The state of the river is not a cause of ill-health.
Runcorn - -	Not affected by floods. The river is polluted by town sewage, liquid refuse from manufactories, chemical works, soap works, but not by solid refuse. Encroachments prevented. The river is sometimes very offensive and injurious to health, caused by the refuse from the alkali and soap works which flows into the sewers and thence into the river.
Lymm - - -	The property on the banks of the river is affected by floods, attributable mainly to the low level of the land, but to some extent by the weirs placed across the river to make it navigable. The river is polluted to a very large extent and increasing yearly. The trustees of the Duke of Bridgewater take measures to prevent any encroachments. The condition of the river is a source of discomfort to persons living in the immediate neighbourhood of it.
Altrincham - -	The river is polluted. The Bridgewater canal, which passes through the northern extremity of the town, was until within the last 12 months a serious nuisance, but steps have been taken by the Bridgewater trustees to remedy it, which appears likely to be effectual.
Sale - - - -	Not affected by floods. The condition of the river is not a source of ill-health.

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, & Monton.	The grounds on either side the river are often flooded, and at times considerable damage is caused to property, especially was this the case during the autumn of the last year. The river is polluted to a serious extent by town sewage and liquid refuse from the several works in the city of Manchester and borough of Salford, and by solid refuse of every kind. Encroachments are not prevented. The condition of the river cannot perhaps be said to be a source of ill-health, but certainly at intervals the effluvia arising from the *Irwell* is a source of great discomfort to persons residing near.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 13 to 17, page 22—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Stretford - -	The property on the banks is affected by floods, attributable in the case of the *Irwell* to the weirs, in the case of the *Mersey* to canal bridge. The *Irwell* largely, the *Mersey* not much; they are not polluted in Stretford by solid refuse. The condition of the *Irwell* is a source of ill-health and discomfort, but the *Mersey* is not.
Moss Side - -	Not affected by floods. The stream is polluted by sewage, dye works, and chemical works, but not in the district of Moss Side; it is polluted by scoria; encroachments are not prevented. The condition of the stream has been supposed a source of ill-health, and hence the reason of its now being covered in.
Salford - -	The valley of the *Irwell* within the borough is subject to periodical inundations, attributed to the insufficient waterway for the discharge of excessive rains which fall in the basin; this insufficiency is aggravated by two private weirs and two weirs in the navigable portion of the river. The river is polluted by town sewage, which under the authority of the *140th section of the Salford Improvement Act* is allowed to flow into it, and also by liquid refuse from dye, bleach, calico, and silk manufactories, chemical, print, gas, and other works. Within the borough the river is not (since the formation of the River Conservancy Committee under the Local Act), polluted by scoria and slag, but cinders are yet thrown in above the borough to a large extent. Encroachments are prevented within the borough. The condition of the river is indirectly a source of ill-health and discomfort; during heavy rains it acts mechanically in holding back the sewage water in the low districts; and the condition of certain open watercourses acts in a direct manner on the health and comfort of the district.
Manchester - -	The basement storeys of the property adjacent to the rivers are occasionally affected by extraordinary floods; but the ground rises rapidly from their banks, so that the area affected by floods within the city is small, and is only flooded on rare occasions. There is, however, a district in the township of Cheetham, within the city, which lies very low, and near to the river *Irwell*, and which to the extent of 36½ acres is liable to be occasionally flooded. In the floods which occurred in November 1866, the whole of this district was considerably flooded, and much damage was caused to the inhabitants. There is no doubt that, in addition to the causes before referred to, the changes constantly taking place in the district through which the rivers flow, the increase of buildings, and of the means for sewering and draining into such rivers, cause the rain fall to find its way more rapidly into the rivers, and thus tend to enhance the volume of water, and to increase the liability to floods. The rivers, before they enter the city, are much polluted by the refuse from the works on their banks. They also receive the refuse from manufacturing works within the city. As already stated all the sewers within the city have their outlets into one or other of the rivers; but the quantity of water discharged from the sewers is so great, in proportion to the sewage matter, that it can hardly be said that the pollution of the rivers is materially increased from this cause. Many works empty their refuse into the sewers, consisting chiefly of dye works, bleach works, paper mills, chemical works, bone works, tan-yards, india-rubber works, and slaughter-houses. A considerable quantity of cinders and other solid refuse is thrown into the rivers before they enter the city; but every care is taken to prevent this practice within the jurisdiction of the Corporation. The Corporation have no special powers to interfere with or prevent encroachments on the rivers, except as regards the river *Medlock*, in relation to which, so far as such river is within the boundaries of the city, special powers were obtained by the Local Act before referred to. There are few dwellings on the banks of the rivers, and ordinarily the currents will prevent very rapid decomposition. The effluvia which arise do not generally extend to any considerable distance beyond the banks, but they are occasionally the cause of much discomfort. During the prevalence of cholera, the inhabitants of the dwellings on the banks of the *Irk* suffered considerably. Many of the houses have, however, been since pulled down. The investigations are not yet completed to the extent necessary to enable any accurate estimate to be made to the relative amount of fever, diarrhœa, or other diseases in the districts adjoining the rivers.
Prestwich - -	The property on the banks is affected by floods. There are a number of weirs erected below the limits of the district, which have a tendency to back up the water. The river is polluted to some slight extent from works within the district, and to a great extent by works outside the district. Encroachments are prevented. The condition of the stream is not a source of ill-health.
Swinton - -	In consequence of the Douglas weir a large quantity of land is flooded during heavy rains. Some of the land has been lowered by coal working to the level of the river. The river is polluted by print works. There are no encroachments. The river and canal are in fair condition.
Kearsley - -	Not affected by floods. The river is polluted in a very small degree by a portion of town sewage and by refuse from chemical and dye works, but not by solid refuse. There are no encroachments on the river within this district. The state of the stream is not a source of ill-health.
Farnworth - -	Not affected by floods. The river is polluted by sewage of Bolton and works situate upon the banks for a distance of three miles previous to entering the boundary of the

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 13 to 17, page 22—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Farnworth—*cont.*	district, but not within the district by solid refuse. Encroachments are prevented Ill-health has not been attributed to the state of this stream.
Bolton - - -	In consequence of the beds of the rivers silting up, properties adjacent have occasionally been flooded. All the sewage of the town and neighbourhood is discharged directly into the river, and they are further polluted by liquid refuse from various works (principally bleach works), and by water from mines. The waters of the streams are much used for condensing by mills and other works, and from which there is a frequent flow of hot water into the streams. Until within the last few years much pollution has been caused by furnace cinders being wilfully thrown into the streams, but this is now materially lessened by the preventive action of the Corporation. Encroachments upon the rivers and streams are not prevented. Unquestionably the condition of the rivers, especially at or near the weirs, is a source of ill-health and discomfort.
Astley Bridge -	Not affected by floods. The streams are polluted by town sewage and by bleach and dye works, but not by solid refuse. Encroachments are prevented. The condition of the streams is not a source of ill-health.
Halliwell - -	Property not affected by floods. The stream is polluted by the refuse from dye and bleach works, not by solid refuse. Not aware of any enroachment. The state of the stream not a source of ill-health.
Radcliffe - -	Not affected by floods. The river is polluted by all kinds of manufacturing refuse, with the exception of that from tan yards and silk printworks, and was formerly polluted by all kind of solid refuse; but since the passing of the *Mersey and Irwell Protection Act, 1862*, very little is put in. We know of no encroachments. During the very dry season of this year the river was offensive.
Whitefield - -	The property on the banks is not affected by floods; the river is polluted by town sewage and by all kinds of fluid and solid refuse.
Bury - - -	Not to any great extent nor so as to cause inconvenience to this district. The cause of floods is excessive rainfall, which frequently occurs in the upper part of the *Irwell;* at Clough Bridge, above Rawtenstall, and Crawshaw Booth the rainfall in December last was upwards of eight inches. These floods do much good by cleansing the bed of the river. The rivers are polluted by town and village sewage, refuse from calico print works, dye and bleach works, and paper mills. The chief refuse from paper mills is lime and other chemicals, which tend in some degree to purify the water, and this is also the case with refuse from other manufactures, though not to the same extent; some by refuse from extensive chemical works gets into the river at and below Radcliffe. The refuse from spent garancine and madder used in print and dye works is very offensive. There are no ironworks. Sand and cinders are thrown into the rivers from foundries, and cinders and ashes from cotton mills, woollen mills, paper mills, and other works. These cinders and ashes do not pollute the river, but improve the quality of the water. Foundations, soil, and other solid matter are thrown into the river to be washed away, which is a very pernicious practice. The self-interest of the various proprietors is the only check on encroachment, and is generally sufficient. The condition of the rivers is not a source of ill-health, except in the case of a long drought, like that of 1868. The advantages of affording employment in manufactures far outweigh any inconvenience.
Ramsbottom - -	Not affected by floods. The river is polluted by town sewage, and refuse from print and bleach works and paper mills. There have been no encroachments. Ill-health is not attributed to the state of the streams.
Bacup - - -	In extreme storms some few houses are flooded for a short time. The town is situated near the sources of two streams, and the flood water soon passes off. These streams are polluted by town sewage to a considerable extent, and by refuse from Turkey red dyeworks; ground logwood is also turned into the river to a large extent. The rivers are also polluted by water from mines. The water of our rivers is also used over and over again by cotton and other manufactories, and in its passage through the boilers of those manufactories loses, we believe, a large portion of the offensive chemical elements. Not polluted by solid refuse. Encroachments are prevented. Complaints are seldom made of the state of the stream.
Heywood - -	Not affected by floods. Encroachments are not prevented. At certain times of the year the condition of the river is a source of ill-health, but not to a great extent, and confined to a small portion of the district only.
Rochdale - -	Some portion of the property in the lower parts of the town are affected in times of a very heavy flood, arising, no doubt, from the extensive gathering ground and its rapid rise. The river is polluted to a certain extent by town sewage, refuse from chemical, dye, print, bleach, and gas works. The pollution by solid refuse is prevented as much as possible within the borough. Encroachments are prevented. During a long droughty season, when the river is nearly dry, it is possible that complaints might be made of the effluvia arising therefrom. The Corporation have kept it as free from stagnant matter as possible in droughty and other weather.

Mersey Basin—(River Irwell).

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Crumpsall	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath	Affected by floods in some instances; in consequence of the silting up of the beds of *Shooters brook* and *Newton brook*, the water backs up through the sewers and into the cellars. All the streams are polluted by town sewage, and by liquid refuse from dye works, chemical works, tan yards, and by cinders and house refuse discharged through the main sewers into *Newton brook* at its junction with *Shooters brook*, the boundary of the townships of Newton Heath and Manchester. Encroachments are prevented. The Rochdale canal is still comparatively pure, and contains many small fish; all the brooks in the south-west portion of the district are very foul and injurious to health.
Failsworth	There is very little property built on the banks of these streams, and none affected by floods. Encroachments are not prevented. The state of the streams is a source of ill-health, but not remarkably so.
Bedford, near Manchester.	The property on banks of stream is affected by floods. The brook is polluted by town sewage but not by solid refuse. There are no encroachments.
Bradford	There is no property on either bank within the district. The entire sewage of the district empties itself into the *Medlock*, which is to some extent polluted by liquid refuse from chemical works and manufactories; it is not polluted by solid refuse within the district; the dams above would prevent any reaching Bradford. Encroachments are never attempted.
Openshaw	Property not affected by floods. The streams are polluted by town sewage and refuse from chemical, dye, and bleach works. Encroachments are prevented. The state of the streams is not considered a source of ill-health.
Gorton	Not affected by floods. No encroachments. The state of the rivers is not a source of ill-health.
Droylsden	The land adjoining the river is occasionally flooded, but not to any serious extent. The stream is not polluted to any appreciable extent. There are no encroachments. The outfall of the sewers of the Local Board is the only source of discomfort, and such outfall is upon agricultural land, and about 200 yards from the nearest house, which is a farmhouse.
Oldham	Property not affected by floods. It is polluted by town sewage and liquid refuse from manufactures and by all kinds of solid refuse. Encroachments are not prevented. It is not said that the condition of the streams is a source of ill-health.
Crompton	The property on both sides is occasionally affected by heavy floods, and perhaps increased by the obstruction in the river caused by the accumulation of silt and other refuse matter. The river is polluted slightly by the sewage from the village of Shaw and other small hamlets and partly by mines, but not by solid refuse. The river is the private property of the owners of the adjoining lands, and being partly filled up by silt and refuse matter, obstructs the ordinary drainage and causes a certain degree of ill-health and discomfort.
Royton	Not affected by floods. The stream is polluted by sewage. It is not considered to be a cause of ill-health.
Lees	Not affected by floods. The stream is polluted by sewage, but not by solid refuse. No encroachments have been made. The condition of river does not cause ill-health.
Watershed of the Bollin, Tributary of the Mersey.	
Chorley	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield	The property on the banks of the river is not affected by floods. The sewage from a considerable portion of the town is discharged into the river, but the Board having very generally discouraged the use of waterclosets the sewage is not offensive; it is diluted by the water supply, which is a constant service, and the rain and storm water of the district. From careful observation the Board believe that the river is not polluted to any appreciable extent, all their efforts for many years having been directed to the paramount necessity of avoiding as much as possible pollution by sewage, and the flow of the river does not admit of the sewage becoming stagnant anywhere; it is rapidly carried off before decomposition begins. The refuse from slaughter-houses is not permitted to go into the sewers, but is carried away promptly under strict regulations and inspection. The river is polluted by liquid refuse from manufactories, chemical works, dyeworks, and silk printworks, and is highly discoloured and offensive to the smell. There is not any liquid refuse discharged from gasworks, tanyards, or mines. Encroachments are prevented. The Board cannot say whether the condition of the river flowing through the town is a source of ill-health; it is a source of discomfort during hot weather, but if the liquid refuse

Mersey Basin—(River Bollin).

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Macclesfield—*cont.*	from dyeworks and chemical works was purified and rendered free from smell the chief cause of discomfort would be removed.
Bollington	Not affected by floods. The stream is very little polluted, there being only one small print works on the stream; it is not polluted by solid refuse.
Watershed of the Weaver, Tributary of the Mersey.	
Northwich	The navigation of the river has been much improved; the cellars of the houses are now seldom flooded. The river is not polluted by sewage or refuse from manufactories Encroachments are prevented. The state of the river not complained of.
Witton-cum-Twambrookes.	Not affected by floods. A portion of the town sewage and liquid refuse from gasworks flows into the river, but does not pollute it to any great extent. It is slightly polluted by discharging coal. Encroachments are prevented.
Sandbach	There are occasional floods, which are to some extent attributable to pounding up of the water along the stream. There is no pollution of any consequence until the stream arrives at Sandbach.
Monks Coppenhall	The low meadows for a few acres are sometimes flooded, which is attributed to the circuitous route of the brook. About 1½ miles below the town the sewage runs in after passing through depositing tanks. There are no manufactories in the town. The greater portion of the sewage comes from the engine works of the London and North-western Railway, the steam sheds, washing of the engines, and from the station. There are, however, grease works and gas works connected with the shops. All the sewage is now being collected into the main outfall sewer. The stream is not polluted by scoria and slag, and is not a source of ill-health, being now comparatively clear water.
Tarporley	Not answered.
Nantwich	Not affected by floods. The river is polluted to a slight extent by the liquid refuse from gas works and a tanyard, but not by solid refuse. No encroachments have been attempted for a number of years. The condition of the river is not a source of ill-health.
Congleton	The Answers to Queries have not been received from this Borough.
RIBBLE RIVER.	
Watershed of the Ribble Proper.	
Southport	Not affected by floods.
Kirkham	The Answers to Queries have not been received from this Local Board of Health.
Fulwood	Not affected by floods. The river is polluted by town sewage, not by solid refuse. No encroachments. Great and repeated complaints have been made of the barrack drainage, but promises are made of estimates to be laid before Parliament to abate the nuisance.
Preston	This is occasionally the case, and arises from an unusual rainfall higher up the river. The sewage from Clitheroe and the refuse from the manufactories flow into the *Ribble*. The sewage from Burnley and other populous places, and the refuse from the different manufactories, are discharged into the *Calder*, and flow from thence into the *Ribble*. The sewage from Blackburn, Darwen, and other populous places in those districts, and the refuse from manufactories are discharged into the *Darwen*, and flow from thence into the *Ribble*. The sewage from Preston is discharged into the *Ribble* below the town, and in the tidal way. The *Calder* and the *Darwen* are both in a most filthy and offensive state. Encroachments are not prevented. The river as it passes by the town is, in very dry seasons, a source of discomfort to persons walking on the banks. The corporation have at a very large expense laid out two public parks (Avenham Park and Miller Park) on the banks of the river.
Leyland	Heavy and continuous fall of rain for a few days floods the low lying farm lands, but we do not attribute it to any obstructions in the stream. The stream is on the whole remarkably pure; occasionally a little pollution takes place, but not to any serious extent. It is not polluted by solid refuse. The condition of the stream is not a source of ill-health or discomfort.
Clitheroe	Occasionally, when heavy rain fall on the hills above, part of the borough is flooded. The streams are polluted by town sewage, but not by solid refuse.
Watershed of the Calder, Tributary of the Ribble.	
Clayton-le-Moors-	Not affected by floods. The river is polluted by liquid and other refuse from manufactories, chemical, gas, calico, and print works, and sewage of towns through which it passes: also by cinders and solid refuse of every kind, thereby rendering it

Ribble River—(River Calder).

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Clayton-le-Moors —*cont.*	unfit for any domestic purpose whatever. Encroachments are very strictly prohibited and prevented. The *Hydburn brook*, being at a low level at the very extremity of the town and district, is neither a source of ill-health or discomfort.
Oswaldtwistle -	The property is not affected by floods. The stream is polluted by the sewage of the district and the refuse from printworks; it is not polluted by scoria; the condition of the stream is not a source of ill-health.
Accrington - -	The cause of floods is attributed to a weir placed across the stream near the Black Bull inn. The water of the river is polluted by refuse from print and dye works, manufactories and bleachworks, and is sometimes very offensive in consequence; it is also polluted by solid refuse. Encroachments are not prevented; the condition of the stream is a source of discomfort.
Burnley - -	The property in the low levels of the town is affected by the floods caused by the heavy rains rapidly flowing off the adjoining steep lands into the rivers. The streams are polluted to a very considerable extent, principally by town sewage, also by liquid refuse from printworks and tanyards, and by scoria, slag, cinders, and other solid refuse, but not so much as formerly, in consequence of the Corporation having taken proceedings against several parties offending. No one is now allowed to build within 15 feet of the centre of the river. The condition of the river is a source of ill-health and discomfort at the lower end of the town.
Brierfield - -	Not affected by floods; the stream is polluted to a slight extent by manufactories and mines, not by solid refuse. Encroachments are not prevented, except by riparian owners. The condition of the stream is not a source of ill-health or discomfort.
Nelson - - -	Not affected by floods. The streams are slightly polluted by sewage from several drains which empty into them, but not by solid refuse. Encroachments are prevented. There have not been any complaints of the condition of the streams.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	The property on the banks is occasionally flooded. The river is polluted by town sewage and by liquid refuse from bleach works and mordant works at the higher extremity of the borough, but not by scoria and slags. Encroachments are prevented. The condition of the river within the borough is not a source of ill-health, except near "Whalley Banks" bridge, where an old mill backs up the water, and in bad weather the river is very offensive there.
Great Harwood -	The property on the bank of the river has only been affected by a flood once to our knowledge, caused by the excessive fall of rain in November 1866, and the bursting of a reservoir at the same time. The river is polluted both by solid and liquid refuse. Encroachments are prevented. The river is too far from the town for the health of the people to be affected by it.
Over-Darwen -	Not affected by floods. The river is polluted to a considerable extent by liquid refuse and town sewage, and also by slag, cinders, and ashes. Encroachments are not prevented. The condition of the river is not a source of discomfort.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	The village of Croston and country round is occasionally flooded. In the flood of November 1866 the iron bridge erected by the railway company held up the flood six inches. The river is in a very foul state; fluid refuse and sewage is discharged into it from the districts above Croston, and from the town of Chorley; it is not polluted by solid refuse. Encroachments are prevented. The condition of the river is certainly a source of discomfort, and we believe of ill-health.
Chorley -	The river is polluted by town sewage and solid refuse. Encroachments are not prevented. The condition of the river is not a source of ill-health.
Ormskirk - -	No river flowing through the town.
Wigan - - -	The property on the river banks not affected by floods; the river is polluted by town sewage and by all kinds of fluid and solid refuse, and to some extent by cinders and coal washing. Encroachments are not prevented. It is believed that the condition of the river and canals is not a source of ill-health and discomfort, though it is difficult to give an opinion.

Series No. 1, General.—Queries——18. Are there any cellar dwellings in the town; if so, how many?——19. Have the sewage works or other works of town improvement influenced the rate of mortality, and in what manner and degree?——20. State the rate of mortality per 1,000 in the town or Local Board district, each year from 1857 to 1867?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	There are a few cellar dwellings. Cannot give the rate of mortality, as at the last census the borough was not then separate from the rest of the district.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	There are several cellar dwellings. 1862 369 26 | 1865 346 25 1863 349 25 | 1866 288 22 1864 255 18 | 1867 276 20 Probably the rate of mortality has and will continue to diminish a little.
Denton - - -	No cellar dwellings. 1858 74 24 | 1863 87 24 1859 83 26 | 1864 91 23 1860 59 19 | 1865 99 24 1861 68 20 | 1866 115 26 1862 88 25 | 1867 98 21
Dukinfield - -	There are 12 cellar dwellings. 1857 25 | 1863 25 1858 29 | 1864 20 1859 22 | 1865 23 1860 24 | 1866 24 1861 26 | 1867 24 1862 25 N.B.—This rate of mortality is for the Township of Dukinfield and comprises the densely populated portion of the Borough of Stalybridge, the population of the Local Board District are more scattered, so that the death rate would be much lower. We have not any means of getting the death rate of the Local Board District.
Stalybridge -	Eighteen cellar dwellings have been closed under the 67th sect. of the 11 & 12 Vict. c. 63. There still remains 72 which do not fall within the provisions of that Act of Parliament. It is believed that the sewerage works have not in any appreciable degree influenced the rate of mortality. The average rate of mortality in the borough from the year 1857 to 1868 is about 20 per 1,000.
Ashton-under-Lyne	There are from 10 to 15 cellar dwellings. There is no separate return for the borough, but the following is believed to be substantially correct. 1858 33 | 1863 30 1859 33 | 1864 23 1860 27 | 1865 23 1861 31 | 1866 28 1862 29 | 1867 26 Within the borough are the Union Workhouse and the District Infirmary. The Ashton Union comprises a population of about 150,000, and the Infirmary District about the same number. The deaths in these two institutions are numerous, and of course raise the average mortality.
Hurst - - -	No means of ascertaining this information.
Mossley - -	No cellar dwellings. No means of ascertaining the rate of mortality.

MERSEY BASIN—(MERSEY PROPER).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Names of Cities, Boroughs, and Districts. | **ANSWERS TO QUERIES.**

LIVERPOOL - -

Watershed of the Mersey Proper.

The cellars of houses in front streets 13,921; of these there are 1,349 which are termed legal because permitted to be occupied as sleeping and living rooms. The cellars of houses in courts 8,000; none of these are legal. The sewers of the town were for some years after their construction only very partially used in the removal of refuse, and the midden system almost universally prevailed in the central and sickly districts up to within the last two years. The improvement in health under the operation of the structural alterations of the Sanitary Amendment Act, 1864, has been very considerable.—[M.O.]

Year.	Total Deaths.	Rate per 1,000 per Annum.	
1857	12,951	31·0	
1858	15,935	32·9	
1859	11,824	27·5	
1860	11,236	25·7	
1861	12,933	29·0	
1862	13,751	30·4	
1863	15,266	33·0	Cotton famine and epid. typhus.
1864	16,836	36·0	
1865	17,282	36·4	
1866	20,198	41·7	Cholera and typhus.
1867	14,513	29·4	
1868	—	29·1	

WATERLOO - WITH - SEAFORTH.

There are no cellar dwellings.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	56	18·33	1863	64	14·19
1858	52	16·54	1864	115	24·95
1859	52	15·00	1865	73	14·26
1860	51	13·84	1866	86	15·99
1861	52	13·75	1867	83	14·41
1862	58	13·67			

It has undoubtedly had a favourable influence on this rate, as may be seen by the above return of the mortality, and it has certainly contributed greatly to the comfort of the inhabitants.

GREAT CROSBY -

No cellar dwellings.

Year.	Total Deaths.	Year.	Total Deaths.
1864	49	1866	46
1865	46	1867	51

It is calculated that the population was 1,945 in 1864, and in 1867, 2,285. The above deaths include 10 bodies washed on shore.

LITHERLAND - -

No cellar dwellings. The sewerage works in this district have greatly improved the health of the inhabitants, but cannot say in what degree. No record has been kept by the Board, nor have they any means of ascertaining this.

BIRKDALE - -

The Answers to Queries have not been received from this Local Board of Health.

WEST DERBY - -

There are no longer any cellars occupied as separate dwellings, the Local Board having suppressed those that formerly existed. As the sewerage works are not yet completed it is too early to give an opinion.

Year.	Total Deaths.	Rate per 1,000 per Annum.
1866	508	20·0
1867	470	19·0
1868	—	18·1

WALTON - ON - THE HILL.

No cellar dwellings. The want of a system of sewerage the Board conceives to be the cause of the increased mortality.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	50	population not known.	1863	53	13
1858	72		1864	73	18
1859	57		1865	81	20¼
1860	62		1866	85	21
1861	56	16	1867*	155	31
1862	71	20	1868	—	29

* It should be explained that the West Derby Union Workhouse was first occupied in 1867 with a population of about 1,000, hence the increased rate of mortality.

MERSEY BASIN—(MERSEY PROPER).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Names of Cities, Boroughs, and Districts. | **ANSWERS TO QUERIES.**

TOXTETH PARK -

No cellar dwellings. The Board do not possess any statistics of the rate of mortality. There is reason to believe that the sewerage has greatly influenced the mortality, by the removal of open ditches and foul water courses, which were the only means of carrying off the drainage from houses previously to 1857.

WAVERTREE - -

Only *one* inhabited cellar. The sewerage works have improved the health of the township.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	68	—	1863	97	17
1858	82	—	1864	123	22
1859	99	—	1865	98	18
1860	85	—	1866	131	21
1861	98	18	1867	128	19
1862	98	18			

LITTLE WOOLTON -

No cellar dwellings. We have no statistics of the rate of mortality.

MUCH WOOLTON -

Ten cellar dwellings. There is no doubt that the high rate of mortality in this district has been caused from want of a proper system of sewerage.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	80	21·8	1863	76	21·2
1858	68	18·5	1864	117	32·6
1859	78	21·2	1865	117	32·6
1860	52	14·2	1866	97	27·1
1861	59	16·5	1867	87	24·3
1862	61	17·0			

GARSTON - -

No cellar dwellings. Part of the district has been for some years past in a state of transition from a rural to an urban character; most of the new houses being small. Great attention has been paid by the board to the sewerage works, but for which the rate of mortality would no doubt have been considerably greater.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1863	55	10·54	1866	130	18·84
1864	88	15·39	1867	113	15·06
1865	78	12·34			

WIDNES - - -

Twelve cellar dwellings. In 1867 the death-rate was 17 per thousand of the population.

SUTTON - - -

No cellar dwellings. There being no separate account kept of the rate of mortality it cannot be furnished.

PRESCOT - -

No cellar dwellings. Rate of mortality not known previous to adoption of Public Health Act in April 1867.

PARR - - - -

Have no return of the rate of mortality from 1857 to 1867; in 1868, 35 per 1,000.

ST. HELENS - -

Sixteen cellar dwellings. No mortality returns are furnished by Corporation.

NEWTON - IN - MACKERFIELD.

No cellar dwellings. Should say that the sewerage works have influenced the rate of mortality, but do not know to what degree.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	105	19·20	1863	124	20·12
1858	99	18·06	1864	169	27·00
1859	123	21·40	1865	143	22·26
1860	125	21·34	1866	164	25·15
1861	116	19·38	1867	120	18·08
1862	145	24·07			

WARRINGTON -

Very few cellar dwellings. No official record has been kept of the rate of mortality in the borough. The death-rate has been calculated from the best information we have.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1857	24·26	1863	24·49
1858	29·60	1864	43·61*
1859	23·82	1865	26·24
1860	24·51	1866	29·38
1861	24·02	1867	26·00
1862	25·23	1868	26·00 to present time.

* Deaths of children under 10 years amount to 31 per 1,000.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Pennington - -	There are six cellar dwellings in the town. It is believed the sewage works have lessened the death-rate in the locality. Year. Total Deaths. | Year. Total Deaths. 1857 113 | 1863 135 1858 104 | 1864 145 1859 160 | 1865 133 1860 121 | 1866 133 1861 116 | 1867 136 1862 140
Westleigh - -	No cellar dwellings. Year. Total Deaths. | Year. Total Deaths. 1857 78 | 1863 114 1858 72 | 1864 139 1859 97 | 1865 116 1860 108 | 1866 129 1861 118 | 1867 122 1862 103
Hindley - -	From 15 to 20 cellar dwellings. Not answered.
Atherton - -	There are no cellar dwellings. Year. Total Deaths. Rate per 1,000 per Annum. | Year. Total Deaths. Rate per 1,000 per Annum. 1857 172 32 | 1863 183 33 1858 196 28 | 1864 234 27 1859 194 29 | 1865 214 30 1860 187 31 | 1866 206 32 1861 167 35 | 1867 205 33 1862 185 32
Tyldesley - with Shakerley.	Forty-one cellar dwellings. Yes, we believe the sewering and other works of town improvement have influenced the death-rate to the full amount stated. Year. Total Deaths. Rate per 1,000 per Annum. | Year. Total Deaths. Rate per 1,000 per Annum. 1857 142 25 | 1863 156 25 1858 159 28 | 1864 239 38 1859 182 31 | 1865 133 21 1860 119 20 | 1866 152 23 1861 160 26 | 1867 134 20 1862 191 31
Rusholme - -	There are nine cellar dwellings. The Board cannot give the rate of mortality.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	About 1,000 cellar dwellings. Rate of mortality not known. The three quarters ending 30 September 1868 show 32 per 1,000 per annum. Previously no accounts taken.
Bredbury - -	Two cellar dwellings. The rate of mortality very little, if any, influenced by the sewerage works. Year. Total Deaths. Rate per 1,000 per Annum. | Year. Total Deaths. Rate per 1,000 per Annum. 1857 58 18·00 | 1863 79 23·00 1858 86 26·75 | 1864 53 15·50 1859 86 26·00 | 1865 77 22·67 1860 74 22·50 | 1866 98 28·00 1861 59 17·33 | 1867 54 15·50 1862 56 16.50
Wallasey - -	Six cellar dwellings. This cannot be obtained from any records of the Board.
Birkenhead - -	There are cellar dwellings, but the number is inconsiderable, and these are required to be in accordance with the provisions of the Local Act 6 Vict. c. 13. Year. Rate per 1,000 per Annum. | Year. Rate per 1,000 per Annnm. 1864 24·39 | 1866 22·44 1865 21·37 | 1867 20·84

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Birkenhead—*cont.*	These returns are from the medical officer's report. The medical officer was appointed February 1864. Sanitary measures have influenced the death-rate.
Oxton - - -	No cellar dwellings. Year. Total Deaths. | Year. Total Deaths. 1860 27 | 1864 40 1861 34 | 1865 49 1862 33 | 1866 60 1863 43 | 1867 33 148, under 11 years; 139, 11 years and under 70; 32, 70 years and upwards.
Tranmere - -	Three cellar dwellings. A plentiful supply of good water, and the sewerage and other works of town improvement have made the district more healthy; there is no other cause to which the reduced death rate can be attributed. Year. Rate per 1,000 per Annum. | Year. Rate per 1,000 per Annum. 1863 19·81 | 1866 19·52 1864 20·77 | 1867 18·04 1865 18·37 | 1868 16·00
Higher Bebington	There are 30 to 40 cellar dwellings. It is believed that the sewerage works have conduced to the health of the district, because, before they were constructed there was a great prejudice against the neighbourhood, but since the completion, the number of houses built and inhabited has steadily increased. No township record of the rate of mortality is kept.
Runcorn - -	No cellar dwellings.
Lymm - - -	No cellar dwellings. Year. Total Deaths. Rate per 1,000 per Annum. | Year. Total Deaths. Rate per 1,000 per Annum. 1857 53 14 | 1863 116 28 1858 64 17 | 1864 86 26 1859 80 21 | 1865 95 22 1860 78 20 | 1866 82 20 nearly. 1861 80 20 | 1867 83 19 nearly. 1862 63 16 nearly. Sewerage works have as yet only been carried out on a limited scale.
Altrincham - -	There are 16 cellar dwellings; no statistics of the rate of mortality.
Sale - - -	No cellar dwellings. Year. Total Deaths. Rate per 1,000 per Annum. | Year. Total Deaths. Rate per 1,000 per Annum. 1857 51 20·3 | 1863 73 21·0 1858 55 20·5 | 1864 67 18·1 1859 58 20·9 | 1865 71 18·0 1860 46 15·8 | 1866 87 20·9 1861 39 12·5 | 1867 73 16·6 1862 50 15·3

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, & Monton.	There are six cellar dwellings in this district. Probably the sewerage works have not influenced the rate of mortality. Cannot give the mortality.
Stretford - -	There are 25 cellar dwellings. Unable to give the rate of mortality.
Moss Side - -	Not able to give the rate of mortality. No cellar dwellings.
Salford - -	There are 746 cellar dwellings. We believe the sewage and other works have acted beneficially in reducing the rate of mortality, but cannot say to what extent.

Rate per 1,000 per annum.

District.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.
Salford -	24·55	26·76	28·89	29·41	28·74	32·78	33·28	32·32	34·34
Pendleton -	20·86	22·22	20·92	24·12	22·09	22·57	21·78	21·55	25·69
Broughton -	12·74	14·72	16·51	17·24	16·20	15·26	14·03	16·27	17·73
Mean average for the Borough -	22·81	24·68	26·06	27·16	26·18	28·59	28·54	28·03	30·53

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Manchester

About 2,658 cellars, which are used as dwellings by 9,548 of the poorer classes. There can be no doubt that the effective sewering of all houses and streets throughout the city, as well as the many new streets and openings, and other improvements which have from time to time been carried out, must have had a beneficial influence, although the healthiness of the city, if judged *only* by the published tables of mortality, does not appear, during the last ten years, to have been much, if at all, increased.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1857	31·7	1862	30·3
1858	32·5	1863	32·6
1859	29·1	1864	30·6
1860	28·0	1865	35·5
1861	30·4	1866	34·6

In 1863 there was an excessive mortality from zymotic diseases, particularly small-pox and scarlet fever. In 1865 diarrhœa and fever were very fatal. In 1866 the mortality was raised by an invasion of cholera. The high death-rate in Manchester is largely due to the excessive mortality in the infant population, nearly one-half of all the deaths occurring in children under the age of five years. A large proportion of the children die within the first year, from want of the care which is necessary in the earliest months of their existence. In the years 1851–60 the total number of deaths in Manchester and Chorlton, from all causes and at all ages, was 74,359; the total under five years, 35,963; the total under one year, 19,725, or rather more than one-half the whole infant mortality, and more than a fourth of the mortality of all ages. The out-door occupations of the mothers, and their employment in mills and factories of various kinds, lead them, in very numerous cases, to leave their infants before they have acquired sufficient vitality, sufficient power to live when deprived of their natural nourishment and the warmth of the parent's body. Many of the women in Manchester resume their employments within a week or ten days after their confinement; and their infants are consigned to the care of young children or of old women. They are improperly fed, and often drugged with opiates to keep them quiet, and the natural consequence is that all but the very strong die of convulsion or wasting. The mortality at all ages is, however, abnormally great. Consumption and diseases of the lungs generally—especially bronchitis—are relatively to the population more fatal than in almost any other locality in England. This is probably due, to a considerable extent, to the constant irritation produced in the air passages by the dense smoke with which the atmosphere is constantly loaded. Zymotic diseases, including autumnal diarrhœa, also largely swell the death-rate. The statement as to the death-rate of certain of the principal cities and towns in the kingdom, which is every week published by the Registrar-General, is, for the purpose of comparison, valuable, to the extent that the conditions which conduce to a high or a low rate of mortality are in each place similar. There is one important condition which is probably peculiar to Manchester, and which must always tend to place its return in unfavourable contrast with most of the other large towns. The district from which the returns are computed for the city of Manchester is of course limited to the townships of Manchester, Chorlton-upon-Medlock, Hulme, Ardwick, and Cheetham. With the exception of Chorlton-upon-Medlock and Cheetham, all such townships are densely populated, and by persons residing to a large extent in small tenements, and consisting mainly of the working classes. In Chorlton-upon-Medlock and Cheetham (the population of which townships has been already stated) there is found, as in most towns, a mixed population of the poor, the middle class, and the comparatively wealthy, and, as ascertained by the returns for the first three-quarters of the year 1868, the rate of mortality in Chorlton-upon-Medlock was only 18·6 in 1,000, and only 16 in 1,000 in Cheetham. In the other townships within the city there is also an almost entire absence of such a suburban population as usually exists in large towns, and which tends, as in the case of Chorlton-upon-Medlock and Cheetham, to reduce the death-rate. For the purpose of accurate comparison the area in Manchester, from which the returns are computed, should be extended so as to include many of the adjoining suburban townships, which are in reality only suburbs of the city, and in which many who were formerly a portion of the city population now reside.

Prestwich

Probably 10 or 12 cellar dwellings.

Year.	Total Deaths.	Year.	Total Deaths.
1858	177	1863	194
1859	170	1864	245
1860	191	1865	237
1861	183	1866	280
1862	157	1867	240

Swinton

Forty cellar dwellings. Unable to furnish the rate of mortality.

Kearsley

Fourteen cellar dwellings; only six occupied. Cannot obtain the rate of mortality.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Farnworth

Six cellar dwellings. It is generally believed that the town improvements have had a beneficial effect upon the health of the inhabitants. The Local Board does not possess information as to the rate of mortality.

Bolton

Prior to the Public Health Act, 1848, being adopted there were 2,049 cellar dwellings in the town, but by the operation of that Act the number is now reduced to 383. There is no doubt that but for the sewerage and other works of improvement executed in the borough the mortality would have much exceeded the following rates.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1858	27·90	1864	29·10
1859	29·50	1865	28·50
1860	30·60	1866	30·00
1861	31·60	1867	29·00
1862	25·70	1868	24·88
1863	27·40		

Astley Bridge

No cellar dwellings. The Local Board is not in possession of information required to fully answer the question as to rate of mortality from 1857 to 1867. For the five years ending 30th September 1867, the total number of deaths in the Astley Bridge District was 440; average, 88. Not aware that the sewerage works have had any influence on the rate of mortality.

Halliwell

No cellar dwellings.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	139	23·6	1862	117	19·5
1858	102	17·0	1863	175	29·4
1859	122	20·3	1864	171	28·5
1860	149	25·0	1865	163	27·4
1861	123	20·5	1866	159	26·5

Radcliffe

About 50 cellar dwellings. Cannot give the rate of mortality.

Whitefield

There are 13 cellar dwellings.

Bury

There are 32 cellar dwellings in the borough.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1862	30·17	1866	26·38
1863	23·78	1867	24·80
1864	24·26	1868	25·30
1865	24·56		

Ramsbottom

There are a very few real cellar dwellings. There are some dwellings in addition under others, but on the level of one street on one side although below the level of the other. Rate of mortality not known. There is no separate Registrar for the district.

Bacup

About 50 cellar dwellings. We have no statistics of the mortality.

Heywood

There are 30 cellar dwellings. Cannot give the rate of mortality.

Rochdale

There are about 480 cellar dwellings.

Year.	Total Deaths.	Year.	Total Deaths.
1857	23·5	1863	23·6
1858	24·3	1864	25·4
1859	26·5	1865	29·2
1860	24·2	1866	24·0
1861	25·5	1867	24·4
1862	22·3	1868	24·8

Average for the 11 years - - 24·8.

Crumpsall

The Answers to Queries have not been received from this Local Board of Health.

Newton Heath

Nineteen cellar dwellings. The district of the Local Board of Health not being coterminous with the Registrar's district it is difficult to obtain the information required.

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Failsworth

No cellar dwellings.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1861	98	18·8	1864	93	17·17
1862	91	17·25	1865	91	16·56
1863	78	14·6			

Bedford, near Manchester.

Not any cellar dwellings.

Year.	Total Deaths.		Year.	Total Deaths.	
1859	173	About 38·5 per 100.	1864	179	About 38·5 per 100.
1860	176		1865	131	
1861	187		1866	154	
1862	165		1867	166	
1863	215		1868	158	

Bradford

There are no cellar dwellings. Rate of mortality, average about 23 in the 1,000.

Openshaw

There are 12 cellar dwellings in premises fronting Ardwick, but none within the township. The sewerage works have not perceptibly influenced the rate of mortality.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	119	15·1	1863	219	23·5
1858	141	17·8	1864	247	25·1
1859	208	26·0	1865	206	20·2
1860	196	24·3	1866	214	20·8
1861	171	20·6	1867	231	21·6
1862	155	18·0			

Gorton

No cellar dwellings.

Droylsden

There are 15 cellar dwellings. Sewerage works do not seem to have influenced the rate of mortality.

Year.	Total Deaths.	Rate per 1,000 per Annum, about	Year.	Total Deaths.	Rate per 1,000 per Annum, about
1858	131	19·5	1863	150	21·1
1859	153	22·5	1864	151	21·1
1860	129	18·5	1865	148	20·5
1861	153	22·0	1866	151	20·5
1862	174	24·75	1867	174	24·0

Oldham

There are 531 cellar dwellings, of which 441 occupied.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1857	27·83	1861	27·01	1865	29·57
1858	28·06	1862	27·81	1866	29·70
1859	23·89	1863	30·88	1867	25·11
1860	25·41	1864	21·57		

Crompton

Not more than six cellar dwellings in the entire district. The sewage works are so small and lately laid down that the Board cannot say that they have affected the death-rate.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	173	25·45	1863	134	18·44
1858	181	26·58	1864	161	22·84
1859	185	26·67	1865	177	23·72
1860	154	22·13	1866	148	19·58
1861	165	23·32	1867	130	17·80
1862	152	21·24			

Royton

About 20 cellar dwellings.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	159	22·64	1863	211	28·17
1858	174	24·94	1864	151	20·16
1859	189	27·10	1865	163	23·32
1860	123	17·63	1866	186	26·94
1861	209	27·90	1867	200	27·24
1862	245	32·71			

Lees

A few cellar dwellings. There are no means of ascertaining the number of deaths exclusively in the district, the Registrar's district extending over a much larger area. Average rate per 1,000 for the whole of Registrar's district for the years 1865, 1866, 1867, 25½. The mortality in 1866 was 33 per 1,000, owing to the prevalence of several epidemic diseases.

Mersey Basin—(River Bollin).

Series No. 1, General—Answers to Queries 18 to 20, page 31—*continued.*

Watershed of the Bollin, Tributary of the Mersey.

Chorley

The Answers to Queries have not been received from this Local Board of Health.

Macclesfield

There are 28 cellar dwellings, but only three are occupied. The sewerage works have reduced the rate of mortality from 33 per thousand.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	757	28	1863	716	26
1858	809	30	1864	617	23
1859	775	29	1865	732	27
1860	765	28	1866	803	30
1861	723	27	1867	663	24
1862	744	27	1868	—	27

Bollington

There are no cellar dwellings.

Year	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	84	21·00	1863	63	15·75
1858	84	21·00	1864	74	18·50
1859	84	24·00	1865	79	19·75
1860	66	16·50	1866	68	17·00
1861	113	28·25	1867	68	17·00
1862	107	26·75			

Watershed of the Weaver, Tributary of the Mersey.

Northwich

There are no cellar dwellings. We cannot furnish any more information as to the rate of mortality, we could only get the information by incurring a considerable expense in searching at the Registrar's office. Many children have died from scarlatina.

Year.	Total Deaths.	Rate per 1,000 per Annum.
1867	25	21

Witton-cum-Twambrookes.

No cellar dwellings. Have no means of ascertaining the rate of mortality.

Sandbach

No cellar dwellings. No returns of the rate of mortality have been furnished to the Local Board. Doubtless the improvements made in the drainage of the town and the exertions of the nuisance inspector have been attended with some good effects; but no system of inspection can be of much avail until Local Boards are *compelled* by law not only to seek out nuisances and report on them, and give notice for their removal or abatement, but to *remove* or abate them by their own servants.

Monks Coppenhall

No cellar dwellings. No returns of the rate of mortality. It is generally considered that the sewerage works and good supply of water are beneficial.

Tarporley

No cellar dwellings. Rate of mortality not known.

Nantwich

No cellar dwellings. The mortality from epidemics has diminished, and the general health of the town improved, but cannot state the degree.

Year.	Total Deaths.	Year.	Total Deaths.
1857	116	1863	119
1858	120	1864	154
1859	138	1865	147
1860	148	1866	138
1861	142	1867	142
1862	95		

Congleton

The Answers to Queries have not been received from this borough.

RIBBLE BASIN.

Watershed of the Ribble Proper.

Southport

No cellar dwellings. The area of the town having been increased by the *Southport Improvement Act*, 1865, consequently there are no means of ascertaining the correct rate upon the present boundary, but the average death-rate for 1867 in the whole district, including the borough of Southport and the township of Meols, was 18·5 per thousand.

Kirkham

The Answers to Queries have not been received from this Local Board of Health.

Fulwood

No cellar dwellings.

Ribble Basin—(Ribble Proper).

Series No. 1, General.—Answers to Queries 18 to 20, page 31—*continued.*

Preston

There are few cellar dwellings in the town, and none are occupied except in conformity with the Public Health Act, 1848, sect. 67. The sewage works are considered to have had much influence in reducing the rate of mortality of the borough, although from the following figures it is not exactly perceived. It has, however, been ascertained that the mortality in certain districts of the town has been materially decreased after drainage, and there has been a marked difference between the mortality in undrained and drained districts. The probability is that as the town increased in size, and districts became more densely populated, the death rate would have increased but for sanitary regulations and improved drainage.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1857	27·39	1863	25·25
1858	32·13	1864	28·68
1859	26·19	1865	31·48
1860	27·27	1866	32·00
1861	31·00	1867	28·61
1862	28·43		

Leyland

No record kept of the rate of mortality.

Clitheroe

Only some three or four cellar dwellings used. Average rate of mortality about 22 per 1,000 for last three years. Not the means of giving all the particulars.

Watershed of the Calder, Tributary of the Ribble.

Clayton-le-Moors

Four cellar dwellings only. The sewerage works, street paving, house drainage, and water supply have had a beneficial effect on the sanitary condition of the town in reducing the rate of deaths.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	116	26	1863	106	19
1858	107	24	1864	100	19
1859	98	21	1865	165	32
1860	102	22	1866	117	22
1861	105	20	1867	97	18
1862	116	24			

Oswaldtwistle

There are 5 or 6 cellar dwellings.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	177	18	1863	185	20
1858	193	21	1864	228	23
1859	209	23	1865	260	25
1860	206	22	1866	264	24
1861	200	22	1867	210	17
1862	180	19			

The drainage has been of great benefit, principally in lessening the amount of sickness, also in diminishing the death-rate which now that we have a plentiful supply of good water will be further lessened. The high rate of mortality in 1865 and 1866 was owing to an epidemic of scarlet fever and other causes not dependent on avoidable influences.

Accrington

There are very few cellar dwellings in the town. The rate of mortality, since the sewerage works were completed, has decreased.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1858	29	1863	20
1859	40	1864	22
1860	36	1865	31
1861	36	1866	26
1862	37	1867	26

Burnley

There are 117 cellar dwellings. The sewerage works and other improvements by requiring all new houses to have proper yards, ashpits, and privies, have unquestionably reduced the rate of mortality. The rate of mortality is as follows:—

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	1026	24·02	1863	953	22·34
1858	914	21·40	1864	1055	24·70
1859	1076	25·17	1865	1404	32·85
1860	951	22·27	1866	1284	30·00
1861	1158	27·11	1867	1063	24·89
1862	980	22·94	1868	1281	29·99

Brierfield

There are 30 cellar dwellings. The information as to rate of mortality cannot be furnished, there not being any records.

Nelson

There are 19 cellar dwellings. No record of the rate of mortality kept.

Ribble Basin—(River Darwen).

Series No. 1, General.—Answers to Queries 18 to 20.—Page 31—*continued.*

Watershed of the Darwen, Tributary of the Ribble.

Blackburn

There are 240 cellar dwellings.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1857	27·93	1863	20·83
1858	26·56	1864	22·84
1859	25·38	1865	26·47
1860	24·22	1866	29·34
1861	27·26	1867	25·37
1862	26·56		

Great Harwood

There are six cellar dwellings. Cannot get the particulars of rate of mortality, as the Registrar has only books for the last three years.

Over-Darwen

There are 25 cellar dwellings. The sewerage works are not yet complete, but there is no doubt that great benefit has resulted from this and other town improvements.

Watershed of the Douglas, Tributary of the Ribble.

Croston

No cellar dwellings. The suppression of nuisances has had a beneficial influence.

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	43	28·6	1862	46	25·6
1858	22	14·6	1864	47	26·2
1859	37	24·6	1865	40	22·2
1860	27	18·0	1866	29	16·2
1861	33	18·4	1867	28	15·6
1862	41	22·9			

Chorley

There are 128 cellar dwellings. The sewerage works and other improvements have reduced the deaths from 30 to 23 per 1,000.

Year.	Rate per 1,000 per Annum.	Year.	Rate per 1,000 per Annum.
1858	30·4	1863	19·8
1859	21·1	1864	20·0
1860	26·4	1865	21·7
1861	24·4	1866	29·0
1862	26·0	1867	26·1

Ormskirk

There are no cellar dwellings; the other queries not answered.

Wigan

There are no cellars occupied as separate dwellings. The following is the rate of mortality:—

Year.	Total Deaths.	Rate per 1,000 per Annum.	Year.	Total Deaths.	Rate per 1,000 per Annum.
1857	1136	—	1863	1146	29·79
1858	1246	—	1864	1050	27·00
1859	1126	—	1865	1139	28·98
1860	1053	—	1866	1328	33·70
1861	1266	33·40	1867	1739	43·36
1862	1118	29·34			

Increase in population since 1861, births over deaths, 3,757.

Series No. 1, General.—Queries——21. Are there any districts of the town especially unhealthy; if so, to what cause is this attributed?——22. Are any liable to be flooded occasionally?——23. How is the flooding caused?

Mersey Basin.

Watershed of the Etherow, Tributary of the Mersey.

Hollingsworth

Glossop

The Answers to Queries have not been received from this Local Board of Health.

There are some districts in which it is not quite so pleasant to live, and not on a dry soil, but they are very seldom flooded.

Watershed of the Goyt, Tributary of the Mersey.

Yeardsley-cum-Whaley.

No parts especially unhealthy.

Mersey Basin—(River Tame).

Series No. 1, General.—Answers to Queries 21 to 23.—Page 41—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Tame, Tributary of the Mersey.
Hyde	There are not any districts particularly unhealthy.
Denton	No districts especially unhealthy.
Dukinfield	No districts especially unhealthy.
Stalybridge	No districts especially unhealthy.
Ashton-under-Lyne	Not any parts especially unhealthy now; cause removed by sewerage works.
Hurst	Not answered.
Mossley	There are districts especially unhealthy from bad drainage.
	Watershed of the Mersey Proper.
Liverpool	The chief and most fatal fever district of the town was that enclosed by Great Crosshall, Standish, Marybone, Milton, and Byrom Streets, 1·2 per cent. of the whole population of this district died from fever in 1865. It was to this district that the sanitary improvements of the health committee were firstly directed, and water-closets substituted for privies. It is satisfactory to know that the improvement in health has been very manifest. Thus in the present week (ending October 10, 1868) the deaths from fever in the borough were 53, of these 22 were in the out townships or near those rural districts which are still unsewered; while neither during this week nor for the last month has there been a fatal case of fever in the old fever district. [M.O.]
Waterloo-with-Seaforth and Great Crosby.	No districts especially unhealthy.
Litherland	There are not any districts especially unhealthy, and none liable to be flooded.
Birkdale	The Answers to Queries have not been received from this Local Board of Health.
West Derby	No parts especially unhealthy.
Walton-on-the-Hill.	There are no districts especially unhealthy, but some liable to floods from the incapacity of the brook to take the flood waters.
Toxteth Park	No part of the district especially unhealthy.
Wavertree	No districts especially unhealthy.
Little Woolton	No districts especially unhealthy.
Much Woolton	No districts especially unhealthy.
Garston	No parts especially unhealthy.
Widnes	Part of the district was liable to floods; this is now prevented by means of embankments and by grids fixed at the outlets of the sewers; the flooding was caused by high tides in the river *Mersey*.
Sutton	There are no districts specially unhealthy; a very small portion is liable to be flooded, where there is very little population.
Prescot	None specially unhealthy or liable to be flooded.
Parr	There are districts especially unhealthy, and caused no doubt through inefficient drainage and smells from the river or brook.
St. Helens	No district within the borough where wholly or even partially built upon can be called especially unhealthy, and even in the vicinity of the *brook*, greatly polluted as it is, it is generally believed that the power of mischief which might arise from the putrefaction of animal matters or other organic refuse from sewers is powerfully and beneficially arrested by the discharge from alkali works of sulphuric matters, which act as powerful disinfectants.
Newton-in-Mackerfield.	Not any parts especially unhealthy, generally speaking, though fever and cholera have on one or two occasions visited the undrained localities.
Warrington	That part of the borough in Cheshire is the most unhealthy, there is no systematic drainage, and the land is low and liable to be flooded.
Pennington	The neighbourhood of Landside is liable to be flooded by *Pennington Brook*, and is unhealthy; it is a rural district, and but thinly populated, and does not materially affect the death rate.
Westleigh	No parts especially unhealthy.
Hindley	Not answered.
Atherton	There are no districts of the town especially unhealthy.
Tyldesley-with-Shakerley.	No parts especially unhealthy.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 21 to 23.—Page 41—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Rusholme	No districts especially unhealthy.
Levenshulme	The Answers to Queries have not been received from this Local Board of Health.
Stockport	There are districts especially unhealthy: causes, defective drainage, overcrowding of dwellings, and in one part of the town a polluted stream from sewage and accumulated filth. None liable to floods; the course of the river is too rapid.
Bredbury	No parts especially unhealthy.
Wallasey	No districts especially unhealthy.
Birkenhead	No districts especially unhealthy. A few cellars or basements in the low level districts are sometimes flooded on occasions of unusually heavy rainfall at high water of spring tides; this flooding is caused by the accumulation or damming up of the upland waters in the lower part of the outlet sewers during the time that the flaps to the outlets are closed by the tide.
Oxton	No districts especially unhealthy, and none liable to be flooded.
Tranmere	There is no part of the district especially unhealthy.
Higher Bebington	The district is especially unhealthy; about two years ago there was in the village of Higher Bebington (which stands on high ground, between two and three miles from the river) an unusual amount of sickness, mainly caused, it was thought, by deficient water supply in a dry season, a defect which has since been remedied.
Runcorn	Only a very few houses are liable to be flooded by an exceptionably high tide.
Lymm	No districts especially unhealthy or liable to be flooded.
Altrincham	Not answered.
Sale	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton.	This is considered to be a very healthy district.
Stretford	Not answered.
Moss Side	No parts especially unhealthy.
Salford	There are districts especially unhealthy. [Those calling for special attention are: Back Hampson Street, Birtle Square and courts, Canal Street, Cook Street, Garden Street and courts, Queen Street and courts, Springfield Lane, and Wood Street; the mortality of Cook Street ranges from 41·47 to 62·80, averages for seven years of near 50, or 5 per cent. of a death-rate. This I attribute to a variety of causes. First, one great evil is overcrowding; many of the dwellings are old and somewhat dilapidated buildings of three storeys high, with in several cases, cellar dwellings, the upper rooms being sub-let to fustian cutters, who carry on their occupation in the garrets, and the lower rooms and cellars occupied chiefly by hawkers and itinerant vendors of various commodities. Cleanliness in their persons and habitations is with them a matter of small moment, the back yards and other appurtenances being used in common are always in a filthy and objectionable condition. Again, the street is thoroughly enclosed on both sides by works, so that anything like adequate ventilation is entirely out of the question, the only ventilation being from above. The main sewer is formed or constructed of metallic tubes; this we believe carries off refuse water from some part of the adjoining gasworks, and the street grids being all trapped, the sewer is always charged with gaseous emanations, which, being forced up the side or branch drains permeates the cellars and lower portions of the dwellings, and has given rise to general and repeated complaints; even small stench trap grids in the cellar areas are not proof against the emission of these foul and unwholesome emanations. Further, the cellar dwellings are most, if not all of them, objectionable and unfit for human habitation; some of them if situate in open localities where sanitary improvements are not so urgently called for, might perhaps be passed over for a time, but in a place where a breath of pure air seldom or ever reaches they should not be tolerated. Upon this subject there is one point that must not be overlooked, past experience has proved that an evil is created from the closing of cellar dwellings without arrangements being made with the owners to connect them with the houses and fill up the areas, otherwise they become places of deposit for all kinds of refuse and filth. With regard to the other seven streets, &c. I have specially mentioned, I suspect the death-rate is to some extent influenced by overcrowding, but principally to the domestic habits and condition of the people. The streets are all well sewered and paved. In Queen Street district and Birtles Square, however, there are many very confined courts (*cul de sacs*), where ventilation is as defective as possible.—M.O.] In some parts new houses have been very hastily built, and either not drained at all or else very imperfectly; in others, the houses are very old and crowded together. There are some districts liable to be flooded by the river backing up the contents of the sewers.
Manchester	The Deansgate, St. George's, and St. Michael's, or Rochdale Road, districts are the most unhealthy, and the state of such districts arises, no doubt to a considerable

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 21 to 23.—Page 41—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester—*cont.*	extent, from the nature and character of the population, and from their filthy and dissolute habits, and also from the overcrowding of their dwellings. St. George's district is occupied almost exclusively by an Irish population; the houses are much overcrowded, and generally in a very dirty condition. Deansgate district is largely occupied by the criminal and vicious classes.
Prestwich - -	Not any districts especially unhealthy.
Swinton - -	Unhealthiness is attributable to imperfect drainage and bad water, but more particularly the latter.
Kearsley - -	No parts especially unhealthy.
Farnworth - -	No districts especially unhealthy.
Bolton - - -	There is no portion of the town specially unhealthy, except in the immediate vicinity of the river weirs.
Astley Bridge -	No districts especially unhealthy or liable to be flooded.
Halliwell - -	No portion of the district is especially unhealthy.
Radcliffe - -	No part unhealthy.
Whitefield - -	No part especially unhealthy.
Bury - - -	The courts and back streets, inhabited by the very lowest classes, are more unhealthy than the better streets; but this arises from the habits of the people, and their horror of ventilation and open windows; they are not liable to be flooded.
Ramsbottom - -	No parts of district especially unhealthy.
Bacup - - -	Portion of the town not yet sewered through which the river *Irwell* flows is especially unhealthy Small pox is prevalent there at present, and may be ascribed to bad drainage, and in a small degree to the state of the river.
Heywood - -	Hooley bridge is in close proximity to the river; it is a very small portion of the district, is especially unhealthy, and is yet undrained.
Rochdale - -	In some parts inhabited by a low class it may be, to a certain extent, unhealthy, arising mainly from the unclean habits of the residents. There is no flooding.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	No part of the district is especially unhealthy and none liable to be flooded.
Failsworth - -	Certain districts are unhealthy, but not remarkably so.
Bedford, near Manchester.	No districts particularly unhealthy, and no district liable to be flooded.
Bradford - -	No districts especially unhealthy, and no district affected by floods.
Openshaw - -	There are not any districts especially unhealthy, and none liable to floods.
Gorton - - -	Hitherto there has been so little cause for complaint of the state of the streams that the subject has not been discussed.
Droylsden - -	No districts especially unhealthy.
Oldham - -	There are districts especially unhealthy; the causes are, overcrowding, ignorance of and repugnance to the ordinary laws of health, cleanliness, and moderation. No districts liable to be flooded.
Crompton - -	There are districts to some extent on and near to the banks of the river especially unhealthy, caused by the insufficient drainage, and also parts liable to be flooded by the bed of the river being raised by silt and refuse matter.
Royton - - -	No parts especially unhealthy.
Lees - - -	No districts especially unhealthy.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	The districts yet undrained and unsewered are especially unhealthy. There is not any flooding. These questions were also submitted to three of the chief medical practitioners of Macclesfield, and their replies are as follows:— (*Mr. Birchenall.*) As a rule the lower parts of the town adjacent to the river have been in former years the most unhealthy. A system of drainage by which all offensive and noxious matter might become utilized has always appeared to me the most plausible. It is in some quarters of the town. I am not aware of any marked difference as attributable to this cause. (*Mr. Bland.*) The districts yet undrained and sewered. By intercepting sewers to carry off the ordure, urine, and other animal and vegetable products, which after collection should be daily distributed over the land. Of late years the offensive state of the river has been much altered for the better, but it is yet capable of further improvement. The refuse from dyers, chemical works, and the material from any factory or offensive trade should be prevented from fouling the river, and persons should be subject to a penalty for such pollution. The overflowing or cleansing of privies and middens is at all times a nuisance, often inducing derangement of the

Mersey Basin—(River Bollin).

Series No. 1, General.—Answers to Queries 21 to 23.—Page 41—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Macclesfield—*cont.*	stomach and bowls, diarrhœa, dysentery, and English cholera. A pure water supply has always been deemed a most important element to the sanitary condition of the inhabitants of any village or town. In Macclesfield we have a constant supply, with occasional exceptions, of water with only 4½ grains of impurity in the gallon, and there can be no question of its salutary effects on the health of the inhabitants. (*Mr. Firth.*) The districts coming more directly under my own observation especially unhealthy are, Pool Street, Garden Court Square, Water Cotes, Lunt Hill, Snow Hill, Mill Lane, Cross Street, and Duke Street, and the cause appears to have been bad drainage, bad ventilation, and the contiguity of many of these places to the river. There appears to me but one remedy for the prevention of pollution, and that is drainage into a closed main sewer, the sewers to be free from grids and the surface water drainage to be separate and distinct from the sewage. The cleansing of the privies, middens, and ash-pits as at present practised is a nuisance affecting the health and comfort of the inhabitants, and these places generally are imperfectly drained. I know of no greater physical boon that has been conferred on the inhabitants of Macclesfield than that of the improved water supply.
Bollington - -	The district is generally healthy, and has improved since the adoption of the Local Government Act.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	No parts especially unhealthy.
Witton-cum-Twan-brookes.	No districts liable to be flooded.
Sandbach - -	No districts especially unhealthy or affected by floods.
Monks Coppenhall	With the exceptions of a few blocks of houses where drains are deficient, or where the same are not connected with the outfall sewers, no part of the town is specially unhealthy. The principal cause of disease is attributed to the dampness of the sub-soil, which is strong clay many yards in thickness, the house floors being laid upon the clay, and the street surfaces not being macadamised or paved.
Tarporley - -	No districts especially unhealthy or affected by floods.
Nantwich - -	No districts especially unhealthy.
Congleton - -	The Answers to Queries have not been received from this borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	Not answered.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	No districts especially unhealthy.
Preston - -	There are districts of the older parts of the town especially unhealthy. The spaces about the houses are not sufficient for proper ventilation, and the habits of the people are very irregular. A small portion of the town situate near the river is liable to be flooded.
Leyland - -	No districts especially unhealthy; the other queries not answered.
Clitheroe - -	Some of the lower parts of the town where the poorer classes reside are especially unhealthy. Some parts are flooded from the uprising and overflowing of the *Wilkin* or *Shaw Brook*.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	There are no districts especially unhealthy and none liable to be flooded.
Oswaldtwistle -	No parts of the district especially unhealthy.
Accrington - -	No districts especially unhealthy.
Burnley - -	No districts especially unhealthy.
Brierfield - -	No districts especially unhealthy or liable to floods.
Nelson - - -	No district especially unhealthy, and only on one occasion was the districts affected by flood, viz., in November 1866, caused by the rapid rise of the upper part of the *Walverden* stream, which is close to the hills.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	When properly drained there will not be any districts especially unhealthy; but at present these are liable to be flooded by a large volume of water in wet seasons, having to flow through a limited width and depth of channel.

Mersey Basin—(River Darwen).

Series No. 1. General.—Answers to Queries 21 and 23.—Page 41—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Great Harwood -	There are not any districts especially unhealthy at present, as every part of the town has been well sewered; some few houses are affected by floods.
Over Darwen -	No districts especially unhealthy, and none liable to be flooded.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	One district has been more unhealthy than the rest, but the board has taken steps for filling up a ditch, which they believe has been the cause of the unhealthiness. There are districts liable to be flooded.
Chorley - -	There are districts especially unhealthy, caused by want of drainage and a supply of water from waterworks. These parts are liable to be flooded.
Ormskirk - -	There are no districts liable to be flooded; the other queries not answered.
Wigan - - -	The districts occupied by the Irish are especially unhealthy from overcrowding and general filthiness. There are not any districts liable to be flooded.

Series No. 1, General.—Queries——24. Have you any suggestions to offer as to the best means of avoiding pollution in future?——25. Have you any suggestions to offer as to the conservancy of rivers and streams?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingsworth -	Not answered.
Glossop - -	Have no suggestions to offer; things are all right if left alone; this is a country district with numerous streams and streamlets flowing down the mountain sides.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	No suggestions to offer.
	Watershed of the Tame, Tributary of the Mersey.
Hyde, Denton, Dukinfield, Stalybridge, Ashton-under-Lyne, and Hurst.	No suggestions to offer.
Mossley - -	To avoid pollution compel the purification of the refuse sewage; also prevent the millowners and other works turning privy and other refuse into the stream.
	Watershed of the Mersey Proper.
Liverpool, Waterloo - with - Seaforth, Great Crosby, Litherland, and Birkdale.	No suggestions to offer.
West Derby - -	The effectual drainage of the district, as contemplated by the Board, will prevent pollution by town sewage.
Walton - on - the - Hill.	By diverting the sewage future pollution can be avoided.
Toxteth Park -	The local board are unable to offer any suggestions for the remedy of the great pollution of the river to which attention has been called; except that, so far as practicable, sewers should be quite distinct from any natural watercourse, and that the latter should be kept as pure as possible.
Wavertree and Little Woolton.	No suggestions to offer.
Much Woolton -	Pollution may be prevented by diverting the sewage from the streams and applying it direct to the land. There is no doubt that a Conservancy Board established throughout the country, with ample powers to prevent the pollution of rivers and streams, would be a great boon.

Mersey Basin—(Mersey Proper).

Series No. 1, General.—Answers to Queries 24 and 25.—Page 46—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Garston - -	No suggestions to offer.
Widnes - - -	Pollution can be avoided by a proper system of drainage much required in the district.
Sutton, Prescot, and Parr.	No suggestions to offer.
St. Helens - -	Not answered.
Newton-in-Mackerfield.	We are of opinion that a very considerable improvement would be effected (in the event of its being found impracticable to prevent the flow of St. Helen's chemical refuse into the brook) by the formation of a covered culvert a short distance from but somewhat parallel with the bank of the *Sankey* canal from St. Helen's until it reaches the river *Mersey*, where during ordinary flow it might be withheld, the sediment allowed to settle, and the water liberated by self-acting flood gates at each ebb tide; such a scheme would be the means of improving the bed of the *Mersey* and abating the abominable nuisance arising from the sulphuric acid passing down the brook polluting the atmosphere for miles around, and would also enhance the value of the lands adjoining, not only for agricultural but to a great extent for commercial purposes.
Warrington - -	Best means of avoiding pollution, prevent towns in upper part of stream from discharging refuse into the river.
Pennington - -	In order to prevent pollution the sewage of the town of Leigh, including portions of the districts of Atherton and Westleigh, may be used for irrigating land in the neighbourhood of Pennington brook.
Westleigh, Hindley, Atherton, & Tyldersley-with-Shakerley.	No suggestions to offer.
Rusholme - -	This Board have found almost insuperable difficulties in providing an efficient system of drainage; the district, as stated, is crossed by many streams over which they have no control. From the absence of any general main sewer below they have no place into which they can empty their sewage, except the streams, and as none of the streams converge within their district they have to find five different outfalls. Were there a scheme comprising the whole watershed of the *Irwell or Mersey*, with branches up each subsidiary valley, made at the cost of the whole district, many of the difficulties of Local Boards would be obviated, and if it can be established that such sewage can be used profitably for agricultural purposes generally, it would in many respects be a great boon to the populous district to be so rid of their sewage without polluting the streams. No doubt dry ashpits may be and ought to be largely adopted, but waterclosets will largely prevail in districts like Rusholme, inhabited mostly by classes above the mere working classes in point of means, and who will not occupy houses without waterclosets. Other refuse of an objectionable character will also arise requiring sewers separated from natural streams, and rendering some comprehensive scheme of sewering absolutely necessary.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport, Bredbury, Wallasey, and Birkenhead.	No suggestions to offer.
Oxton - - -	More effective laws and Government supervision over the Local Conservancy Board, with compulsory irrigation where practicable.
Tranmere, Higher Bebington, Runcorn, and Altrincham.	No suggestions to offer.
Lymm - - -	By intercepting the cause of the pollution at its source. It seems desirable to have a Board appointed with a view to prevent pollution.
Sale - - -	The best means of avoiding pollution is in our opinion to have properly constructed settling and filtering tanks.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton, Stretford, and Moss Side.	No suggestions to offer.
Salford - -	In order to avoid pollution in future we suggest that works proposed for intercepting the sewage now discharged into the *Irwell* at numerous places within the borough should be carried out, and the sewage conveyed to an outlet away from the borough near Mode Wheel. The advantages sought are mainly the exclusion from the river of matters which at present unquestionably produce offensive emanations,

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 24 and 25.—Page 46—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Salford—*cont.*	and, as a natural consequence, a vitiated state of the atmosphere. It is almost superfluous for us to quote authorities, or to bring instances to prove that a contaminated atmosphere contains the elements of disease. The very fact of town populations having a rate of mortality 50 per cent. higher than country populations, proves this; and it is undeniable that the main cause of this excess is the impure state of the air which envelopes most of our large towns; overcrowding, defective ventilation, and deficient drainage are mainly answerable for this result. It may possibly be argued that owing to the volume of sewage being so small in comparison with that of the river water, no sensible amount of injury to the superincumbent atmosphere can arise. To this it may be replied, that smells from the river are generally perceptible, sometimes indeed intolerable, and that if impure air, as is maintained, be the cause of an excessive mortality, the present polluted state of the river calls for immediate remedial measures. Another advantage of the proposed intercepting sewers will be to relieve the low lying districts of Broughton, and the prevention of back water flooding in Peel Park. A third advantage will be that nearly all the sewage of the borough will be conducted to a spot which we consider well selected and suited for the purpose. At this point, if found advisable, the solid and liquid constituents of the sewage may be separated, the former being converted into a portable manure, and the latter passed into the river. We are of opinion that the advantages to be derived from the construction of these works will be equivalent to the cost. The rate of mortality in the Salford district is excessive, and we are satisfied that deficient drainage tends to this result. The deaths from scarlatina, diarrhœa, dysentery, and diseases of the respiratory organs are more, proportionately, in Salford than in Liverpool, Bolton, Blackburn, Wigan, Preston, Sheffield, Bradford, Leeds, and many other large towns. The age at death is likewise low, 50 per cent. being children under five years old. The following figures illustrate the death-rate in Salford, &c. They are computed from averages of the last six years, in which the Registrar-General has particularized each sub-district, namely, 1856 to 1861 inclusive, and show the average annual rate of mortality to 1,000 persons living:— Salford - - - - - 28·0 Broughton - - - - - 14·4 Pendleton - - - - - 21·5 *England.* In 139 districts and 56 sub-districts, comprising the chief towns - 23·7 In the remaining districts and sub-districts of England and Wales, comprising chiefly small towns and country parishes - - 19·6 Glendale and Rothbury - - - - - - 15·2 It will thus appear that the average probability of life in Salford is only half that in Broughton, and that Broughton even excels Glendale, so frequently quoted as a model of salubrity. [The injurious effects of discharging the drainage of the borough into the river are two-fold, namely, the formation of mud banks at the outlets, and a further pollution of the already filthy stream. The contemplated works would remedy the first of these, and to some extent improve the latter. The condition of the river is by no means satisfactory when it enters the borough, but it becomes infinitely worse as it receives, in its course, the drainage of Manchester and Salford. The population of Manchester is four times that of Salford, but the effect produced by the drainage from the two places is not in the same proportion. This is due to the fact that Manchester is situated on the outer or convex curve of the river, along which the current sets, whilst Salford is on the concave side, where the velocity of the stream is less. The consequence is that the sewage of Manchester becomes at once mixed with, and carried along by, the stream, whilst that from some of the principal Salford sewers tends to stagnate at the outlets; the mud banks which exist along the Salford side of the river are evidences of this, and their influence will be most felt during the summer months when the river is low. On a recent occasion the Corporation of Manchester gave evidence before Parliament that the condition of the river was injurious to the health of the community, and contended moreover that they were not justified in adopting a more modern and efficient system of house drainage, on the ground that they would thereby still further pollute the stream, and render it little better than a huge cesspool. The exclusion of the Salford drainage would of course only mitigate the evil, but, if accomplished, the authorities of Manchester would have no excuse for perpetuating their share of the nuisance, and as they admit its ill effects upon the public health, would probably follow the example set by Salford, and remedy it. With these views, yet feeling satisfied that the exclusion of the Salford sewage alone would perceptibly affect the condition of the river, and thereby improve the health of the inhabitants of the district, also that this can be attained at a cost, very slightly exceeding a rate of one penny in the pound per annum, I recommend the carrying out of the proposed intercepting works.—C.C.E.]
Manchester - -	With reference to the best mode of avoiding in future the pollution of rivers, or with reference to the conservancy of rivers, the Corporation do not feel themselves to be in a position to make any suggestion. The subject is attended with enormous

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 24 and 25.—Page 46—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester—*cont.*	difficulty, and it is only as the result of the important inquiry now being made by the Royal Commissioners, and of a careful consideration of the evidence which will be obtained from parties interested in, or who may be affected by, any changes proposed, that any scheme likely to be effective, and at the same time satisfactory, can be devised. It is with the mode in which it may be proposed to deal with the sewage of towns that the Corporation is mainly interested. As already stated, the sewers in Manchester find their outfall into one or other of the rivers flowing through the city. The same rivers receive the sewage from a large number of towns and houses, as well as the pollution from a large number of manufactories, before they enter Manchester, and it may be questionable whether such streams are not in fact almost, if not quite, as polluted when they enter as they are when they leave the city. If the sewage of towns is to be interfered with, such interference must necessarily extend to the sewage along the whole course of the rivers, and unless artificial means, or conduits (as in London), are constructed, with a proper outfall into the sea, and into which all local authorities may be compelled to carry the sewage from their respective districts, it is difficult to see in what manner the natural streams and rivers can be protected from sewage pollution. Irrigation, for the purpose of dealing satisfactorily with the whole of the sewage of Manchester—which is estimated to represent about 20 million gallons per day—is, in the opinion of the Council, so far as Manchester is concerned, impracticable. With all questions relating to the sewage, the mode of dealing with the human excreta from houses is closely connected. In Manchester waterclosets in small houses hardly exist. In such houses, privies and ashpits are the rule and waterclosets the exception. If waterclosets had been introduced into all the houses, the state of the rivers in Manchester would long ere this have been intolerable. In addition, the increased quantity of water which would have been required could not have been supplied by the existing works. The *cost* of water, as well as the difficulty of obtaining, at *any* cost, the additional quantity of water which would be required in districts where waterclosets might be generally introduced, is a most important and vital question when dealing with this subject. When the excreta from houses are permitted to pass into the sewers, and thence into the rivers and natural streams, a valuable manure is partially, if not entirely destroyed—a great nuisance, which can only be got rid of, if at all, at enormous cost, is created—and a consumption of water arises which in many cases could not be met by any existing, if indeed by any possible works. The difficulties are not less when considering the pollution arising from manufactories. In that case it does not appear to be a question of money. There is little doubt that such pollution may be considerably lessened; but in what way it can be altogether prevented, without seriously interfering with trade, it is difficult to say.
Prestwich - -	To prevent pollution extensive powers conferred by an Act of Parliament upon a Board of Commissioners or other authority, with adequate means of enforcing them would be advisable.
Swinton, Kearsley, Farnworth, Bolton, Astley Bridge, Hallliwell, Radcliffe, and Whitefield.	No suggestions to offer.
Bury - - -	The best means of avoiding pollution in future is that earth, soil, road sweepings, foundations, and solid refuse of this nature ought to be kept out of the rivers, brooks, and tributaries, and that the town sewage ought, if practicable, to be filtered and deodorized before being passed into the rivers. No effectual system of filtration or deodorization of sewage has, however, yet come under our observation, but we think a trial of Mr. Spencer's carbide (as used at the Wakefield and Southport Water Works) is very desirable. As regards manufacturing pollutions, these might be to some extent modified, but they cannot be wholly done away with without destroying the trade, and it is for the country to choose whether they will have absolutely pure streams and no manufactures, or rivers and brooks to some extent polluted coupled with manufacturing wealth, and a dense and well-employed population. As to conservancy, any legislation should be general, and not confined to one watershed only, otherwise it would only tend to remove manufactures from one district to another, and the conservancy should not be confided to corporations or local boards, as it would tend to favouritism, and would never be consistently and effectively carried out.
Ramsbottom - -	No suggestions to offer.
Bacup - - -	We have no suggestion to offer except that we believe it possible to prevent the chemical elements used at dye works from entering the rivers in their most noxious state, precipitants might be used with great effect, and logwood (which is a good fertilizer) might easily be prevented entering the rivers. We consider that the conservancy of rivers and streams in the face of the immense amount of manufacturing which is carried on in this county is a most difficult work, but if each manufactory fouling the stream could make it one of the most important parts of their business to have depositing tanks, and precipitating and deodorizing apparatus,

Mersey Basin—(River Irwell).

Series No. 1, General.—Answers to Queries 24 and 25.—Page 46—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bacup—*cont.*	the desired end would be much furthered. It cannot, however, be expected that all private individuals will take that amount of interest in the matter as to adopt such a suggestion, it would have to be placed in the hands of the local authorities, and it would be an Inspector's duty to make visits to the manufactories, and see that the tanks and purifying apparatus were constantly working. We believe it possible for the above plan to be worked out to a successful issue.
Heywood & Rochdale.	No suggestions to offer.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	In order to avoid pollution in future completely sewer all urban districts, culvert brooks used as sewers, and form intercepting sewers to protect rivers and pure streams. It is desirable that each watershed should be governed by a representative Board having the necessary authority to prevent the pollution of streams, except where expedient for manufacturing purposes.
Failsworth - -	No suggestions to offer.
Bedford, near Manchester.	We suggest as the best means of avoiding pollution in future that the sewage should be used for irrigation.
Bradford - -	We would suggest that filter beds be laid down on a low piece of land near the present outfall of the sewer of this district into the river *Medlock*.
Openshaw - -	The streams through this district being very small, and there being no encroachments on their banks, have produced no public inconvenience; their conservancy therefore has not been entertained.
Gorton, Droylsden, and Oldham.	No suggestions to offer.
Crompton - -	The landowners who claim the bed of the river ought to be compelled to cleanse it; various applications to them to do so have been made by the Board, but with three exceptions they have refused, denying their liability; and notwithstanding the evils arising from its present state, the Board finds itself powerless either to compel the landowners to empty and cleanse their respective lengths, or to empty and cleanse the river at the expense of the ratepayers; either of the courses would avoid pollution for the future.
Royton and Lees -	No suggestions to offer.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	The Board is of opinion the best means of avoiding pollution in future would be to prevent dyers, manufacturing chemists, bleachers and others from indiscriminately discharging into the river all their liquid refuse. They believe it is possible to purify it to some extent or to neutralize its offensiveness without materially interfering with their business. And with regard to the sewage, to continue strictly the rule as to non-admission of waterclosets, and if necessary to deodorize the sewage before it is discharged into the river. The Board are not prepared to offer any suggestions beyond the immediate necessity of placing them under the control of some local authority, with ample powers to carry out well-defined duties in regard to the purification and general protection of rivers.
Bollington -	No suggestions to offer.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich & Witton-cum-Twambrookes.	No suggestions to offer.
Sandbach - -	The suggestion we offer for preventing pollution in future is that all solid matters, including night-soil, should twice or oftener daily be called for by a public scavenger, and taken out of the town a considerable distance and so utilized. The surface water might then be allowed to flow into the brooks or rivers without much mischief, but under any circumstances a large quantity of solid matter must get into the open channels, and a tank, or a series of tanks, should also be placed to receive the water coming from a town, and as much of the sewage or solid matter got out of it as possible before it is allowed to run into a brook or river.
Monks Coppenhall	The best means of avoiding pollution is irrigation with the sewage. This we are in favour of, but it could not be effected in Crewe without pumping all the sewage, which would be a serious expense; the town being inhabited almost entirely by workmen and persons employed at the railway works, it would fall heavily upon the ratepayers.
Tarporley - -	Not answered.

Mersey Basin—(River Weaver).

Series No. 1, General.—Answers to Queries 24 and 25.—Page 46—*continued.*

Names of Cities, Boroughs, or Districts.	Answers to Queries.
Nantwich - -	No suggestions to offer; except that the dry earth system (or peat where available) should be adopted.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	No suggestions to offer.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	No complaints have been made, excepting of the sewage from the Barracks.
Preston - -	Some simple, easy, and inexpensive mode should be adopted, whereby parties can be prevented polluting rivers and streams, certain times should be given for the constructing of works in cases where the rivers and streams are at present polluted, and the future pollution of streams by new works should be prohibited. These subjects have been carefully considered in the case of the *Lee Conservancy Act of 1868*, which contains most important provisions upon these subjects. It is desirable that conservators of rivers and streams should be appointed. Could not the board of conservators appointed under the Salmon Fisheries Act be invested with powers in their respective districts, similar to those given to the conservators under the *Lee Conservancy Act, 1868*. The providing of funds to enable them effectually to perform their duties is a question of much difficulty.
Leyland and Clitheroe.	No suggestions to offer.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors & Oswaldtwistle.	No suggestions to offer.
Accrington - -	To avoid pollution, prevent refuse from print and dye works, manufactories, and bleach works being turned into the rivers, and vest in corporate or non-corporate bodies of districts power to deal with rivers within their limits.
Burnley - -	The pollution of the rivers by town sewage, ashes, liquid refuse from printworks, gas works, tan yards, chemical and other works, can only be avoided by a prohibitory Act of Parliament. The rivers and streams should be placed under the control of the local authority, who should be invested with ample powers to prevent pollution.
Brierfield and Nelson.	No suggestions to offer.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	It is suggested as the best means of avoiding pollution in future, and for the proper conservancy of rivers and streams, that an Act of Parliament should be passed making it a criminal offence for either a public body or private individual to pollute a river or stream either by turning in sewage, refuse from manufactories, discolouring the water, or depositing ashes, solid refuse, or filth in the bed thereof; and that inspectors be appointed by Government to watch the rivers and streams and prosecute all offenders. That reservoirs should be constructed in each watershed in such position to enable sufficient water to be impounded and supplied to mill owners and others having vested rights in the river or streams, as compensation for existing ones which would then be removed. That in all places similar to Blackburn, where the staple trade of the town requires a large amount of steam power, and where the only resource is the river, the volume of which in dry weather is small, the authorities of the town should be compelled to make storage reservoirs, as before stated, and from these to compensate the river in time of drought, by causing to flow down during the twelve working hours at least 150 cubic feet of water per horse-power of engines in mills situated on its banks, and then the using of river water for steam purposes would not affect the temperature or quality of the water, or be in the slightest degree a nuisance. In any case we think the management of all rivers and streams should be in the hands of Government officers; in public bodies there are too many interests to serve to do justice to the management of rivers and streams.
Great Harwood & Over-Darwen.	No suggestions to offer.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	To prevent pollution proceedings have been taken by private gentlemen of the district against the town of Chorley, and we believe an injunction has been obtained, but we perceive no benefit as yet.
Chorley - -	Not answered.
Ormskirk - -	We suggest as the best means of avoiding pollution in future that town sewage should be used in irrigation.
Wigan - - -	Not answered.

SERIES No. 2, SEWERAGE.

Queries——1. Have Sewerage Works been carried out in the town?——2. When were they commenced?——3. When completed?——4. Describe them, and state cost?——5. Are the sewers ventilated; if so, describe mode of ventilation?——6. Are they flushed; if so, state how often and by what mode?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	All sewerage has been done under the control of the landowners, chiefly on Lord Edward Howard's estate. There is no general system.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Sewerage works have not been carried out.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	Sewerage works commenced in the spring of 1864; completed about the middle of 1866. The works consisted of one general scheme of main drainage for the whole town; the sewer varying from to four feet in diameter. These works cost about 12,000*l.* The sewers are ventilated by down spouts and one large chimney. They are not flushed at regular periods, once or twice in the summer, with the exception of one or two; the whole of the sewers have a very good fall. The mode of flushing is to attach a hose pipe to one of the mains of the waterworks to block up both ends of the sewer, and when it is filled with water to let it out at the lower end.
Denton - - -	Sewerage works commenced in 1863, finished in 1865. Main sewers, 3,985 yards; branch drains, 9,763 yards Cost, 5,295*l.* 2*s.* 1*d.* They are ventilated by shafts, with open gratings in the streets, the gases passing through charcoal baskets. They are flushed by storm waters.
Dukinfield - -	Sewerage works commenced in 1863, finished in 1868. The sewers are for the most part built of brick, set in mortar on fire-clay inverts; some few are constructed of sanitary pipes. The sewers are ventilated by the connexions with the down spouts from the roofs of buildings, by street grids in the openings of which baskets of charcoal are placed. They are flushed several times each year by the water from the bleach works ponds.
Stalybridge - -	Main sewers have been constructed in all the public streets and the house drainage connected therewith. Commenced in 1863; finished in 1868. The cost was about 2,000*l.* The sewers are ventilated by manholes in the centre of the street through a layer of charcoal; the sewers are not flushed.
Ashton-under-Lyne	Sewerage works were carried out 40 years ago. Additional works constantly going on. The sewers are now carried under all the principal streets. Since 1849, about 25,000*l.* has been spent upon these works; the sewers are ventilated by the drop spouts of the houses, and flushed largely by water pumped from collieries, and spring water constantly running through them.
Hurst - -	Sewerage works commenced in 1864; finished in 1865. The main sewers laid down take away the surface water from streets and refuse of houses; they are ventilated by means of the drop spouts from the adjoining houses. They are not flushed, the gradients being steep.
Mossley - -	Sewerage works commenced in 1865, finished in 1867. The sewers laid down take away the surface water from streets, and refuse of houses. A considerable number of houses are now sewered, and the Local Board are compelling all who can to use the sewers. They are ventilated by means of drop spouts from the adjoining houses; and it is in contemplation to place ventilators at the head of each sewer. The sewers have a steep gradient, and are not flushed.
	Watershed of the Mersey Proper.
Liverpool - -	A system of sewerage for Liverpool was devised by Sir John Rennie in 1816, and was partly carried out in the years between that and 1846. During that period 49 miles 807 yards of sewers were made. Much of this had subsequently to be reconstructed. The new system of sewerage was begun in 1847. Although all the streets in the borough may be said to be sewered, yet as new streets are being made at the rate of upwards of three miles a year, the sewerage will not be completed until all the land within the borough is laid out. The sewerage is based on the catch-water principle, that is, that the upland waters are not permitted to flow down to the lower parts of the town except at the points of discharge. There are eight outlets discharging the sewage into the river, but all these are so arranged that they can be connected by an intercepting sewer, and the sewage carried to the north end for utilization. The sewers are ventilated in three ways:—1st. They are connected with the ash-pits or chimneys of furnaces. 2nd. The drop spouts of high houses when not near windows are carried into the drain without being tapped. 3rd. Pipes are carried from the roof of the sewers above

Mersey Basin—(Mersey proper).

Series No. 2, Sewerage.—Answers to Queries 1 to 6.—Page 52—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Liverpool—*cont.*	the tops of the highest buildings in their neighbourhood. The tops are furnished with Archimedian screw pumps, which are kept constantly in motion by the air. Of these there are nearly 1,200 at work, and the number is constantly being increased. The scouring cocks of the water pipes are arranged so as to flush the sewers. As the pipes have to be periodically scoured regular flushing is insured. Besides this there is a staff of men regularly employed in flushing the drains of the borough. The upper end of each drain has a branch carried up to a flushing box, into which a hose can be inserted. [B. E.]
Waterloo - with - Seaforth.	Sewerage works commenced in July 1858, finished in May 1862. A complete system of main sewerage has been constructed throughout the whole of the district. The sewage is discharged by three outfalls into the estuary of the river *Mersey;* the entire cost of the works was 9,500*l.* Brick sewers, egg-shaped, 7,131 lineal yards, the largest 3 feet 6 inches by 2 feet 3 inches, and the smallest 3 feet 3 inches by 2 feet; 296 lineal yards of earthenware pipes, ranging in diameter from 12 inches to 15 inches; 1,005 lineal yards of cast-iron pipes, ranging in diameter from 15 inches to 2 feet. No systematic ventilation. Some of the sewers are flushed by water flowing from a private pond and a neighbouring brook.
Great Crosby -	Sewerage works commenced in August 1865, and finished September 1866. Egg-shaped brick sewers and earthenware tile pipes. Cost, 8,000*l.* Ventilated by upright air shafts discharging above the levels of house tops, and flushed every fortnight from chambers formed for that purpose and supplied from the water mains.
Litherland - -	Sewerage works commenced 1865; finished 1868. Cost, 6,000*l.*, and consists of a main outfall through the district which joins the *Mersey* dock outfall sewer with tributary sewers when necessary. Ventilated by air shafts; and flushed continually by a force pump and by a brook which is turned into the main sewer.
Birkdale - -	The answers to Queries have not been received from this Local Board of Health.
West Derby - -	Sewerage works have been and are now being carried out by this Board. Some of the sewers are constructed of brickwork, oval in shape, and varying in size from 5 ft. 3 ins. by 3 ft. 6 ins. to 3 ft. by 2 ft. Others are constructed of glazed earthenware pipes, circular in form, and varying from 1 ft. 6 ins. to 9 ins. in diameter. 11 miles of main outlet sewers (independent of tributary and house drains) have already been constructed. The cost up to the 2nd December 1868 has been as above, 38,410*l.* 13*s.* 11*d.* The sewers are ventilated by means of air shafts connected with the manholes, the foul air passing through charcoal; they have not yet been flushed.
Walton - on - the - Hill.	No general system of sewerage has yet been adopted.
Toxteth Park -	The sewerage is being continually carried out as new streets are formed this being a rural and surburban district of the great town of Liverpool, and the class of property consists chiefly of villa residences detached and semi-detached. The sewers are constructed of brick, egg-shaped form, varying in size from 1′ 10″ × 2′ 3″ to 2′ 6″ × 3′ 9″, and are about 8,500 lineal yards; the cost being, 7,011*l.* The sewers are ventilated through the rain spouts from the roofs of houses. The sewers are frequently examined; they have all good gradients, and do not require artificial flushing.
Wavertree - -	Sewerage works have been carried out in the village district; with main outlet into the Liverpool sewers. Commenced, March 1853; finished, October 1857. Total cost, 5,267*l.* 10*s.* 4*d.* Ventilated partially by means of the rain spouts. The main sewers are flushed from a small lake in the township when requisite.
Little Woolton -	No sewerage works.
Much Woolton -	A complete system of sewerage is at present being carried out in the district, March 1868; when completed there will be about eight miles of main and tributary sewers, exclusive of those in private streets, and the cost will be about 13,000*l.* With the exception of the eastern outlet 3 ft. × 2 ft. to the subsidence tanks, the whole of the sewers are constructed with glazed earthenware pipes varying in size from 12 ins. to 24 ins. The sewers are ventilated by charcoal baskets placed at intervals in the sides of the manholes, with the necessary ventilating shaft carried to the surface of the street. Ample provision has been made for flushing the sewers by a series of valves placed at intervals in the manholes.
Garston - -	Sewerage works were commenced in 1858, and completed, so far as they at present extend, in 1866. They are ordinary sewers. Cost, 11,931*l.* 18*s.* 8*d.*; are ventilated with "Howard" ventilators; are flushed by the brooks running from the adjoining districts, and by flushing cocks from the water mains.
Widnes - - -	No public system of sewers has been carried out by the Board; the sewers are not flushed in consequence of the water supply to the town being in an unfinished state.
Sutton, Prescot, and Parr.	No sewerage works have been carried out.

Mersey Basin—(Mersey proper).

Series No. 2, Sewerage.—Answers to Queries 1 to 6.—Page 52—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
St. Helens	On the passing of the first Improvement Act in 1844, sewerage works were carried out; extensions are made from time to time, as the streets are formed. The sewers are not ventilated, and are not flushed.
Newton-in-Mackerfield.	Sewage works commenced in 1864; not completed. There are three brick culvert outlets discharging themselves east, west, and south of the district, into which the tributary pipe sewers discharge themselves; the mode of treating the sewage at these outfalls is undecided and incomplete. The cost already incurred is about 6,000*l.*; the sewers are ventilated by charcoal grids in the manhole shafts, and by connexions to down spouts of buildings; there is no available means for flushing.
Warrington	The large sewers have been constructed of bricks. The smaller sewers and the house drains are of circular glazed pipes, cost about 20,200*l.*; commenced in 1858, not yet completed.
Pennington	Sewerage works commenced in 1864; finished in 1868. Circular sewers of bricks set in blue lias mortar and glazed stoneware pipes. The outlet sewer into *Pennington Brook* is three feet diameter, the sewers emptying into this outlet being less in size down to nine inches. Cost, about 3,000*l.* The sewers are ventilated by being connected with water spouts. Flushed only by storm water.
Westleigh	Circular sewers of brick set in blue lias mortar, and glazed stoneware pipes. Commenced in 1864; finished in 1867. Cost not separately known. No particular means have been taken for the ventilation of sewers. Flushed only by storm water.
Hindley	Sewers for the drainage of 100 houses at a cost of 400*l.* (commenced October 1868).
Atherton	The sewering of Chowbent has been carried out. Commenced in 1864, completed 1866. Other sewers are now being constructed. The sewers are of brick and earthenware pipes, of circular form. Sewers are ventilated by shafts to the surface, the gases being passed through a chamber filled with charcoal. Flushed only by storm water.
Tyldesley-with-Shakerley.	Sewerage works commenced in January 1864, not yet completed. The outlet is a brick-barrel sewer, two feet six inches diameter; the remainder are of earthenware pipes, 15 inches, 12 inches, and 9 inches in diameter; cost to this date, 582*l.* 1*s.* 1*d.* Ventilated by two-inch iron pipes carried above the eaves of the houses at the highest end of the street. Flushed occasionally by street hydrants on water mains.
Rusholme	Sewerage works commenced in 1852. They are not yet wholly completed. Not ventilated and not flushed. Cost, 2,887*l.* 13*s.* 3*d.*
Levenshulme	The answers to queries have not been received from this Local Board of Health.
Stockport	A partial sewering, commenced in 1863, has been effected, cost 29,000*l.* In some cases the sewers are ventilated by the spouts of houses, in others by charcoal ventilating grates. Not flushed save by rain; this would be sufficient from the hilly nature of the town were the whole town properly sewered.
Bredbury	A sewer was made by the Guardians of the Stockport Union under the Public Works (Manufacturing Districts) Act in a portion of the more densely populated part of the township in 1865, at a cost of from 1,300*l.* to 1,500*l.*; it is not ventilated; but is flushed two or three times a year from the surplus water of a reservoir.
Wallasey	Brick and earthenware pipe sewers, cost 12,816*l.* Commenced, 1855; finished 1868; ventilated through the rainwater spouts from the roofs of houses; flushed, from the water mains by means of hose, once a month.
Birkenhead	The streets were sewered as the town and docks were laid out, commencing soon after the passing of the Act 3 & 4 Will. 4. c. 63., 1833, and is continued as needed. The length of the sewers is 42 miles, about 2½ miles constructed of stone, 33 miles of 9-inch brickwork mostly egg-shaped, and 6½ miles of glazed stoneware pipes; many of the sewers were constructed by the owners of land abutting on the streets, a portion by the Birkenhead Railway Company, and the great culvert by the Dock Trustees; the cost therefore cannot be given. They are ventilated by upright shafts adjoining the vertical entrances or manholes in centre of the streets. Each shaft is intercepted by a charcoal basket through which the sewer gases pass. No artificial system of flushing, but the rainfall of a large area of watershed beyond the limits of the town passes through the main sewers.
Oxton	No general system of sewerage has been carried out in the district, but plans have been prepared, and about 2,760 yards of brick sewers have been constructed by private persons through land at present sparsely built on. The old sewers at present answer the requirements of the district. It is not contemplated to ventilate the sewers; they are flushed twice a week by hydrants on the mains and flushing pipes through the gullies.
Tranmere	Main sewers commenced 1864; finished 1865, are egg-shaped, brick in hydraulic mortar, with manholes and side entrances, flushing boxes and ventilation, and the subsidiary sewers are earthenware pipes with brick shafts and manholes. Ventilated

Mersey Basin—(Mersey proper).

Series No. 2, Sewerage.—Answers to Queries 1 to 6.—Page 52—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Tranmere—*cont.*	by shafts from the manholes with air gratings to the surface of road and wire baskets filled with charcoal between; are flushed monthly, with two-inch hose direct from the water mains.
Higher Bebington	The system of main sewerage was commenced in February 1861, and finished about April 1863. The sewers are Rock Lane sewer, 985 yards long; cost, 1,255*l.* Sewer along the river beach, 636 yards long, of which 372 are in the rock cutting, and the remainder glazed drain socket tiles; cost, 407*l.* Sewer down the beach to low water, 250 yards cast-iron pipes; cost, 765*l.* Dacre Hill sewer, 400 yards, glazed socket drain tiles; cost, 185*l.* Higher Bebington village sewer, 2,380 yards, glazed socket pipes; cost, 620*l.* They are all ventilated with open gratings; and are flushed once a month by water mains.
Runcorn	Sewerage works are carried on gradually as the town increases. The main sewers in most cases are of brick, in a very few instances stoneware pipes are used; there are about 10,000 lineal yards of sewers; cost, about 5,000*l.* In some cases they are ventilated by the rain water spouts from the houses. The inclination is sufficient to render them self-cleansing.
Lymm	See answer on page 9.
Altrincham	Sewerage works commenced in 1851, finished 1852. The sewers are constructed of egg-shaped glazed pipes, the diameter of which range from 6 ins. × 4 ins. to 25 ins. × 18 ins. They are ventilated by the down spouts from the roofs of the houses. It has never been found necessary to flush them, the ordinary rainfall being sufficient.
Sale	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton.	Sewerage works, have been carried out; commenced in 1864; finished in 1865. Manholes are provided, and the sewers ventilated by means thereof. Upon examination, some four months ago, it was ascertained that the sewers, although laid for three years, had scarcely a trace of sediment in them, and consequently they have not required flushing; ample means of flushing were provided when the sewers were constructed.
Stetford	Sewerage works have not been carried out by this board.
Moss Side	As streets are formed they are sewered; some are in progress now. Costs defrayed by the owners of the property; the sewers are not ventilated, and are not flushed.
Salford	Sewers for the drainage of the borough have been made from time to time under the several streets having different outlets into the river, but there is not any general system of sewerage concentrating in one outlet. *Salford District.*—In the older parts drains have existed for many years, but the principal portion now existing have been formed since 1844. *Broughton District.*—Principally since 1853; some had been formed by landowners previously. *Pendleton District.*—Principally since 1854. Sewers are being extended or added to as the building of houses proceeds. *Salford District.*—37,840 yards main trunk and branch brick sewers; cost, 21,753*l.* Not ventilated; not flushed. *Broughton District.*—Main trunk sewers of brickwork, secondary or street sewers of circular earthenware pipes; cost of the whole, 12,000*l.* Imperfectly ventilated. Occasionally flushed by means of sluice valves in the trunk sewers, and by the water which is allowed to run to waste from water mains when run off. *Pendleton District.*—24,430 yards main trunk and branch brick and pipe sewers; cost, 19,915*l.* Imperfectly ventilated. Several pipe sewers require flushing occasionally, and this is done by fixing hose to nearest hydrant and connecting it with the flushing flue constructed at the head of all pipe sewers.
Manchester	Efficient sewerage works have been carried out in all the streets within the city. The areas drained within the several townships being as follows:—Manchester, 1,285 acres; Cheetham, 648 acres; Hulme, 409 acres; Chorlton-upon-Medlock, 604 acres; Ardwick, 273 acres; Beswick, 16 acres. The sewerage works were commenced before the date of the Corporation in 1838, and as new streets are formed and laid out, they are sewered and paved by the Council at the expense of the landowners adjoining such streets, so that the necessity for additional sewering is constantly arising. So far as existing streets are concerned, it may be said that the sewerage is completed, and there is no doubt that the city is throughout effectively sewered and drained. The areas of the several townships not yet built upon are as follows:—Manchester, 360 a. 3 r. 35 p.; Cheetham, 270 a. 3 r. 4 p.; Hulme, 68 a. 1 r. 30 p.; Chorlton-upon-Medlock, 41 a. 3 r. 9 p.; Ardwick, 235 a. 3 r. 38 p.; Beswick, 80 a. 1 r. 31 p. The main outfall sewers are principally constructed of brickwork, and the smaller sewers are glazed earthenware oval pipes. The size of the brick sewers varying from 6 ft. by 3 ft. to 3 ft. by 2 ft., and the pipe sewers from 25 in. by 18 in. to 12 in. by 9 in. The inclinations generally are very good, varying from 1 in 30 to 1 in 300. There

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester—*cont.*	are 63 main sewers of various lengths flowing, according to the watersheds, into the nearest streams. Altogether there are about 280 miles of main sewers in the city, and the cost has been about 340,000*l.* There is no special mode of ventilation adopted, but the down spouts from the houses, and the street grids, which are untrapped, are used for the purpose. Nearly all the main sewers have such rapid falls that they do not require flushing; in special cases water is used from the nearest main for the purpose.
Prestwich - -	Sewerage works were commenced in March 1868, and are in progress.
Swinton - -	No sewerage works.
Kearsley - -	The town portion of the district is divided into three parts, called Stoneclough, Old Hall Street, and Kearsley Moor. That block called Old Hall Street has been paved and sewered by the Local Board. Commenced in September 1866; and both public sewerage and private drainage completed May 1868. Ventilated by down pipes from buildings, all being attached and flushed by rainfall only.
Farnworth - -	Sewerage works were commenced in 1863, and are not yet completed; but 3,200 yards of 3ft. brick sewer, 4,000 yards 200 brick sewer, and the following pipe drains:—200 yds. 15 in., 2,000 yds. 12 in., 2,000 yds. 9 in., 2,000 yds. 6 in., 3,000 yds. 4 in., have been constructed. The whole of the down spouts within the district are connected with the sewers for the purposes of ventilation, and the sewers are flushed by rain fall.
Bolton - - -	Sewerage works to a large extent have been carried out in the town, but a complete system has not yet been attained. They were commenced in 1850, and are still in progress, and consist of main sewers varying from 4 ft. 6 in. to 1 ft. in diameter made of brick and earthenware pipes of 9 ins. and 12 ins. diameter. The total length of all kinds executed is 81,291 yards at a cost of 24,458*l.* 12*s.* 3*d.* The sewers are ventilated partly by man holes opening into the centres of the streets and partly by down spouts from buildings. The sewers are not flushed, the rate of fall being sufficiently great to render flushing unnecessary.
Astley Bridge -	Sewerage works commenced in 1865, and not quite completed. The sewers are of brick and earthenware, pipes through the main roads having the outlet in the *Astley Brook;* they are ventilated by stack pipes from buildings, and not flushed.
Halliwell - -	Sewerage works have been carried out, but not very extensively; commenced in 1866, and still in progress. Brick sewers, varying from 20 inches to 3 feet diameter, and glazed earthenware pipes, 9 and 12 inches diameter. Total length, 1,884 lineal yards. Cost 1,646*l.* 16*s.* 10*d.* Ventilated by manholes brought to the surface, and by the down spouts of houses. Not flushed.
Radcliffe - -	A complete system of sewerage for this district is now in course of construction. The main sewers are of 9-inch brickwork, egg shape. The smaller sewers are constructed of circular glazed sanitary pipes. The sewers are ventilated by means of the down spouts from the houses. No necessity for flushing at present.
Whitefield - -	A portion only of a complete system of drainage, under the Local Government Act, has been carried out. Commenced in July 1867; and the Board have now the matter under consideration, with a view to complete the same. The portion already executed are the mains, of brickwork and glazed earthenware pipes; cost, 270*l.* 1*s.* 5*d.* The ventilation is effected by the down spouts from the houses being directly connected with the drains. No flushing except in cases of necessity.
Bury - - -	Sewerage works were commenced 1847, but the most extensive in 1863, and were finished in 1868. They consist of large main and intercepting sewers, having their outlets to the rivers below the town, and the subsidiary sewers in the streets, courts, and alleys; cost, about 25,000*l.* There are no special means of ventilation used. The downspouts from the houses are connected directly with the sewers, by which means a ventilation is secured above the eaves of the houses throughout the district, and some ventilation is attained through the street grids; they are occasionally but not frequently flushed, as the falls of the sewers are considerable.
Ramsbottom - -	Sewerage works commenced in 1864; finished in 1866. The main sewer commencing at the outfall is built egg-shaped with stone par-points for 232 lineal yards 42″ ins. × 28″ ins., and then branching in two directions, measuring together 792 yards 36″ ins. × 24″ ins.; connected with these and laid in the public thoroughfares are 60 lineal yards of 21 ins., 833 yards of 18 ins., 703 yards of 15 ins. and 782 yards of 12 ins. circular glazed earthenware pipes. Lawson's patent street traps and grids are fixed at proper intervals and discharge into the main sewer through 6 in. pipes. Besides the above a system of sewers has been laid in the private streets consisting of 2,270 lineal yards of pipes varying from 15 to 9 ins. diameter together with 1,959 lineal yards of house and side drains. Cost, public sewers 2,901*l.*; private, 1,900*l.* The sewers are ventilated by grates, and frequently flushed by means of water from the reservoirs of two mills.
Bacup - - -	About two-thirds of the town is sewered. The work commenced in 1864, and consists of 1,700 yards brick sewer, 3 ft. × 2 ft.; 4,414 yards, branch pipe sewers; 93½ yards brick sewer, 2 ft. diameter; 340 yards, 3 ft. × 3 ft., brick sewer 817 yards, earthenware and iron pipes, and two sewage tanks; total cost of sewering and tanks

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bacup—*cont.*	12,500*l.*; the sewers are ventilated by a shaft to surface of street, with a wire tray at the top filled with charcoal, protected from the wet and covered with a grate; the grate, tray, &c. being removable so that the shaft may also be used for flushing purposes; they are also ventilated by means of the down pipes from eaves of houses, but are not flushed at present; means however for flushing are provided by the ventilating shafts just referred to; the reason for not flushing is, a deficiency of water during the summer months.
Heywood - -	Sewerage works commenced in 1864, and not yet finished. Three-fourths of the work is already executed. The largest sewer or outfall into the river Roch is 4 feet 9 inches by 3 feet 9 inches oval shape, and varying in size down to 3 feet by 2 feet, built of bricks; the stoneware pipe sewers vary from 21 inches diameter to 12 inches. Some few are ventilated by down spouts to houses, and some portions are flushed when necessary.
Rochdale - -	The town is partially sewered; the works were executed at different periods, ranging many years back, and are not completed. The sewers are principally formed of earthenware pipes, ranging from 12 to 20 inches diameter. The cost, 6,492*l.*, does not include sewers for which private improvement rates have been made under the Rochdale Improvement Act, 1853. A portion of the sewers are ventilated by manholes or air shafts, the effluvia being made to pass through a wire basket filled with charcoal. None of the sewers are artificially flushed; the rainfall is sufficient for this purpose.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	Sewerage works have been extensively carried out; commenced in 1855, and there are some works still in progress. Cost, including street grids, 7,121*l.* 8*s.* 2*d.* Some of the sewers are ventilated by down spouts from the roofs of buildings, and one by a flue in connexion with a large chimney. Not flushed except by rainfall.
Failsworth - -	Sewerage works commenced in 1864, and not yet completed. The sewers are 300 yards of 6 inch, 66 yards of 9 inch, 384 yards of 12 inch, 196 yards of 15 inch, and 122 yards of 18 inch stoneware pipes; also 938 yards of brick sewer 30 ins. × 20 ins.; cost, 1,630*l.* The sewers are not ventilated, and only flushed by the surface water.
Bedford, near Manchester.	Sewerage works commenced in 1864; finished in 1869. Brick barrel and pipe sewers; ventilated by connection with down spouts; also by air gratings to manholes, and flushed by storm water from brook after heavy rains.
Bradford - -	Sewerage works commenced in 1850 by R. Townley Parker, Esq., and since 1858 carried out by the Local Board of Health. The main sewers were completed in 1851, those since laid down were completed within six months from the date of contract. There is about one mile in length of 3 feet by 2 feet brick sewer, and about two miles in length of 18 inches and 15 inches fire-clay glazed socketed pipes; cost 2,000*l.*; they are ventilated by means of open grids in the streets and down spouts attached to houses; flushed only by storms.
Openshaw - -	Sewerage works commenced in 1864, finished in 1868. Comprising brook culverting 4 ft. and 3 ft. diameter, and main sewers of brick and stoneware pipes, ranging from 3 ft. × 2 ft. to 12 inches diameter, with a fall of from 1 in 100 to 1 in 216. Cost, 8,762*l.* Ventilated by means of down spouts from the roofs of houses, and by means of perforated manhole covers; the principal main sewer can be flushed by turning the water into it from a brook, under which it passes, and where means for flushing have been provided but not yet required.
Gorton - - -	The main arterial sewers were completed about June 1868, but there are still further extensions being made. The sewerage works comprise 1,408 yds. of 36 in. brick sewers, 1,520 yds. of 30 in. brick sewers, 980 yds. of 24 in. brick sewers, 1,165 yds. of 18 × 27 in. brick sewers, 2,634 yds. of 15 in. pipe sewers, 880 yds. of 12 in. pipe sewers, 1,349 yds. of 9 in. pipe sewers, 3,705 yds. of 6 in. pipe sewers; together with gulleys, traps, manholes, and lamp holes, at a total cost of 9,579*l.* 11*s.* 9*d.* The sewers are ventilated by means of down spouts from the roofs of works and dwelling houses by manholes and lamp holes with perforated covers. Flushing apparatus has been provided and fixed in the manholes, and flushing can be performed by means of a hose and pipe dropped into the lamp holes.
Droylsden - -	Three miles and 1,310 yards of main sewers have been put in the streets. Commenced in 1863, finished in 1866. Cost, 5,473*l.* 17*s.* Ventilated by the street grids. Flushed only by storm waters.
Oldham - - -	Sewerage works were commenced in 1864; there are two main outlets to the sewers already made, one a tributary of the *Medlock* and the other a tributary of the *Irk;* they are constructed with hard burnt bricks laid in lias lime with manholes, and side entrances as required. Ventilated by manholes, side entrances, and rain-water spouts. They do not require flushing.
Crompton - -	Sewers have been laid in the highways through a portion of the village of Shaw. Commenced 1858, finished in 1867. The sewers are sanitary pipes of nine inches in diameter, ventilated by stench traps generally, and are only flushed by rainfall.

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 1 to 6.—Page 52—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Royton - - -	Sewerage works have not been carried out in this district.
Lees - - -	Not any uniform system of sewers.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	Sewerage works have been carried out in a great portion of the town; the streets, courts, alleys, passages, and backyards are effectually drained, and the surface made good by paving or flagging. The former commenced 1852, and works are still going on from time to time. The large main sewers are brickwork, the smaller are of earthenware tubes. The cost of the whole has been 33,234*l*. The sewers are ventilated in a great measure by rain-water spouts from roofs, and in some instances by manhole shafts. The fall in most of the mains is very good, and there has been very little necessity for flushing.
Bollington - -	Sewerage works commenced in 1863; finished in 1865; the sewers are formed of earthenware tubes, and cost 952*l*. 13*s*. 9*d*.; they are ventilated by common traps and are not flushed.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	Sewers are not ventilated except by grids. They are not flushed.
Witton-cum-Twambrookes.	No sewerage works have been carried out by the Board except repairs to existing sewers.
Sandbach - -	A main sewer, at a cost of 700*l*., it is not ventilated, and is not flushed.
Monks Coppenhall	Two outfall sewers through the outskirts of the town, and one set of filtering or sediment tanks. Commenced in 1866, finished as far as present decided, in 1868. The sewers are not ventilated, but there is an arrangement for flushing the northen outfall by turning in the water from the brook at the extreme top end by means of a flood gate. The southern section is occasionally flushed by letting off the water from the swimming baths.
Tarporley - -	No sewerage works.
Nantwich - -	Sewers commenced in 1854, finished in 1856; of stoneware tubular drain pipes of various sizes laid in the streets. No separate account of cost kept. Ventilated by branch drains and rain-water stacks, and flushed occasionally by water at high pressure from the mains.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	There are 18 miles of main sewers; commenced in 1846, and are still in progress, as new streets are required; cost, 15,000*l*. The largest is 3 feet diameter of 9 inches brickwork; the smallest is 9 inches diameter of glazed sanitary pipes; 350 acres are drained into the sea; 1,483 acres, the remainder, being drained into the *Janes* brook, which empties into the sea at Crossens; two of the main sewers are ventilated into the chimney at the gasworks by a 6-inch pipe, others by means of 4-inch pipes at the ends of buildings or high walls. The sewers are occasionally flushed by a hose pipe to the hydrants on the waterworks main.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	Brick sewers in all streets; commenced in 1850; finished 1851; cost of about 1,000*l*. Not ventilated. Not flushed.
Preston - -	The town has been completely sewered excepting a few subsidiary mains; commenced in 1853; finished 1865. *Public Sewers.*—16¼ miles of stoneware pipes, and 8¾ miles of brick sewers, cost 50,000*l*. Also 30 miles of stoneware pipe sewers in streets paid for by owners, cost 9,000*l*. The sewers are ventilated by down spouts from houses. They are flushed by water turned into them from the water mains. During the year 1868 the supply of water has been so limited that the sewers have not been flushed.
Leyland & Clitheroe.	No sewerage works.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	Sewerage works to a large extent have been carried out upon a complete and systematic plan; commenced in 1864, finished in 1868; comprising circular glazed earthenware pipes of the respective sizes of 25 in., 18 in., 15 in., 12 in., and 9 in., with

Ribble Basin—(River Calder).

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Names of Cities, Boroughs, and Districts.	Answers to Queries.
Clayton-le-Moors —*cont.*	manholes, storm chambers, and means of flushing at a cost of 4,891*l*. 12*s*. 10*d*.; the sewers are ventilated by combined lamp holes and ventilating grates with charcoal baskets, and by down spouts; and are thoroughly flushed by the rainfall.
Oswaldtwistle -	The sewers are not ventilated, but they are flushed fortnightly by hose pipes from water mains.
Accrington - -	Sewerage works commenced about 1863; not yet completed. The whole of the sewers are of earthenware sanitary pipes, and have cost to the present 6,390*l*. The sewers are ventilated by means of pipes stack attached to buildings, and are flushed by means of connections with the river.
Burnley - -	The sewers are ventilated by means of the rain water pipes at the summit of the sewers. The main sewers seldom require flushing or cleansing; when any obstruction occurs it is removed by flushing with a hose pipe connected with the water mains.
Brierfield & Nelson.	There are no sewerage works.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	Sewerage works commenced in 1858, completed in 1868. One outlet comprises a main sewer 6′ 0″ by 4′ 0″, egg shaped, with tributary main sewers from 4′ 10″ by 2′ 8″ egg shaped, to two feet diameter, all of brick, and pipe sewers from 21 inches to 9 inches diameter; total length of main sewers 32 miles. Subsidiary mains in back roads from 9″ to 15″ diameter, 19 miles. There are six storm overflows from the sewers, so placed as to discharge the storm water direct into the river above flood water line. Cost, about 90,000*l*. All downspouts from houses are connected direct with the main sewers; pipes are brought from the sewers to the surface of the streets and charcoal ventilators fixed thereon; the main sewer is connected to three factory chimneys, and the means of ventilation is being daily increased. The fall of sewers being great they are self-cleansing, and do not need flushing.
Great Harwood -	Sewerage works commenced in February 1864; finished March 1867; the works consist of a general scheme of pipe sewers, from 21 inches diameter to 9 inches, and cost 4,966*l*. 7*s*.; the sewers are ventilated principally by the rain pipes attached to buildings; they do not require flushing, the fall is good.
Over Darwen -	Sewerage works were commenced in 1863, are being carried out and will shortly be finished, and will cost between 7,000*l*. and 8,000*l*.; the sewers are ventilated by rain-water spouts and special charcoal ventilators, but not flushed.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	No general system of sewerage has been adopted owing to the flatness of the country.
Chorley - -	The sewers were commenced in 1855, finished in 1857; are constructed of bricks and glazed earthenware pipes, and cost upwards of 12,000*l*. Ventilated by the rain-water pipes attached to the houses, and flushed about once annually by hose pipes from the street mains.
Ormskirk - -	Sewerage works commenced in June 1852, and consist of 603 yards of brick, and 5,098 yards of pipe. There are 72 gullies and 28 shafts, and 16 shafts in brick sewer; the sewers are ventilated by shafts, and down spouts from houses; all are connected where practicable, and are flushed by water from the hydrants through the gullies.
Wigan - - -	Sewerage works were commenced in 1852 and finished in 1860, though of course new sewers are being put down as the town increases. The main sewers are of brick, set in hydraulic mortar; the branch mains are of circular shaped stoneware pipes. Cost, 24,269*l*. 19*s*. 9½*d*. The sewers are ventilated by special shafts of 4″ and 6″ iron pipes, attached to the house drains. No occasion for flushing, though this is done occasionally by means of stop planks.

SERIES No. 2, SEWERAGE.—QUERIES——7. How many waterclosets, trough or tank closets, or self-acting tumbler tanks are there in the town?——8. Are they all connected with the sewers?——9. Are the sinks and gullies of houses connected with the sewers?——10. Are there any cesspools; if so, is the overflow from them connected with the sewers?——11. Are there are any cesspools, privies, middens, or ashpits within dwelling-houses?

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
HOLLINGWORTH -	The Answers to Queries have not been received from this Local Board of Health.
GLOSSOP - -	Do not know the number of waterclosets, only a few good houses have them; cannot answer the other queries.
	Watershed of the Goyt, Tributary of the Mersey.
YEARDSLEY - CUM - WHALEY.	No waterclosets. No cesspools within dwelling houses.
	Watershed of the Tame, Tributary of the Mersey.
HYDE - - -	A considerable number of waterclosets, but no tank closets, or self-acting tumbling tanks; these and the sinks and gullies are generally connected with the sewers. There are but two or three cesspools; these are at present unconnected with the sewers, but the board have ordered them to be connected; there are none inside a house.
DENTON - - -	Twenty waterclosets, all connected with the sewers. There are no tank closets or tumbler tanks. Sinks and gullies connected with the sewers. No cesspools.
DUKINFIELD - -	About 40 waterclosets; they, and the sinks and gullies, are connected with the sewers. No cesspools.
STALYBRIDGE - -	There are about 400 or 500 waterclosets, but there are no trough or tank closets. The waterclosets and sinks and gullies are all connected with the sewers. Very few cesspools, but the overflow from them is connected with the sewers. No cesspools, privies, middens, or ashpits within dwelling houses.
ASHTON-UNDER-LYNE	About 200 waterclosets, and all connected with the sewers. No trough or tank closets or self-acting tumbler tanks. The sinks and gullies are connected with the sewers, but most of them are trapped. No cesspools except at some of the mills, which are regularly emptied, and the night soil carted away; no overflow into sewers.
HURST - - -	There are only a few waterclosets, and these are not all connected with sewers; the sinks and gullies are connected with sewers; no cesspools.
MOSSLEY - -	No waterclosets. The sinks and gullies are connected with the sewers. There are one or two cesspools.
	Watershed of the Mersey Proper.
LIVERPOOL - -	The number of waterclosets is estimated at 29,000, and in addition there are 2,150 trough waterclosets, each of which serves for the houses of a court. They and the sinks and gullies are all connected with the sewers. There may still be a few cesspools the existence of which are unknown to the authorities. Whenever a cesspool is discovered it is filled up and bricked over. Ashpits are removed, and privies are converted into waterclosets.—[R.E.] Since July 1863, the health committee have ordered the conversion into waterclosets of 713 privies, situate within the houses and beneath the inhabited rooms of houses. There probably still exist a few examples of such structure and position, though unknown to the medical officer.—[M.O.]
WATERLOO - WITH - SEAFORTH.	There are 700 waterclosets; these, and sinks and gullies are connected with the sewers. No trough or tank closets, or self-acting tumbler tanks. Not any cesspools.
GREAT CROSBY -	There are 121 waterclosets. No trough closets. The waterclosets, where practicable, are connected with the sewers. There are a few cesspools, these are connected with the sewers.
LITHERLAND -	There are 130 waterclosets; these and sinks and gullies connected with sewers. No cesspools within dwelling houses. There are cesspools, but not connected with the sewers.
WEST DERBY - -	The number of waterclosets about 1,200, trough waterclosets 5. Many are, and the whole will be, connected with the sewers as the works progress. The sinks and gullies are generally connected with the sewers. There are cesspools which are being done away with as the houses are drained into the sewers.
WALTON - ON - THE - HILL.	Number of waterclosets not known; these and sinks and gullies not connected with sewers. There are cesspools, but none within dwelling houses.
TOXTETH PARK -	There have been put to all houses built since 1861 500 waterclosets, pursuant to the byelaws adopted by the Board. There are privies which were constructed prior to that date, but they are not numerous. Trough, tank, and self-acting tumbler tanks

MERSEY BASIN—(MERSEY PROPER).

Series No. 2, Sewerage.—Answers to Queries 7 to 11.—Page 60—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
TOXTETH PARK—*cont.*	have not been used at all. Sinks and gullies are connected with the sewers. There are about 18 cesspools in detached houses scattered in various parts of the district, and not connected with the sewer, but none within dwelling houses.
WAVERTREE - -	About 365 waterclosets. The waterclosets in the inside or sewered district and the sinks and gullies are all connected with the sewers. In the outside or country district cesspools and dry wells are used, but none within dwelling houses.
LITTLE WOOLTON -	About 30 waterclosets, and about 70 cesspools, but not any within dwelling houses.
MUCH WOOLTON -	Number of waterclosets not known, but all the better class of houses are provided with them; they and the sinks and gullies are not yet connected with the sewers. It is intended to abolish what cesspools there are, and drain direct into the sewers.
GARSTON - -	Waterclosets, about 300. No tank closets or self-acting tumbler tanks. There are two or three earth closets. The waterclosets, sinks, and gullies, are connected with the sewers. There are a few cesspools (but none within dwelling houses) in the rural portions of the district not connected with the sewers.
WIDNES - - -	No waterclosets.
SUTTON - - -	Not answered.
PRESCOT - -	A few waterclosets; these, and the sinks and gullies are connected with the old drains; the overflow from cesspools is connected with drains; there are not any cesspools within dwelling houses.
PARR - - -	Not answered.
ST. HELENS - -	There are 250 waterclosets, but no trough or tank closets, and they and the sinks and gullies are connected with the sewers. No cesspools.
NEWTON -IN- MACKERFIELD.	About 40 to 50 waterclosets; these and sinks and gullies are connected with the sewers. There are cesspools, the overflow from each is connected with the sewers.
WARRINGTON - -	From 450 to 500 waterclosets. A public trough closet has been erected as a trial. Waterclosets are generally of ordinary construction, and these and sinks and gullies are all connected with sewers. Very few cesspools, but none within dwelling houses.
PENNINGTON - -	Three waterclosets, and the sinks and gullies of houses are connected with the sewers. There are cesspools, but not within dwelling houses, the overflows from which are connected with the sewers.
WESTLEIGH - -	No waterclosets; the sinks and gullies are connected with the sewers. There are cesspools, but not within dwelling houses, the overflow being connected with the sewers.
HINDLEY - -	Not answered.
ATHERTON - -	Three waterclosets; these and the sinks and gullies are connected with the sewers. There are cesspools, which are connected with the sewers, but none within dwelling houses.
TYLDESLEY - WITH - SHAKERLEY.	About six waterclosets; three of them and sinks and gullies connected with the sewers. No tumbler tanks. There are cesspools, but not within dwelling houses.
RUSHOLME - -	There are 800 waterclosets, and these, sinks, and gullies are connected with the sewers. No cesspools.
BIRKDALE and LEVENSHULME.	The Answers to Queries have not been received from this Local Board of Health.
STOCKPORT -	Cannot say how many waterclosets. There are few cesspools, privies, middens, and ashpits within dwelling houses. There are not many cesspools; the overflow must go into the sewers.
BREDBURY - -	Only one watercloset, and very few sinks and gullies are connected with the sewer. No cesspools.
WALLASEY - -	There are 656 pan closets; these and sinks and gullies connected with sewers. Very few cesspools, and are not connected with the sewers, as they act as a substitute for them. No cesspools within dwelling houses.
BIRKENHEAD - -	There are 4,200 waterclosets, of which about 184 are trough, flushed by 25 tumblers; these, and the sinks and gullies, are connected with the sewers; there are a few cesspools (none within dwelling houses), these also are connected with the sewers.
OXTON - - -	There are 123 waterclosets, and most of them are connected with the sewers. The waste pipes from sinks and gullies are cut off outside the houses, and the refuse flows on the surface into small trapped gullies communicating with the sewer, thus preventing the gases entering houses from the blowing of the traps. There are a few cesspools (none within dwelling houses), which are being done away with as quickly as circumstances will admit.
TRANMERE - -	About 2,000 waterclosets; one trough closet and 16 tumbler closets self-acting; these and sinks and gullies are all connected with sewers. No cesspools.

Mersey Basin—(Mersey Proper).

Series No. 2, Sewerage.—Answers to Queries 7 to 11.—Page 60—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Higher Bebington	About 300 pan and hopper closets, all connected with sewers. There are no trough or tank closets or self-acting tumbling tanks. There are a few cesspools, but not within dwelling houses, and the overflow is connected with the sewers.
Runcorn - -	Not more than 20 waterclosets in the town. In most cases these and sinks and gullies are connected with sewers. Not more than six cesspools; they are not all connected with the sewers. No cesspools within dwelling houses.
Lymm - - -	Number of waterclosets not known; these, and the sinks and gullies, and overflows from cesspools are connected with sewer in the drained portion of the district; no cesspools within dwelling houses.
Altrincham - -	The waterclosets are very numerous, but the exact number has never been ascertained; they are connected with the sewers; there are no trough or tank closets or self-acting tumbler tanks. The sinks and gullies are connected with the sewers. There is a considerable number of cesspools; none within dwelling houses, and in very few cases is the overflow connected with the sewers.
Sale - - -	Not answered.
Watershed of the Irwell, Tributary of the Mersey.	
Barton, Eccles, Winton, & Monton.	There are a considerable number of waterclosets in the district; they and the sinks and gullies are connected with the sewers. There are many cesspools, but none within dwelling houses; they are not all connected with the sewers.
Stretford - -	About 500 waterclosets; the majority of these, and sinks and gullies are connected with sewers. There are cesspools, and in some cases the overflow is connected with the sewers; no cesspools within dwelling houses.
Moss Side - -	About 400 waterclosets; they and the sinks and gullies are connected with the sewers. There are no cesspools.
Salford - -	The number of waterclosets attached to works and houses is 558; they are all connected with either sewers or flow directly into the river *Irwell*, as in the case of some works which skirt the river banks. The sinks and gullies are connected to such of the sewers as have been constructed in the adjacent streets and passages. There are cesspools, and the overflow from them is connected with the sewers. 709 waterclosets; no self-acting tumbler tanks; the greater part are connected with the sewers. There are cesspools; most of them are connected with the sewers. Waterclosets to works and houses, 267. About 75 per cent. are connected with sewers, and the 25 per cent. with cesspools. About 150 cesspools, and the overflow from them is in most cases connected with the sewers. It is believed there are not any within dwelling houses.
Manchester - -	There are from 66,000 to 67,000 dwelling-houses within the city; and although the number is not exactly ascertained it is estimated that there are about 10,000 waterclosets, and, so far as is known, they are all what are called pan-closets; these and the sinks and gullies of the houses are all connected with the sewers. Cesspools are not allowed, and (so far as has been found practicable) are prevented.
Prestwich - -	Not answered.
Swinton - -	About 20 waterclosets. There are cesspools, but not within dwelling houses.
Kearsley - -	Very few waterclosets. No cesspools.
Farnworth - -	About 40 ordinary waterclosets, and these as well as the sinks and gullies are connected with the sewers. No cesspools.
Bolton - - -	There are 300 waterclosets in the town; except at a few of the mills there are no trough or tank closets. The waterclosets, sinks, and gullies of houses are connected with the sewers. There are no cesspools in the town; in former years there were many cesspools, privies, middens, and ashpits within dwelling houses, but these have been removed by the action of the corporation.
Astley Bridge -	No waterclosets. Sinks and gullies are connected with the sewers. No cesspools.
Halliwell - -	No waterclosets, sinks, and gullies are connected with the sewers. No cesspools.
Radcliffe - -	About 20 waterclosets, and it is proposed to have them and the sinks and gullies connected with the sewers. No cesspools allowed; and the byelaws prohibit dwelling-houses, workshops, or other buildings to be erected over privies, middens, or ashpits.
Whitefield - -	About 50 waterclosets, all connected with the sewers. The sinks and gullies are connected with the sewers, but in the better class of houses they have patent stench pipes. Not any cesspools.
Bury - - -	There are 147 waterclosets, chiefly in the better class of houses; there are no trough or tank closets or self-acting tumbler tanks. About half of the waterclosets are connected with the sewers, the others are led into open ashpits, or in case of country houses discharged upon the land. The sinks and gullies of houses are connected with the sewers. Stench traps being invariably used both at the sinks and gullies. There are no cesspools. The byelaws prohibit the erection of dwelling houses, workshops, or other buildings over privies or ashpits.

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 7 to 11.—Page 60—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Ramsbottom - -	There are very few waterclosets, and none have been permitted to be constructed for some years; only a very small number are connected with the sewers, and a few others are connected with old sewers, not constructed by the Local Board, which communicate with the river. There are no cesspools.
Bacup - - -	About 60 waterclosets; one-third of these are connected with the sewers. In those parts of the town where sewers are laid, about 900 sinks and gullies of houses are connected. There are a large number of cesspools. The custom previous to the constitution of Board was to have a cesspool to each privy covered with flags, and in many cases an ashpit over; no cesspools are now allowed except in special cases.
Heywood - -	About 100 closets, and 20 tank closets; about two-thirds of the closets and all sinks and gullies are connected with the sewers. No cesspools.
Rochdale - -	There are about 300 waterclosets, and they are connected with the sewers. No tank or self-acting tumbler tanks are in use. In most cases the sinks and gullies are connected with the sewers. There are some cesspools connected with mills, but they do not flow into the sewers; they are emptied from time to time by the contractor for the removal of night soil. There are not more than half a dozen cesspools under, but none within dwelling houses.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	There are three waterclosets in the district connected with sewers. There are seven cesspools, but not within dwelling houses, and the overflow from each is connected with the sewers.
Failsworth - -	No waterclosets. The sinks and gullies are connected with the sewers. There are a number of cesspools, but they are only connected with the sewers to a very limited extent. No cesspools within dwelling houses.
Bedford, near Manchester.	About 12 ordinary closets; these, and sinks, gullies, and cesspools are connected with the sewers; no cesspools within dwelling houses.
Bradford - -	No waterclosets; sinks and gullies and cesspools are connected with the sewers; no cesspools within dwelling houses.
Openshaw - -	There are no waterclosets.
Gorton - - -	About 40 waterclosets, and these and sinks and gullies are connected with the sewers. No tank closets. There are only three cesspools, which are connected with the sewers; and one cesspool within dwelling house.
Droylsden - -	About 12 waterclosets, connected with sewers. No trough or tank closets or self-acting tumbler tanks. The gullies are connected with the sewers. There are three cesspools, middens, and privies within dwelling houses.
Oldham - -	About 700 waterclosets, all connected with sewers. Not any trough or tank closets. The sinks and gullies are generally connected with the sewers. There are no cesspools.
Crompton - -	The number and construction of waterclosets not known; not connected with sewers. Sinks and gullies very partially connected with the sewers. No cesspools.
Royton - - -	Very few waterclosets; sinks, and gullies are generally connected with the sewers. No cesspools.
Lees - - -	No record is kept of the number of waterclosets. There are cesspools in some cases connected with the sewers, but none within dwelling-houses.
Watershed of the Bollin, Tributary of the Mersey.	
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	There are 220 waterclosets, not any trough closets, or self-acting tumbling tanks. The waterclosets are mostly connected with the sewers, but in several instances the drains from closets empty into a cesspool, and the overflow only goes into the sewers. As far as possible pipes from sinks are turned on to the surface to adjacent grid, and there are few openings or traps inside. There are very few cesspools. Some are connected with sewers.
Bollington - -	No waterclosets; sinks and gullies are connected with the sewers. No cesspools.
Watershed of the Weaver, Tributary of the Mersey.	
Northwich - -	Sixty waterclosets, not connected with sewers. There are no trough or tank closets, or self-acting tumbler tanks; some of the sinks and gullies are connected with the sewers. There are cesspools, but not within dwelling houses; but the overflow, if any, from them, is not connected with the sewers.
Witton-cum-Twambrookes.	Very few waterclosets, and they and the sinks and gullies are connected with the sewers. Not any cesspools.

Mersey Basin (River Weaver).

Series No. 2. Sewerage.—Answers to Queries 7 to 11.—Page 60—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Sandbach	There are four closets, and these are connected with main sewer. There are no trough tank closets or self-acting tumbler. The sinks and gullies are also connected with the sewers. There are cesspools, but not within dwelling houses, and they are mostly connected with the sewers.
Monks Coppenhall	There are very few waterclosets. The sink pipes are made to empty outside the walls upon a trapped gully, thereby preventing any smell coming up from the sewer into the houses. This should be more generally enforced at other places, as it is more conducive to health than many sanitary arrangements, and very simple. There are a few cesspools but none within dwelling houses, and steps are being taken to cause them to be removed.
Tarporley	Not answered.
Nantwich	About 300 pan closets, and connected with sewers. No cesspools.
Congleton	The Answers to Queries have not been received from this Borough.
RIBBLE BASIN.	
Watershed of the Ribble Proper.	
Southport	There are 1,050 waterclosets. These and sinks and gullies drained into cesspools. No tank closets. There are cesspools, privies, middens, and ashpits within dwelling houses.
Kirkham	The Answers to Queries have not been received from this Local Board of Health.
Fulwood	About 75 waterclosets; these and sinks and gullies all connected with sewers. No cesspools.
Preston	There are about 2,300 waterclosets, all connected with sewers, not any trough or tank closets, or self-acting tumbler tanks. No cesspools within dwelling houses. Sinks and gullies are connected with the sewers. Cesspools all drained into sewers.
Leyland	A few houses of the better class have waterclosets, but these, and the sinks, gullies, and cesspools are not connected with the sewers.
Clitheroe	Very few waterclosets; no trough or tank closets. The sinks and gullies are connected to such drains as exist. There are cesspools; the overflow is not directly connected with the drains. No cesspools within dwelling houses.
Watershed of the Calder, Tributary of the Ribble.	
Clayton-le-Moors	Not more than five or six waterclosets; two only connected with the sewers. House drainage is being carried out. No cesspools.
Oswaldtwistle	There are six waterclosets. No trough or tank closets or self-acting tumbler tanks; they and the sinks and gullies are connected with the sewers. There are cesspools (none within houses); these are also connected with the sewers.
Accrington	Very few waterclosets. The waterclosets, sinks, and gullies that are near the line of sewers are connected. There are cesspools, but not within dwelling houses, and the overflow is connected with the sewers.
Burnley	The number of waterclosets is at least 500, and they and the sinks and gullies are connected with the sewers. The overflow from the cesspools is in most cases connected with the main sewers. No cesspools, &c. within dwelling houses.
Brierfield	About six waterclosets; there are no public sewers.
Nelson	There are 12 waterclosets, these are not connected with sewers; the sink and gullies are connected with old drains; there are cesspools.
Watershed of the Darwen, Tributary of the Ribble.	
Blackburn	There are 700 waterclosets, and these and the sinks and gullies are connected with the sewers. There are cesspools and a trap is formed at the bottom of them, and all the liquid is conveyed through it to the sewers. There are no cesspools within dwelling houses; they are all situated in yards behind the houses and about 20 feet therefrom.
Great Harwood	No waterclosets; sinks and gullies are connected with the sewers; no cesspools.
Over Darwen	There are about 60 waterclosets; they, sinks and gullies and cesspools are connected with the sewers; no cesspools within dwelling houses.
Watershed of the Douglas, Tributary of the Ribble.	
Croston	There are several waterclosets; only one connected with sewers. There are cesspools, but none within dwelling houses.
Chorley	About 200 waterclosets, all and sinks and gullies connected with sewers. No tank closets. No cesspools.

Mersey Basin—(River Douglas).

Series No. 2, Sewerage.—Answers to Queries 7 to 11.—Page 60—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Ormskirk	There are 125 waterclosets; no troughs except at the workhouse; about 12 tank closets, the principal are from screw down tap, and basin and trap; all (except two or three) are connected with sewers. The greatest portion of sinks and gullies are connected with the sewer, some flow down grooved channels to S trap and grate. There are two or three cesspools which have no connexion with the sewer.
Wigan	Closets are not generally in use; can't say how many, they and the sinks and gullies are connected with the sewers. There are numerous cesspools, but none within dwelling houses, and they are generally drained into the sewers.

Series No. 2, Sewerage.—Queries——12. What number of privies, middens, or ash-pits are there?——13. Are they connected with the sewers?——14. Are they cleansed systematically, at what intervals?——15. By whom?——16. What is the cost annually?——17. If done by local authority, what amount is obtained for the refuse?——18. What weight of refuse is removed annually?——19. To what purpose is the refuse devoted?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
MERSEY BASIN.	
Watershed of the Etherow, Tributary of the Mersey.	
Hollingworth	The Answers to Queries have not been received from this Local Board of Health.
Glossop	Do not know the number of privies, middens, or ashpits, they are not in all cases connected with sewers. Each party attends to his own; the landlords for cottage tenants. The sanitary inspector has the superintendence of this department. The refuse is sometimes used for manure.
Watershed of the Goyt, Tributary of the Mersey.	
Yeardsley-cum-Whaley.	About 100 privies; cleansed by the owners or occupiers as often as requisite.
Watershed of the Tame, Tributary of the Mersey.	
Hyde	A considerable number of privies, middens, and ashpits; these are generally connected with the sewers. When any require cleansing the Nuisance Inspector gives notice to the tenants, and this is then done by owners or tenants generally.
Denton	About 400 privies; connected with sewers; only cleansed when the nuisance inspector requires it to be done, and then by the occupiers.
Dukinfield	About 2,000 privies, and about 900 ash-pits; for the most part they are connected with the sewers; not systematically cleansed and by the owners.
Stalybridge	About 2,000 privies; in many cases they are not connected with the sewers; they are not systematically cleansed; are not done by the Local Authority; refuse used for levelling and raising land.
Ashton-under-Lyne	There are 6,250 privies, 400 ash-pits. They are connected with the sewers; are cleansed as often as required, about four times a year on an average, by men employed by the corporation, at an annual cost of 1,646*l.* Amount obtained for 6,637 tons in 1867–8, 95*l.* Dry rubbish disposed of in the best manner possible, but not to a profit; night soil used for agricultural purposes.
Hurst	Some of the privies, middens, and ashpits, are connected with the sewers; they are cleansed by the owners, but not systematically.
Mossley	In one or two instances the privies are connected with the sewers, but notice is about to be given to disconnect them. They are not cleansed systematically.
Watershed of the Mersey Proper.	
Liverpool	The number of privies is estimated at about 20,000. Many of these have a midden or ash-pit, but in many cases also one midden or ash-pit is common to two privies. These are connected with the sewers and are cleansed systematically by men employed by the corporation when found or reported to be full or nearly so, but not at regular intervals, without reference to their condition. The intervals vary considerably according to the capacity of the receptacle and the number of individuals using the same, say from one month to twelve. The net cost of the cleansing of middens and ash-pits by the scavenging department for the year 1867, the first year of the present system, was 23,068*l.* 16*s.* 9*d.* The cost for the present year, 1868, may be estimated approxi-

Mersey Basin—(Mersey Proper).

Series No. 2, Sewerage.—Answers to Queries 12 to 19.—Page 65—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Liverpool—*cont.*	mately at 21,000*l.* The amount received for 111,022 loads in the year 1867, about 7,000*l.*, for 138,777 tons in the year 1868, about 8,000*l.* The bulk of the refuse is sold as manure. Dry ashes and rubbish are deposited on vacant ground, building sites, and in delphs.—[R.E.]
Waterloo - with - Seaforth.	There are 819 ash-pits with privies, and 300 ash-pits and middens without privies. Connected with the sewers, with the exception of a few of the middens. Cleansed systematically, whenever required, by night soil contractor, at a cost of 250*l.* per annum. The weight of the refuse removed annually is about 1,100 tons.
Great Crosby -	There are 451 privies; these are connected with sewers, cleansed by the occupiers; and in default by men employed by the Board; cost not paid out of rates. A contractor takes the refuse, in addition to a small charge payable by the occupiers; it is used for agricultural purposes.
Litherland - -	There are 386 privies and ash-pits; connected with sewers; emptied whenever required by the owner or occupier. Refuse used for agricultural purposes.
Birkdale - -	The answers to queries have not been received from this Local Board of Health.
West Derby - -	There are about 3,300 privies and about 3,000 middens or ash-pits. They are being connected with the sewers. They are emptied and cleansed when required; by a contractor under this Board at a cost of 300*l.* per annum, the contractor taking the refuse, and disposes of the night-soil to farmers for agricultural purposes.
Walton - on - the - Hill.	Number not known. Not connected with sewers. Cleansed by occupants.
Toxteth Park -	There are 110 privies, middens, or ash-pits. Both middens and ash-pits, in the majority of cases, are connected with the sewers. They are cleansed systematically, and on an average of about every two months. By a contractor, whose contract is 130*l.* per annum for the current year. Receipts, *nil.* The refuse removed is estimated at about 1,370 tons annually. Where night soil is mixed with the ashes it is sold by the contractor as manure to the neighbouring landowners and farmers; ashes only are deposited in hollow places or pits.
Wavertree - -	About 520 privies and middens in the village, and 150 in the outside district. Connected with sewers in the inside, but not in the outside district. Emptied by contract in the inside district within seven days from receipt of notice from tenant of house. In the outside district tenants get them emptied when required by a contractor. Costs, 120*l.* a year. Contractor takes the refuse, 930 tons annually, under his contract, and sells it to farmers and others.
Little Woolton -	About 130 privies and ash-pits. Some are connected with private sewers; they are emptied about four times a year by the farmers.
Much Woolton -	There are 553 privies; they are not connected with the sewers. Cleansed by farmers of the adjoining district.
Garston - -	About 1,000 privies, generally connected with the sewers, cleansed when full by the occupiers; there is no cost to the board, and the refuse is devoted to the manuring of land.
Widnes - -	There are 1,950 privies, 1,540 ash-pits. Connected with sewers. Emptied quarterly by men employed by the Local Board. Costs, 385*l.* 13*s.* 5*d.* Receive 150*l.* per annum for 1,800 tons refuse removed. Used for agricultural purposes.
Sutton - - -	The privies and middens are cleansed when required by men employed by the Local Board of Health, and the refuse is used for dressing land.
Prescot - - -	There are a few privies, middens, and ashpits; these are cleansed three or four times a year by men employed by the Local Board, at a cost of about 100*l.*; and the refuse of about 1,300 tons is sold for about 100*l.* to farmers, and used for agricultural purposes.
Parr - - -	Privies and ashpits cleansed by contractor to Local Board. At a cost of 15*l.* per annum. Refuse belongs to and is sold by the contractor.
St. Helen's - -	About 6,000 privies and 4,000 ash-pits. A portion only are connected with the sewers. There is a considerable population scattered over the more rural districts of the Borough, and at Sutton Oak, Parr Stocks, St. Anns, and Windle City are clusters of undrained dwellings. The privies, middens, and ash-pits are cleansed only as occasions requires, by men employed by the corporation acting as trustees under the St. Helen's Improvement Act, 1855, and by the Parr and Sutton Local Boards of Health. The refuse remains the property of the contractor, in addition to the sum of 300*l.*, which is the amount of contract for cleansing that portion known as St. Helen's "proper;" it is disposed of to the farmers for manure.
Newton - in - Mackerfield.	About 600 privies, &c. Connected with sewers. Emptied when required by a contractor. At a cost of from 40*l.* to 50*l.* per annum. The refuse belongs entirely to the contractor, and is used on grass land chiefly.

Mersey Basin—(Mersey Proper).

Series No. 2, Sewerage.—Answers to Queries 12 to 19.—Page 65—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Warrington - -	About 4,500 privies, and 4,000 ash-pits, generally connected with sewers. Ash-pits and privies are emptied by a contractor employed by the corporation, and as soon as they are full. Corporation pay 450*l.* for three years, or 150*l.* per year. 700 tons cinders; 5,500 tons cinders and night-soil mixed.
Pennington - -	About 1,000 privies. Connected with the sewers. They are cleaned out when required; by men employed by the Local Board. Costs, about 80*l.* Receive about 40*l.* for 1,000 tons of refuse, which is spread upon land for agricultural purposes.
Westleigh - -	About 1,000 privies. A considerable portion of them are connected with the sewers. They are emptied when full. By farmers of the locality. Refuse applied to the land for agricultural purposes.
Hindley - -	About 800 privies. Not generally connected with sewers. Emptied by farmers.
Atherton - -	About 1,400 privies and ash-pits. The bulk of them in the town of Chowbent are connected with the sewers. No system of cleansing; they are emptied when full by the farmers in the locality, at no cost to the Local Board.
Tyldesley - with - Shakerley.	About 500 privies. The greater portion are connected with the sewers. Emptied when required by farmers.
Rusholme - -	There are 1,350 privies, with ash-pits connected therewith. Drained into sewers. Are cleansed at irregular intervals, as required, by men employed by the Board; at a cost of 300*l.* per annum. 12*l.* per annum is received for 4,000 tons of refuse.
Levenshulme -	The answers to queries have not been received from this Local Board of Health.
Stockport - -	About 5,660 privies. In some cases they are connected with sewers, emptied whenever the nuisance inspector requires it, and by the parties to whom they belong under the penalties of the Act. Not done by the Local Authority, save when the parties are contumacious. The refuse is worth nothing, the cost exceeds the value. Cannot give the weight of refuse, it is used for agricultural purposes.
Bredbury - -	Many privies, but mostly dry and not injurious to health. Not connected with sewers. Emptied several times a year by the farmers in the township. Refuse is used for agricultural purposes.
Wallasey - -	1,698 privies. In nearly every case connected with sewers. Emptied when requiring it by the Board's contractor. Costs about 350*l.* with refuse, which is used for agricultural purposes.
Birkenhead - -	There are 3,400, privies, with middens, most of them connected by a drain with the sewers, cleansed systematically as they become full (and whenever required by a notice from the occupiers or the Inspector of Nuisances) by the contractor with the local authority, at a cost of 1,400*l.* to 1,500*l.* a year. The refuse is the property of the contractor, and used for agricultural purposes.
Oxton - - -	There are 507 privies, connected with the sewers where practicable; cleansed when required by a contractor, at a cost of 36*l.* per annum; nothing received for the refuse, which is devoted to agricultural purposes.
Tranmere - -	About 2,000 privies. They are connected with sewers, and emptied as soon as required by a contractor employed by the Local Board and his staff. Cost 350*l.* per annum. Nothing received for refuse. Cannot say weight. But is used for agricultural purposes.
Higher Bebington	About 140 privies. Connected with sewers. They are cleansed within 48 hours after notice left at the office of the Local Board, by a contractor who undertakes the work for an annual sum of 100*l.*, and takes the contents.
Runcorn - -	As a general rule, one privy to every house, but in some cases there is only one for three or four houses; all connected with the sewers. Emptied when full by the contractor at a cost of 300*l.*, and he has the refuse, about 5,000 tons, which is used for farming purposes.
Lymm - - -	Do not know number of privies; these are connected with sewers in the drained portion of the district; they are cleansed by owners but not systematically, under the direction of the Nuisance Inspector.
Altrincham - -	There are a large number of privies; they are not connected with the sewers; are cleansed when required, but not at stated intervals, and by the occupiers of houses to which they are attached.
Sale - - -	Not answered.
Watershed of the Irwell, Tributary of the Mersey.	
Barton, Eccles, Winton, & Monton.	When required the privies and ash-pits are emptied by the occupiers of houses.
Stretford - -	Cannot give the number of privies, middens, and ashpits. These are cleansed every three months by a contractor employed by the Local Board, at a cost of 200*l.*; who removes about 1,800 tons of refuse, and uses it for agricultural purposes.

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 12 to 19—Page 65—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Moss Side	The privies are connected with the sewers, and cleansed three or four times a year, as occasion may require, by men employed by the Board of Health, at a cost of 145*l.* 12*s.* per annum. This manure is not in much request, and is sometimes difficult to dispose of. The amount received for it is about 20*l.* per annum, and the refuse is used for agricultural purposes.
Salford	*Salford District.*—Privies and ashpits attached to houses and works, 10,342. Many of them are connected with sewers, but some have no drains whatever. The ashpits, privies, &c. are cleansed when they are full or whenever notice is received from the inhabitants that they require emptying, by men employed by the corporation. The cost in the year 1867 was 5,056*l.* The amount obtained in the year 1867 was 2,940*l.* The average weight of refuse for the last four years is 26,300 tons. Sold for agricultural purposes and sent by the river and canal to farmers within a radius of about 20 miles. *Broughton District.*—Privies and ashpits, 4,141. Generally connected with sewers. They are emptied on an average every four months by men employed by the corporation. Cost 300*l.* annually. Taken by the contractors as part remuneration. The weight of refuse about 3,000 tons. That portion which is valueless for agricultural purposes is cast away as rubbish on vacant land at a distance from buildings. *Pendleton District.*—Privies and ashpits, 7,079. Ashpits partially connected with sewers. Same answer as Salford district. Cost 1,515*l.* annually. Amount obtained 933*l.* The weight of refuse about 9,357 tons. Used for agricultural purposes.
Manchester	About 38,000 privies, with ash-pits connected therewith. In many cases the privies, middens, or ash-pits are connected with the sewers; but the corporation object to any water being allowed to pass into any ash-pit. Additional powers have been recently obtained, and the corporation are taking steps to compel the ash-pits to be altered, or constructed in such a manner as may be considered to be most desirable in a sanitary point of view. It will necessarily occupy some time before the corporation can effectively and satisfactorily deal with the large number of ash-pits which, as already stated, exist in the city. The privies and ash-pits throughout the city are systematically emptied and cleansed by the men employed by the corporation, without delay when the necessity is stated to exist, either by notice from the inhabitants or from any of the corporation officers. During the last year the gross cost, including carriage of manure to farmers, was 17,660*l.* 10*s.* 4*d.* The amount received during the same year for manure sold, and freight and carriage refunded, was 6,740*l.* 0*s.* 8*d.* During the same year the quantity of refuse removed, suitable for manure, was 73,594 tons, and of rubbish 47,393, or a total of 120,987 tons. The refuse is used as manure in Yorkshire, Lincolnshire, and Cheshire, and other places, and chiefly for growing turnips, potatoes, wheat, and grass.
Prestwich	The ash-pits are emptied when required by order of the nuisance inspector to the Board and by the contractor engaged by and at the expense of the board. The cost is 1*s.* 6*d.* per ash-pit emptied. Nothing is obtained for the refuse. It is part of the agreement with the contractor that he should have it.
Swinton	There are 1,800 privies; emptied partly by the owners and occupiers.
Kearsley	Privies and ash-pits average about one to every three houses, in some instances they are connected with sewers; cleansed at intervals when required; by owners or occupiers. Refuse used for farming purposes.
Farnworth	There are 1,400 privies, connected with sewers in many cases; emptied when required; generally by the occupiers, and in all cases of neglect by the Local Board, the occupiers being in all such cases charged with the cost. The refuse is used for agricultural purposes.
Bolton	There are 6,890 privies and middens or ash-pits. The privies are in connexion with the ash-pits, and the latter are drained into the sewers so as to prevent the accumulation of water. Both are systematically cleansed by the corporation as often as they become filled, at an annual cost, as shown by the last published accounts (year 1867–8), 3,172*l.* 8*s.* 8*d.*, towards which a sum of 1,567*l.* 17*s.* 10*d.* is obtained by sale of the refuse. The weight of refuse removed for the year ending 30 June 1868 was 22,465 tons; part of this thrown away, and the remainder sold to farmers.
Astley Bridge	There are 965 privies, middens, and ashpits; these where practicable are connected with the sewers and are properly cleansed, but at uncertain intervals, by the neighbouring farmers, at no cost to Local Board of Health; farmers use refuse for tilling their land.
Halliwell	There are 829 privies and ash-pits; they are not connected with the sewers; are properly cleansed, but at uncertain intervals, by the neighbouring farmers.
Radcliffe	About 500 privies; the refuse is removed by the farmers in the district for agricultural purposes when necessary.
Whitefield	The ashpits to the newly-erected property are drained directly into the sewers. Cleansed principally by farmers in the neighbourhood, and the refuse is devoted to agricultural purposes.

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 12 to 19.—Page 65—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bury	There are 3,765 privies, 2,400 ashpits. In some cases one ashpit serves for two or more privies. Some of the ashpits are connected with the sewers for draining the rain water, but a method of filtering is adopted by the drainage passing through stones and gravel and thence into earthenware pipes with a perforated rose head. The ashpits are cleansed systematically by the scavengers of the Commissioners, a strict supervision being made by the sanitary inspector, at a cost of 700*l.* annually, including keep of horses and men's wages, but exclusive of inspector's salary. The manure (*i.e.*, a mixture of fæcal matter and ashes) only is sold; it realizes about 100*l.* per ann. The refuse removed is about 7,000 tons, exclusive of street sweepings, which is about 3,000 tons. The dry ashes, which are not mixed with night soil, are used for filling up hollows in the suburbs of the town. The manure is used for agricultural purposes.
Ramsbottom	The number of privies is not known; they are not connected with sewers; cleansed whenever required or at the request of any householder; by a contractor under the Local Board, at a cost of 45*l.* per annum; nothing is obtained for the refuse; it is allowed to be removed by certain landowners and occupiers of land in the neighbourhood without payment in consideration of their carting it away free of charge to the Board.
Bacup	About 640 privies; not connected with sewers. When a cesspool or ash-pit requires emptying, the fact is communicated to the nuisance inspector, after which the place is emptied as quickly as possible. By a contractor on behalf of the Local Board. Average cost since constitution of Board 400*l.* per annum. Remove about 5,000 tons. Nothing is obtained for the refuse, it is the property of the contractor for the time being.
Heywood	About 100 privies, and 800 ash-pits. About 100 are connected within the sewers; they are cleansed when necessary, by owners and occupiers, and under the direction of the nuisance inspector. Refuse taken away by the farmers in the district and used for agricultural purposes.
Rochdale	About 4,000 privies. In some cases they are connected with the sewers. Formerly they were cleansed by men employed by the corporation when notice was given by the owners or occupiers; but now the corporation contract for the removal of the night soil, ashes, rubbish, and filth, at a cost of 1,300*l.* per annum. The contractor takes the refuse, about 4,500 tons. The parts suitable for manure are devoted to agricultural purposes; the other parts the contractor picks where he can.
Crumpsall	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath	About 1,550 privies. Connected with sewers so far as sewerage has been completed. They are cleansed when full or required by the inspectors of nuisances. By men employed by the contractors. Cost 300*l.* Receipts, *nil.* About 3,600 tons removed; the night soil is used for agricultural purposes, and the rubbish is used for filling up holes and hollow places in the land occupied by the contractor, who is a farmer.
Failsworth	About 400 privies. Only one connected with the sewers. They are cleansed by owners of property as occasion requires. Refuse used as manure principally to the land.
Bedford, near Manchester.	About 700 privies, middens, and ashpits, overflow from which only connected with sewers; are emptied when full by farmers in the township; the refuse is used as manure for land.
Bradford	About 1,000 privies, middens, and ashpits; these are connected with the sewers; are cleansed whenever required by a contractor under Local Board, at a cost of 100*l.* yearly; nothing received for the refuse.
Openshaw	About 2,000 privies. Not connected with sewers. Emptied at various intervals according to requirements, by contractor for cleansing ash-pits, privies, &c., and removing the soil. Cost 350*l.* The contractor, who farms land in the adjoining district of Gorton, applies the 600 tons of refuse removed to his own use.
Gorton	About 3,900 privies, and about 2,400 ash-pits; they are connected in all the parts of the district to which the main sewers extend. There is no regular system of cleansing them; but they are emptied about twice a year by men who make a trade of it, and the refuse is partially removed in carts belonging to the Local Board, and is used for agricultural purposes.
Droylsden	About 700 privies. 400 ash-pits. For the most part they are connected with the sewers, and they are emptied when, in the judgment of the inspector of nuisances, they seem to require it, and by the owners.
Oldham	Privies 2,305. Ash-pits 2,735. Boxes for the reception of night soil, 69. Not any connected with sewers, emptied as required by men in the employ of the corporation. Net cost, including plant, 4,000*l.* per year. Receive about 2,000*l.* for about 50,000 tons of refuse, exclusive of street sweepings. Sold principally to farmers in the district of Ormskirk.
Crompton	Number of privies not known; they are not connected with sewers; are cleansed by the owners. The refuse used generally for agricultural purposes.

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 12 to 19.—Page 65—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Royton	About 300 privies; not connected with the sewers, and not systematically cleansed.
Lees	Privies not connected with sewers. Cleansed only when thought necessary by the owners. The refuse is put on land for farming purposes.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield	There are 2,945 privies and 2,186 ash-pits; connected with sewers; cleansed about every three months by men appointed by the Local Board; at a cost of about 250*l.* per annum. The refuse realizes the cost which is incurred in its removal. About 3,000 tons is removed, and it is carted away by farmers for manure.
Bollington	About 289 privies, middens, and ashpits, not connected with sewers, are not cleansed systematically; the refuse is taken away by farmers in the neighbourhood and used for agricultural purposes.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich	Not more than 150 privies; not connected with sewers; cleansed often as required by owners or occupiers. The Local Board have adopted to an extent, as an experiment, the process of the Patent Eureka Company, and pay 12*l.* annually for the emptying of the boxes, and obtain for the refuse perhaps 5*l.*, not more, which is used for agricultural purposes.
Witton-cum-Twambrookes.	Probably 700. In very few cases are they connected with the sewers; they are emptied when requisite by the occupiers. Refuse sold to farmers, or given away.
Sandbach	There are 1,120 privies, middens, and ashpits; they are generally connected with the sewers; are not cleansed systematically and *never will be* until the Local Board are by law compelled to cleanse them at stated intervals. It is possible that the cost of doing this would not be recouped by the return for the refuse, but the ratepayers would greatly benefit by the proper removal of the rubbish in improved health, &c. &c. &c.
Monks Coppenhall	About 3,000 privies and 1,500 ashpits; they are generally connected with sewers, but builders try to shirk the drainage of them. Cesspits are now being made at the outside of the privies, covered over by a flag, keeping the night soil and the ashes separate. They are emptied when full by the contractor to the Board at a cost of 300*l.* per annum. Contractor makes what he can of night soil to farmers for manure. No demand for ashes, except to fill up pits and hollows in the outskirts of the town.
Tarporley	The privies are emptied when required by the occupiers of the houses; refuse used for agricultural purposes.
Nantwich	About 1,000 covered ashpits, but no covered cess-pits to houses. Not connected with sewers. Emptied about twice a year by the owner or the parties who purchase the manure. Refuse used for agricultural purposes.
Congleton	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport	There are 3,050 privies and ashpits connected with sewers. Cleansed as often as considered necessary by night soil men employed by the corporation. Cost about 1,000*l.* Receipts, 740*l.* About 9,000 tons removed. Sold to neighbouring farmers to manure their land.
Kirkham	The Answers to Queries have not been received from this Local Board of Health.
Fulwood	Each house has an ash-pit; not in all cases connected with sewers; cleansed by the tenants when requisite. The refuse, being chiefly ashes, is used for filling up roadside ditches.
Preston	About 8,000 privies; all drained into sewers; they are cleansed when required on giving notice at the office of the Local Board; by contractors employed by the corporation. The cost is 1,431*l.*, this being the amount paid by the Local Board to the contractors, who in addition take and dispose of 25,000 to 30,000 tons of refuse. The contractors sell the night soil and street sweepings to farmers. Other refuse is used for filling up land.
Leyland	There is generally one privy, midden, and ash-pit to each house; not connected with sewers. They are cleansed when thought to require it by the owners or occupiers of the property at no cost to the Local Board, and this district being in a great measure an agricultural one, the refuse is put upon the land.
Clitheroe	There are about 1,680 privies. The Local Board employ scavengers regularly to empty the privies and ash-pits, at a cost of 70*l.* Obtain 46*l.* for 1,200 tons of refuse used for agricultural purposes.

Ribble Basin—(River Calder).

Series No. 2, Sewerage.—Answers to Queries 12 to 19.—Page 65—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	Nearly every house is provided with privy and ash-pit. Not any connected with sewers. Emptied as occasion requires by the occupiers. Refuse used for agricultural purposes.
Oswaldtwistle	About 1,500 privies, most of them connected with the sewers; they are not systematically, but are cleansed out when full by the owners or occupiers, and the refuse is used for manure.
Accrington	About 2,000 privies. Ash-pits are connected with the sewers to drain surface water only. They are cleaned when required by the Board, at a cost of about 300*l.* Liquid manure is used for agricultural purposes, and the other refuse is disposed of as best we can.
Burnley	About 2,500 privies, all connected with sewers. They are cleansed when required by the occupiers of the premises or the owners of the property, or, in default, by the inspector of nuisances at their expense. Refuse used for agricultural purposes.
Brierfield	About 300 privies, middens, and ash-pits, cleansed generally when necessary by the owners or occupiers of houses; refuse used for agricultural purposes.
Nelson	There are 575 privies and 456 ash-pits. None are connected with the drains. They are emptied about four times a year by the occupiers or owners of houses; cost about 2*s.* 4*d.* each time. About 200 tons of refuse removed and used for filling and levelling low places, except night soil, which is taken away for agricultural purposes.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn	About 13,500 privies and 6,700 middens or ash pits; in most cases there is one privy to each house and one ashpit to two privies. They are so connected to the sewers as only to convey the liquid thereto. They are cleansed when required, or on receiving notice from the tenants of the house, by men employed by the corporation; at a cost of, in 1866 and 1867, 1,638*l.* 15*s.* 5*d.* per annum. Amount obtained for refuse in 1866 and 1867, 257*l.* 9*s.* per year. Refuse removed, 2,605 tons, comprising two-thirds ashes and one-third excrement; also 580 tons of excrement not mixed with ashes. The clean ashes are thrown away, the privy refuse is sold to farmers.
Great Harwood	About 600 privies, middens, and ash-pits. They are not connected with the sewers; are not cleansed systematically, but by owners of the property; refuse used for agricultural purposes.
Over Darwen	There are upwards of 4,000 privies, middens, and ash-pits; about one-third of them are connected with the sewers. They are cleansed systematically by a contractor under the Local Board of Health at a cost of 550*l.* a year, and the sum of 95*l.* 7*s.* 6*d.* is received for the refuse, which is removed and used for agricultural purposes.
	Watershed of the Douglas, Tributary of the Ribble.
Croston	Most of the houses have privies, middens, or ash-pits. Some are connected wish sewers. They are cleaned out as occasion requires by the owners. Weight of refuse not known; used for agricultural purposes.
Chorley	About 1,000 privies connected with sewers; emptied as soon as full by men employed by Chorley Commissioners. Cost about 290*l.* Receive about 100*l.* per annum. Remove about 5,000 tons. Used for agricultural purposes.
Ormskirk	Where practicable the privies, middens, and ash-pits are connected with the sewer. When full they are cleansed by the farmers in the neighbourhood, under the directions of the inspector of nuisances, at no cost to the Local Board. The night soil is used by the farmers for agricultural purposes, and street sweepings for the same purpose.
Wigan	About 1,500 privies and ashpits, and these are drained into sewers. They are cleansed regularly, as often as required, by a contractor employed by the Local Board, at a cost of 800*l.* per annum, and the refuse belongs to the contractor and is sold as manure.

SERIES No. 2, SEWERAGE.—QUERIES——20. Is there a ready sale for the refuse, and does the amount received for it exceed the cost of cleansing the privies, middens, and ash-pits, and removing refuse; or does it only cover the cost; or is there an annual deficiency; state the amount in either case?——21. To what extent is the refuse employed?——22. Is the cleansing of the privies, middens, and ash-pits complained of as a nuisance affecting the health and comfort of the inhabitants?——23. Are disinfectants used, if so, state them, and are they efficient in preventing smell?——24. Is sickness attributed to the privies, middens, and ash-pits?

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
HOLLINGWORTH -	The Answers to Queries have not been received from this Local Board of Health.
GLOSSOP - - -	There is no sale for the refuse; the other Queries not answered.
	Watershed of the Goyt, Tributary of the Mersey.
YEARDSLEY - CUM - WHALEY.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
HYDE - - -	Some of the refuse is taken by farmers; there are no complaints. Sulphate of iron is used as a disinfectant, and is a very efficient preventitive. Sickness is not attributed to the privies, middens, and ashpits.
DENTON - - -	There is no sale for the refuse; on the contrary, it costs at least 2*s.* per ton to get it taken away. The privies are complained of. The Board of Health always keeps carbolic acid to supply gratuitously, but it is very rarely applied for. Sickness is attributed to the ash-pits, privies, and middens.
DUKINFIELD - -	No sale for it. It is all considered waste refuse, and is used to fill up hollows. Sometimes the cleansing of the privies is complained of.
STALYBRIDGE - -	There is no sale at all for the refuse. No part of it is used for agricultural purposes. It is believed that sickness is not attributed to the privies.
ASHTON - UNDER - LYNE.	Sale of refuse difficult. An annual loss of about 1,550*l.* a year, or thereabouts. The mode of emptying the privies not complained of.
HURST - - -	The removal of refuse from privies by the inhabitants is very irregular and is complained of as a nuisance. There is a difficulty in getting rid of it.
MOSSLEY - -	The removal of refuse by the inhabitants from privies is very irregular, and is complained of as a nuisance. There is a difficulty of getting rid of it. Chloride of lime is used in summer time by the Board to the sewers and bad places. Sickness has in some instances been attributed to the middens, privies, and ash-pits.
	Watershed of the Mersey Proper.
LIVERPOOL - -	There is a ready sale for all that can be made manure of, but the prices at present obtained do not cover more than about one-third the cost of collection and removal. The deficiency in 1867 was about 16,000*l.* In 1868 it probably will be 13,000*l.* Contents of middens readily and entirely disposed of. Mere ashes and rubbish difficult to get rid of. Proportion of the latter increasing, owing to conversions. In 1866 a memorial was presented to Mr. Secretary Walpole on the subject of the manure wharves and midden system by certain inhabitants of the borough, in consequence of which Mr. A. Taylor was sent down to inquire into and report upon the whole question. His report was printed, and is herewith sent. Sickness (and especially the summer and infantile diarrhœa) is attributed by the medical officer to the emanations from privies and middens.—[M.O.]
WATERLOO - WITH - SEAFORTH.	There are no complaints, but on the contrary the mode of cleansing seems to give general satisfaction. No disinfectants are used.
GREAT CROSBY -	The cleansing is not complained of. Disinfectants are not used, and sickness is not attributed to the privies.
LITHERLAND - -	All used for agricultural purposes. Carbolic acid and chloride of lime, both of which are efficient. No complaints as to sickness or as a nuisance.
BIRKDALE - -	The Answers to Queries have not been received from this Local Board of Health.
WEST DERBY - -	The Board pays 300*l.* a year for the removal, and the contractor takes the refuse for his own benefit. Carbolic acid has been and is used occasionally with satisfactory results. Sickness has been attributed to the middens and ash-pits.
WALTON - ON - THE - HILL.	No complaints; disinfectants are used in case of fever.
TOXTETH PARK -	The Board cannot tell the amount received, but it is comparatively trifling compared to the cost of removal. The total deficiency to the Board is the amount of the contract,

MERSEY BASIN—(MERSEY PROPER).

Series No. 2, Sewerage.—Answers to Queries 20 to 24.—Page 72—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
TOXTETH PARK—*cont.*	130*l.* per annum. The cleansing is done chiefly at night. No disinfectant used. In one locality fever was frequent before the middens were drained, but since then it has almost entirely disappeared.
WAVERTREE - -	Not very ready sale. Amount realized small; much under the price of the contract. The other queries not answered.
LITTLE WOOLTON -	Not answered.
MUCH WOOLTON -	No. No disinfectants used. The privies, middens, and ash-pits from not being properly drained are undoubtedly prejudicial to health.
GARSTON - -	The cleansing of the privies is not complained of. Chloride of lime is used when requisite, and is found efficient. Sickness is not attributed to them.
WIDNES - -	The amount received does not cover the cost, but there is a loss to the Board of about 235*l.* annually. The whole of the refuse is used. The cleansing is not complained of, but sickness, to some extent, is attributed to the privies.
SUTTON - - -	There is a ready sale for the refuse, and the amount received for it exceeds the cost slightly, and it is all used. The cleansing of middens is not complained of; disinfectants are not used and sickness is not attributed to the privies.
PRESCOT - - -	There is a fair demand for the refuse and the amount received about covers cost of removal. The cleansing of the privies, middens, and ashpits is complained of as a nuisance; disinfectants are occasionally used. Sickness is sometimes attributed to the privies and ash-pits.
PARR - - -	The privies, middens, and ash-pits are complained of, and sickness is attributed to them. No disinfectants used.
ST. HELEN'S - -	The whole of the refuse is used for agricultural purposes. Sickness is not attributed to the privies. Under the St. Helen's Improvement Act the back yard space to each house must not be less than one-half of the space built upon, and as a consequence privies and ash-pits are generally some 20 to 30 feet away from the nearest window or door of a dwelling house.
NEWTON - IN - MACKERFIELD.	Deficient to the amount of contract, 40*l.* to 50*l.* annually. Occasionally the privies, middens are complained of. Sometimes chloride of lime, as a disinfectant, is used. Not aware that sickness has been attributed to middens and ash-pits.
WARRINGTON - -	The contractor sells the refuse to farmers. Cases of sickness have been traced to badly constructed middens, but when properly drained, and at sufficient distance from dwellings, no nuisance is noticed.
PENNINGTON - -	There is no difficulty in getting rid of the refuse, but there is an annual deficiency of 40*l.* Disinfectants used only in rare cases.
WESTLEIGH - -	Not answered.
HINDLEY - -	Not answered.
ATHERTON - -	No complaints have been made. Disinfectants only have been used to a very limited extent during the height of summer.
TYDLESLEY - WITH - SHAKERLEY.	No disinfectant used. The other queries not answered.
RUSHOLME - -	There is not a ready sale for the refuse, and the amount received does not cover the cost. There is a deficiency of 288*l.* a year; one load out of 20 is used for manure, and the other 19 are rubbish. No complaints.
LEVENSHULME - -	The Answers to Queries have not been received from this Local Board of Health.
STOCKPORT - -	The cost exceeds the value; no account kept. Of course sickness must result, but it is to prevent this that the local authority acts.
BREDBURY - -	Farmers remove it without charge. Used as manure for the land in the township. Lime, as a disinfectant, used.
WALLASEY - -	Refuse retained by contractor. The cleansing of privies and ash-pits not complained of.
BIRKENHEAD - -	There is an annual deficiency to the extent of the amount paid the contractor. Generally speaking the cleansing of privies is not complained of as a nuisance. In very confined situations they are the cause of sickness.
OXTON - - -	The refuse is entirely used by the contractor on his farm. The cleansing of privies is not complained of as a nuisance. No disinfectants are used, and sickness has not been attributed to them.
TRANMERE - -	The refuse belongs to the contractor. Scarcely any sale for it. It is chiefly used by the contractor on his own farm about five miles from the district. The cleansing of privies not complained of.
HIGHER BEBINGTON	No complaints made of the privies. The other queries not answered.
RUNCORN - -	The contractor, in addition to 300*l.* per annum, has the benefit of the refuse, the whole of which is used for farming purposes. Sometimes the cleansing of privies is complained of as a nuisance, and frequently sickness is attributed to them.

Mersey Basin—(Mersey Proper).

Series No. 2, Sewerage.—Answers to Queries 20 to 24.—Page 72—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Lymm - - -	The whole of the refuse is employed as manure by farmers in the neighbourhood.
Altrincham - -	Disinfectants are occasionally used, but not always. No complaint has been made hitherto.
Sale - - -	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton.	Were the Board to undertake the emptying of ash-pits and the removal of night soil, there would be a considerable annual deficiency. Generally speaking there are very few complaints, but sickness has been attributed in isolated cases to the privies, middens, and ash-pits. No disinfectants used.
Stretford - -	The Board does not receive anything for the refuse; the cleansing is not complained of. Disinfectants are not used, and sickness is not attributed to the privies, middens, and ashpits.
Moss Side - -	The cleansing is not complained of. In hot weather McDougall's disinfecting powder is used, and answers very well. Sickness has not been attributed to them.
Salford - -	*Salford District.*—In the summer months there is generally an accumulation at the depôt, but as soon as the season arrives at which farmers require it the stock is usually cleared out in a few months. There is an annual deficiency. That deficiency in 1867 was 2,116*l.* The refuse is wholly employed, and the quantity disposed of to the farmers has averaged for the last four years 25,000 tons. *Broughton District.*—Difficult to dispose of. Useless rubbish is mixed in the ashpits. The contractor disposes of that portion which is suitable for agricultural purposes. *Pendleton District.*—At some portions of the year there is a difficulty in disposing of it. The expenditure exceeds the income by about 582*l.* per annum. The refuse is wholly employed, partly as manure and partly for filling up and levelling purposes. The cleansing of the privies, middens, and ashpits is occasionally complained of as a nuisance, and sickness is decidedly attributed to them. The Medical Officer says,— "The exciting causes are as follows:—1*st, the defective privy accommodation; 2nd, the imperfect system of trapping at present in vogue in the houses; 3rd, general sanitary defects;* 4th, improper and inefficient treatment of the sick. 1*st, the defective privy accommodation. Almost all the privies in the borough, in their present state, are 'nuisances and dangerous to health.' In number they are by no means deficient, in fact, there are almost too many; but in construction they are most defective. They are undrained, and in many cases the receptacles of all the household slops. The yard and slopstone drainage frequently finds its way into them. Their smell is most offensive, and the houses near to them are filled with excrement tainted air.* The only remedy for this is reconstruction. Until this is done your death-rate must continue a very high one. I do not advocate hasty measures, but a certain number of these privies ought to be reconstructed every year. If this were systematically done, the worst cases being dealt with first, in a few years no defective privies would exist in your borough. I know it is a bold step, but it is a most necessary one; wherever sanitary improvements are ordered let the whole work be done once for all.—*2nd. The imperfect trapping: At present the houses ventilate the sewers. The street grids are trapped while the house drains are left untrapped.* The remedy here is apparent; trap the house drains, and at the same time provide for the ventilation of the sewers. The sewers themselves are, I fear, in a very defective condition. An investigation as to their present state should be made, and a report showing their condition and levels be presented to this committee.—*3rd. General sanitary defects.* Under this head I would include all upward streets, courts, and passages; all defectively drained yards. In most streets and courts there is a deficiency in the number of the grids; this both keeps the yards wet and induces the people to empty their slops into the ashpits; I specially refer to streets that are closed at one end." * * * "The late rain is answerable for the sudden rise in our death-rate. Not enough rain came to flush the sewers, while enough came to stir up and agitate their contents, thus setting free a large quantity of sewer gases." * * * "It will now be our duty to be particularly active in sanitary work. Where we are able to remove nuisances, we must remove them with as little delay as possible. Where we cannot as yet remove them, we must disinfect, &c., and so diminish their evil effects. *One of your sewers is now connected with Messrs. Mather and Platt's chimney.* This experiment cannot yet be said to be at work, as several grids close to it are untrapped; its ventilating influence must, therefore, be limited by these air openings. Disinfection of fever cases is very actively pursued, and no means at present possessed by this office are left undone."
Manchester - -	There is considerable difficulty in disposing of the refuse. As a matter of fact, the cleansing of middens, privies, and ash-pits is not complained of by the occupiers of the houses as a nuisance affecting their health and comfort. For some time past, carbolic acid has been used with much advantage in connexion with the removal of the night-soil. Of course differences of opinion exist, and are expressed as to the advantages, or disadvantages, in a sanitary point of view, of the system of privies and

Mersey Basin—(River Irwell).

Series No. 2, Sewerage.—Answers to Queries 20 to 24.—Page 72—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester—*cont.*	ash-pits as opposed to waterclosets. Sickness is, certainly not generally, attributed to the privies, middens, and ash-pits; but difference of opinion does exist as to the effect of that arrangement.
Prestwich - -	Not answered.
Swinton - -	Sickness has been attributed to the middens and ash-pits. The other queries not answered.
Kearsley - -	Not answered.
Farnworth - -	Sickness is attributed to the privies, but not especially so.
Bolton - - -	There is a ready sale for the valuable portion of the refuse, but the cost of removal, as shown by the account for the past year, exceeds the amount received for sale by the sum of 1,604*l.* 10*s.* 10*d.* The weight sold during the past year was 16,874 tons, against 5,591 tons thrown away. The cleansing of the privies and ash-pits is not complained of as a nuisance. And, except where they are insufficiently drained, no sickness is attributed to them.
Astley Bridge -	There is a ready sale for the refuse; the cleansing of privies is not complained of as a nuisance; no disinfectants used. Sickness is not attributed to the privies.
Halliwell - -	No disinfectants used. No complaints made.
Radcliffe - -	No disinfectants used. The privies are not complained of as a nuisance.
Whitefield - -	There is a difficulty in getting the farmers to remove the ashes from the ashpits without being paid. The cleansing is not complained of; disinfectants are not necessary.
Bury - - -	There is no sale for the dry ashes from the ashpits, the actual manure being the only saleable portion, and the proportion of ashes is so great that the manure is very inferior. The amount received is only about one-seventh of the cost, leaving an annual deficiency of 600*l.* to be paid for out of the rates. No complaints made of the cleansing, as it is always done during the night; disinfectants are not used, and sickness is not attributed to the privies and middens.
Ramsbottom - -	The deficiency to the Board is 45*l.* per annum. The privies are not complained of as a nuisance.
Bacup - - -	Scavenging is an item of expenditure for which there is no return; the deficit to the Board is therefore 400*l.* per annum. McDougall's disinfecting powder used to a small extent during hot weather; we find it to allay smell for only a short period after being applied.
Heywood - -	Any dry refuse is taken for filling up and raising land. No complaints; no disinfectants used.
Rochdale - -	Previous to the present year (1869) the contractor received 810*l.* per annum for removing the night soil, ashes, filth, and rubbish. He stated that he had lost by it, and refused to enter upon a fresh contract for less than 1,300*l.* per annum. As to sickness, this is a matter of opinion; much depends on the state in which they are kept; if cleansed regularly very few, if any, cases of sickness would arise; but in courts, alleys, and densely populated localities, where the accommodation is limited, complaints have occasionally been made of sickness, which the Corporation have taken steps to remedy by summoning the parties before the magistrates or otherwise.
Crumpsall -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	About two-thirds is used for agricultural purposes; the remainder, being rubbish, is used for filling up holes. Cleansing of the ashpits has not been complained of.
Failsworth -	If refuse removed by the Board it would not cover the cost of removal. There are very few complaints as to the mode of removal. Chloride of lime is used in some cases as a disinfectant, but very seldom.
Bedford, near Manchester.	The refuse is given to farmers. The cleansing is not complained of. No disinfectants used.
Bradford - -	The deficiency is the whole cost, 100*l.* Cleansing not complained of. No disinfectants used.
Openshaw - -	Complaints are only made when the cleansing is done contrary to the byelaws of the Local Board.
Gorton - - -	No complaints of the privies. The other queries not answered.
Droylsden - -	There is not a ready sale for the refuse. During hot weather chloride of lime is used, and is deemed sufficient in preventing smell.
Oldham - -	The annual deficiency is about 4,000*l.* All that is good for anything is used as manure. Sickness is not attributed to the privies.
Crompton - -	Complaints are very rare. The other queries not answered.
Royton - - -	Not answered.
Lees - - -	The cleansing of privies not complained of as a nuisance. The other queries not answered.

Mersey Basin—(River Bollin).

Series No. 2, Sewerage.—Answers to Queries 20 to 24.—Page 72—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	No complaints of privies. Peat charcoal, carbolic acid, McDougall's powder, and lime are used as disinfectants.
Bollington -	The refuse is sold. The other queries not answered.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	Ready sale. Amount does not exceed cost of cleansing, but there is an annual deficiency of 6*l.* Disinfecting powder used, which is obtained from the Patent Eureka Company, and is efficient in preventing smell.
Witton-cum-Twambrookes.	No complaints made; the privies are cleansed early in the morning. No disinfectants used.
Sandbach - -	The night soil is taken away very early in the morning or late at night, but of course there are complaints occasionally of this work being done in the day time. No disinfectants are used, sickness is not attributed to the removal of the refuse from the privies.
Monks Coppenhall	The cleansing of the privies is not much complained of. The worst cases are where they are not properly drained; disinfectants are not used, but ought to be. Sickness has not, within our knowledge, been attributed to the privies and middens; we have expected it from not using disinfectants.
Tarporley - -	The refuse is used to the full extent. The other queries not answered.
Nantwich - -	There is a ready sale for the refuse to the extent for which it is available, and it is believed the proceeds rather more than cover the cost of removal.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	There is a fair demand for the refuse at 2*s.* to 2*s.* 6*d.* per ton. There is a loss of about 260*l.* per annum to the Corporation. All cesspools and ash-pits are emptied between the hours of 11 p.m. and 5 a.m. There are no complaints of any nuisance or discomfort. "Bishop's" disinfecting powder is used, and is very effective.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	Sickness is not attributed to the privies, the houses being mostly detached. The other queries not answered.
Preston - -	There is some difficulty in disposing of refuse. The amount received for it does not equal the cost of cleansing the privies; the deficiency to the Local Board is 1,431*l.* The refuse is not employed to a very great extent; it is used principally for potatoes and grass land. The men employed by Local Board sweep the streets, and the Board pays a contractor 200*l.* a year to remove the refuse, of which he also has the disposal. The privies and ash-pits are required to be emptied between the hours of eight in the evening and eight in the morning, and the Local Board employ men to disinfect the middens after emptying.
Leyland - -	The whole of the refuse is used. No disinfectants used; no complaints made.
Clitheroe - -	The refuse is sold, but does not cover the cost of getting out and removing it. There is an annual deficiency of about 24*l.* Sickness is not attributed to the middens and ash-pits.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	The privies being connected with the ash-pit no disinfectants are required.
Oswaldtwistle -	Sickness is attributed to the ashpits and privies where the accumulations are of long standing.
Accrington - -	No sale for the refuse, consequently there is an annual deficiency. No complaints made of nuisance or discomfort.
Burnley - -	The whole of the refuse (with the exception of ashes) is used by farmers. The privies are cleansed during the night from 9 p.m. to 6 a.m., with an extension until noon on Tuesdays and Fridays. The cleansing during the daytime is complained of as a nuisance. Disinfectants are not used.
Brierfield - -	The refuse is wholly used for agriculture. The other queries not answered.
Nelson - -	Occupiers of land take away the refuse, in most cases, gratis. Night soil applied to the land. There was one case of sickness in the year 1864 attributed to the privy and ashpit.

Ribble Basin—(River Darwen).

Series No. 2, Sewerage.—Answers to Queries 20 to 24.—Page 72—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	There is a ready sale for the refuse at 4*s.* 6*d.* per ton for privy manure unmixed, and 1*s.* 6*d.* for that mixed. There is an annual deficiency of 1,381*l.* The clean ashes are tipped to fill up old stone quarries, clay pits, and other places in the neighbourhood. The cleansing of the privies is not complained of. Disinfecting powder is used after the privies and middens are emptied, and where they are thoroughly drained sickness is not attributed to them.
Great Harwood -	There are more complaints lodged on this account than any other; no disinfectants used, and sickness is very often attributed to the privies.
Over Darwen -	There is not a ready sale for the refuse, the cleansing is not complained of. The other queries not answered.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	The farmers take away the manure and refuse, under private arrangement with the owners. No complaint has been made.
Chorley - -	A ready sale at certain seasons of the year. Annual deficiency of profit and loss, 190*l.* About 2,500 tons is annually applied to agricultural purposes. Privies, middens, and ash-pits not complained of.
Ormskirk - -	After cleansing the privies and middens all the refuse are carefully swept up and in many cases washed away by use of hose. The other queries not answered.
Wigan - - -	The cleansing of the privies and ashpits is not complained of as a nuisance, but sickness is by some attributed to them. The other queries not answered.

SERIES No. 3, SEWAGE WORKS.

Queries——1. Describe the works; state where they are situate and how far distant from town? ——2. How is the sewage treated; by lime, perchloride of iron, or by any other disinfectant; if so, in what proportion?——3. Is the sewage filtered; if so, describe process, and the state of the effluent water? ——4. Where is the effluent water discharged?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	These Queries not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde, Denton, Dukinfield, Stalybridge, Ashton-under - Lyne, Hurst, & Mossley.	There are no sewage works; the sewage is not treated, but flows direct into the river.
	Watershed of the Mersey Proper.
Liverpool - -	There are no works for treating the sewage with deodorants or disinfectants; the sewage flows direct into the *Mersey.* [B.E.]
Waterloo - with - Seaforth, Great Crosby, Litherland, West Derby, Walton - on - the - Hill, Toxteth Park, Wavertree, & Little Woolton.	There are no sewage works.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.

MERSEY BASIN—(MERSEY PROPER).

Series No. 3, Sewage Works.—Answers to Queries 1 to 4.—Page 77—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
MUCH WOOLTON -	Subsidence tanks have been constructed, but not yet used for the eastern portion of the district, and are situate about three-quarters of a mile from the village. No disinfectants are used. The sewage is not filtered, and it is intended for the present to discharge the effluent water into the brook.
GARSTON, WIDNES, SUTTON, PRESCOT, PARR, and ST. HELEN'S.	There are no sewage works.
NEWTON-IN-MACKERFIELD.	The sewage is filtered at east outlet only, about 400 yards from town, as an experiment through gravel and coke. The effluent water flows into *Newton brook*; from thence into *Sankey brook*.
WARRINGTON, PENNINGTON, WESTLEIGH, HINDLEY, and ATHERTON.	There are no sewage works.
TYLDESLEY - WITH - SHAKERLEY.	A small work is newly constructed for one street only filtered through gravel and charcoal; the effluent water is satisfactory, and flows into a brook named *Moss ditch.*
RUSHOLME, STOCKPORT, BREDBURY, WALLASEY, BIRKENHEAD, OXTON, TRANMERE, HIGHER BEBINGTON, RUNCORN, and LYMM.	There are no sewage works, the sewage flows direct into the river.
LEVENSHULME -	The Answers to Queries have not been received from this Local Board of Health.
ALTRINCHAM - -	The sewage flows direct from the pipes into a brick tank, where it is allowed to settle, but the result is by no means satisfactory, as although the greater portion of the solid matter is retained in the tank the effluent water passes off in a state of only partial purification. The Local Board have had it in contemplation to construct a series of three of these tanks on a principle which they believe would be thoroughly efficacious, but until the report of the Rivers Pollution Commission is issued they feel that they would not be justified in incurring the heavy expense which the works would entail, and which might possibly be utterly thrown away. The effluent water is discharged into the before-mentioned brook, called *Timperley brook*, and thence into the river *Mersey*.
SALE - - -	Not answered.
Watershed of the Irwell, Tributary of the Mersey.	
BARTON, ECCLES, WINTON, & MONTON.	There are no sewage works within this distsict.
STRETFORD - -	These Queries not answered.
MOSS SIDE - -	The main sewers along all streets are connected with a main sewer which empties itself into the river *Irwell* about one mile distant from the district of Moss Side. The sewage is not filtered, and flows direct into the river.
SALFORD - -	There are no sewage works in Salford. (*Questions 2 to 17 not answered.*)
MANCHESTER - -	There are no sewage or irrigation works established. The contents of the sewers all pass into the rivers.
PRESTWICH, SWINTON	Not answered.
KEARSLEY & FARNWORTH.	No sewage works.
BOLTON - - -	There are no sewage works. All the sewage of the town flows into the river *Croal.*
ASTLEY BRIDGE -	No sewage works.
HALLIWELL - -	Sewage works are established on the northern boundary. No disinfectants used. The ordinary sewage is passed into three settling tanks, averaging 70 feet by 12 feet and 15 feet 6 inches deep. Provision is made for the flood water to pass at once into the river. The state of the effluent water is much improved, and is discharged into the *Dean brook.*
RADCLIFFE and WHITEFIELD.	There are no sewage works.
BURY - - -	There are no works for the utilization of the sewage by irrigation, solidification, deodorization, or the like. The waterclosets being few the sewage is worthless for agricultural purposes. It is not treated nor filtered, but flows direct into the rivers *Irwell* and *Roch* below the town.
RAMSBOTTOM - -	No sewage works.

MERSEY BASIN—(RIVER IRWELL).

Series No. 3, Sewage Works.—Answers to Queries 1 to 4.—Page 77—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
BACUP - - -	The sewage works are two filtering tanks, 54 ft. × 20 ft., situate one mile from the centre of the town. Each tank is divided in four compartments by two rows of planks set edgewise in iron frames with ¾ inch division between the edge of each plank, and 16 inches apart from each other, the space filled in with broken stones, gravel, &c.; the sewage after having gone through the filters about a month, with some advantage; at the end of that time begins to issue as dirty, if not more so, than upon its entrance into the tanks. The tanks have only been at work five months, we cannot pronounce as to their success or otherwise; should the present ones not succeed, we shall adopt some other method of filtering. The sewage is not treated chemically. The effluent water is discharged into the river *Irwell*, about 300 yards below the tanks.
HEYWOOD - -	The main sewer conveys the whole sewage of the district, about half a mile below the town into the river *Roch.*
ROCHDALE, NEWTON HEATH, FAILSWORTH, BEDFORD NEAR MANCHESTER, BRADFORD, OPENSHAW, DROYLSDEN, CROMPTON, ROYTON, and LEES.	There are no sewage works.
CRUMPSALL - -	The Answers to Queries have not been received from this Local Board of Health.
GORTON - -	The sewage is not disinfected; is discharged almost entirely into *Gorton Brook*, and the remainder viâ Ardwick Green into the river *Medlock.*
OLDHAM - -	There are no special outlet works, the sewers are merely turned into the streams, one of which flows to the *Irk* and the other to the *Medlock.* In no way whatever is the sewage treated with disinfectants or filtered.
Watershed of the Bollin, Tributary of the Mersey.	
CHORLEY - -	The Answers to Queries have not been received from this Local Board of Health.
MACCLESFIELD and BOLLINGTON.	There are not any sewage works; the sewage is not disinfected or filtered.
Watershed of the Weaver, Tributary of the Mersey.	
NORTHWICH, WITTON-CUM-TWAMBROOKES, & SANDBACH.	There are no sewage works.
MONKS COPPENHALL	Sediment tanks have been constructed for the purpose of filtration of sewage through gravel and charcoal filters on land one and a half miles below the town. The filtration was abandoned because it was considered not to answer. Experiments are now being made in a small plot of ground. The sewage is taken from the tanks, run upon the ground in trigs about six feet apart, percolates through the soil into drain pipes, and passes into the brook in a moderately pure state. The greatest objection to this is that the land is liable to be flooded by the brook, and the crops thereby damaged. The process is yet in its infancy.
TARPORLEY - -	No sewage works.
NANTWICH - -	The sewage is carried into the river *Weaver*, about a quarter of a mile below the town. No disinfectant used.
CONGLETON - -	The Answers to Queries have not been received from this Borough.
RIBBLE BASIN.	
Watershed of the Ribble Proper.	
SOUTHPORT, FULWOOD, PRESTON, LEYLAND, and CLITHEROE.	There are no sewage works. The sewage is not filtered, or disinfected, but discharged into the river.
KIRKHAM - -	The Answers to Queries have not been received from this Local Board of Health.
Watershed of the Calder, Tributary of the Ribble.	
CLAYTON-LE-MOORS	There are no sewage works at present, it is suggested to construct tanks and filters on a piece of ground purchased for the purpose when the sewage is in a state to require it, but as no excreta or foul solid matters are admitted into the sewers the effluent water is perfectly inoffensive, and flows into the *Hyndburn* brook.
OSWALDTWISTLE -	No sewage works; the sewage flows into the brook at Foxhill bank.

Ribble Basin—(River Calder).

Series No. 3, Sewage Works.—Answers to Queries 1 to 4.—Page 77—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Accrington	The works are situate in Hog Lane, about half a mile from the centre of the town. The sewage is treated by lime and McDougall's disinfecting fluid in the proportion of 2 tons of lime, 20 gallons of disinfecting fluid, and 25,000 gallons of spring water to the sewage of the town. The sewage is not filtered, and it is discharged into the river *Hyndburn*, a quarter of a mile below the deodorising works.
Burnley, Brierfield, & Nelson.	There are no sewage works.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn	The works are situated on the river *Blakewater*, and just without the borough boundary, and comprises 10,000 square yards of land. Five tanks 190 feet long, with dwarf walls across in three places, and in the two last tanks wire frames filled with gorse for filtering. The sewage is treated with cream of lime. 6 cwt. of dry lime used in one day to about 1¼ million gallons of sewerage. The sewage passes through filters formed of wood and wire frames two feet wide, filled in between with gorse, and placed across the tank. All solids or matters in suspension are removed, but the liquid is still very impure when it flows into the *Blakewater*, a tributary, *Darwen*, which joins the *Ribble* at Preston. From frequent observation the volume discharged from the main sewer in floods and streams is ascertained to be 4,800 cubic feet per minute, and from storm overflows 700 cubic feet per minute. The sewers drain an area of about 1,500 acres. In July 1866, the dry weather flow of sewage average 154 cubic feet per minute, or for 24 hours 1,500,000 gallons. In July 1868, the dry weather flow of sewage averaged 200 cubic feet per minute, or for 24 hours 2,000,000 gallons.
Great Harwood	No sewage works; land has been purchased as a site, but no works laid down as yet.
Over Darwen	There are settling tanks; the sewage is not disinfected, it is filtered through strainers and straw, and the effluent water flows into the river *Darwen*.
	Watershed of the Douglas, Tributary of the Ribble.
Croston	Not answered.
Chorley	These works are only just commenced; the sewage farm is situate about a mile from the town. The effluent water flows into the river *Yarrow*.
Ormskirk	Not answered.
Wigan	No sewage works. The sewage is turned into the river *Douglas* about half a mile below the town. (*Questions 2 to 17 not answered.*)

Series No. 3, Sewage Works.—Query 5. Is steam, hot or warm water, conveyed into the sewers?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth	The Answers to Queries have not been received from this Local Board of Health.
Glossop	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley-cum-Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde	No.
Denton	Yes, but no nuisance arises therefrom.
Stalybridge	Yes, to a large extent.
Ashton-under-Lyne	Steam or warm water is, to a considerable extent, conveyed from the mills into the sewers. The cases where steam is turned into sewers are under the consideration of the Corporation officers.
Dukinfield, Hurst, and Mossley.	Not answered.

Mersey Basin—(Mersey Proper).

Series No. 3, Sewage Works.—Answers to Query 5.—Page 80—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Mersey Proper.
Liverpool	Steam or hot water is not now permitted to be conveyed into the sewers without having previously been cooled in a well or tank. But there are doubtless cases where hot water is conveyed into the sewers without the knowledge of the authorities. [B. E.]
Waterloo-with-Seaforth.	There is no nuisance arising from steam, hot or warm water, conveyed into the sewers.
Great Crosby, Little Woolton, & Much Woolton.	No.
Litherland, West Derby, Walton-on-the-Hill, Garston, and Widnes.	Not answered.
Toxteth Park	There are no manufactories in the district.
Wavertree	One rope manufactory turns hot water into the sewers.
Birkdale	The Answers to Queries have not been received from this Local Board of Health.
Sutton, Prescot, Parr, Warrington, Hindley, Wallasey, Birkenhead, & Sale.	Not answered.
St. Helens, Newton-in-Mackerfield, Atherton, Tydersley-with-Shakerley, Rusholme, Bredbury, Oxton, Tranmere, Higher Bebington, and Altrincham.	No steam, hot or warm water is conveyed into the sewers.
Pennington and Westleigh.	Only to a small extent.
Levenshulme	The Answers to Queries have not been received from this Local Board of Health.
Stockport & Runcorn.	Steam or hot water is passed into the sewers.
Lymm	See Answer to Queries 6 and 7, page 9.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton, Moss Side, Farnworth, Astley Bridge, and Halliwell.	Steam or hot water is not conveyed into the sewers.
Stretford, Salford, Manchester, Prestwich, Swinton, Kearsley, & Ramsbottom.	Not answered.
Bolton	Hot or warm water is frequently conveyed into the sewers.
Radcliffe and Whitefield.	Steam or hot water is conveyed into the sewers, but no nuisance arises therefrom.
Bury	Hot water from steam boilers is occasionally allowed to pass into the sewers, and it tends to flush them.
Bacup	In one or two cases hot water is passed into the sewers, but without authority; we cannot trace a nuisance to the introduction.
Heywood, Failsworth, Bradford, Openshaw, Royton, & Lees.	Not answered.
Rochdale	Steam or hot water is passed into some of the sewers.

Mersey Basin—(River Irwell).

Series No. 3, Sewage Works.—Answers to Query 5.—Page 80—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath -	Hot water is conveyed into one of the sewers. No complaint of any nuisance arising therefrom.
Bedford near Manchester.	Warm water is conveyed into the sewers, but does not cause a nuisance.
Gorton & Crompton	Steam or hot water is not passed into the sewers.
Droylsden - -	Steam or hot water from some of the mills is passed into the sewers when the boilers are being cleansed. There has been no complaint of this being a nuisance.
Oldham - -	Steam or hot water is conveyed into the sewers.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	Steam or hot water is not passed into the sewers.
Bollington - -	Not answered.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich and Nantwich.	Steam or hot water is not passed into the sewers.
Witton-cum-Twambrookes & Sandbach.	Not answered.
Monks Coppenhall	The hot water from the works flows into the sewers, causing the temperature of the sewage to vary; no other result is noticed.
Tarporley - -	See Answers to Queries 1 to 6, page 20.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport & Fulwood.	Steam or hot water is not passed into the sewers.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Preston - -	Steam or hot water is passed into the sewers.
Leyland - -	See Answers to Queries 1 to 6, page 58.
Clitheroe - -	Not answered.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	Steam or hot water is conveyed into the sewers, but no nuisance arises therefrom.
Oswaldtwistle, Brierfield, and Nelson.	Not answered.
Accrington - -	Steam or hot water is not passed into the sewers.
Burnley - -	Steam or hot water is passed into the sewers.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	Steam or hot water in three or four cases is occasionally conveyed into the sewers.
Great Harwood & Over Darwen.	Steam or hot water is not conveyed into the sewers.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	Steam or hot water is not conveyed into the sewers.
Chorley - -	Occasionally steam or hot water is passed into the sewers.
Ormskirk & Wigan	Not answered.

Series No. 3, Sewage Works.—Queries——6. Were many springs tapped during the execution of the sewerage works; if so, state about the volume of water thus entering the sewers daily?——7. Is the level of the well-water in the town affected by the sewers; and to what extent is it depressed?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	A few, but we cannot state the volume of water thus entering the sewers. There are no wells in Hyde.
Denton - - -	There were no springs tapped.
Dukinfield - -	Not answered.
Stalybridge - -	There were no springs tapped. There are no wells in the borough.
Ashton-under-Lyne	Springs were tapped, and a considerable quantity of water is constantly running down the sewers, but it is impossible to estimate the quantity. Well water is not used, except in one case where the level of the water is not affected by the sewers.
Hurst and Mossley	Not answered.
	Watershed of the Mersey Proper.
Liverpool - -	Very few springs were tapped in the execution of the work, and these few were of very small volume. The level of the well water is not affected by the sewers.—[B.E.]
Waterloo - with - Seaforth.	Not many springs tapped. Since the execution of the sewerage the extent of well water is greatly depressed, so much so that many or most of the wells are useless.
Great Crosby -	No springs tapped. The limit of the well water is in some places affected to the exent of four or five feet.
Litherland - -	No springs tapped.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby - -	Springs have been tapped during the progress of the works, but no water has been allowed to enter the sewers from these springs after the completion of the works. Level of well water not affected.
Walton - on - the - Hill and Little Woolton.	Not answered.
Toxteth Park -	No springs tapped. There are no public wells.
Wavertree - -	Two top springs were tapped. Volume of water, perhaps 100 gallons daily, for three or four months in the year. The water in one well was depressed about 16 feet.
Much Woolton -	No springs have been tapped. Well water not depressed.
Garston - -	No springs tapped.
Widnes, Sutton, Prescot, & Parr.	Not answered.
St. Helen's -	No springs tapped. The level of the well water in the more populous parts was depressed, but cannot say to what extent, for the wells are now in disuse or filled up.
Newton - in - Mackerfield, Pennington, Westleigh, Atherton, Tyldersley - with - Shakerley, and Rusholme.	No springs tapped.
Warrington and Hindley.	Not answered.
Levensholme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	Some springs were tapped, but all that could be were dammed out from the sewers, so that the supply of water for condensing purposes should not be injured. It is only the wells for condensing water that are so affected.
Bredbury, Oxton, Higher Bebbington, & Runcorn.	No springs tapped.

MERSEY BASIN—(MERSEY PROPER).

Series No. 3, Sewage Works.—Answers to Queries 6 and 7.—Page 83—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
WALLASEY & BIRKENHEAD.	Not answered.
TRANMERE	No springs tapped; the level of the well water is not affected by the sewers.
LYMM	See Answers to Queries 6 and 7, page 9.
ALTRINCHAM	Three small springs were tapped, but it is impossible to state the volume of water entering the sewers daily. The level of the well water was affected, but we are unable to say to what extent. Very little use is now made of the wells.
SALE	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
BARTON, ECCLES, WINTON, & MONTON.	No springs tapped. Probably well water has in some instances been affected by the construction of sewers.
STRETFORD	These Queries not answered.
MOSS SIDE and KEARSLEY.	No springs tapped.
SALFORD, MANCHESTER, PRESTWICH, and SWINTON.	Not answered.
FARNWORTH	Some springs were tapped, level of well water not depressed.
BOLTON	In making the sewers many springs were tapped, but the volume of water therefrom was never large, and these have now all been drained off. There are no wells in the town.
ASTLEY BRIDGE	There is a continuous volume of spring water flowing through the sewers. No wells.
HALLIWELL	One spring tapped; about 100 gallons per minute flows into the sewers.
RADCLIFFE	No springs tapped. The original wells are either all filled up or not used.
WHITEFIELD	No springs tapped, and there are not any wells.
BURY	A great many. The volume varies according to the rain-fall; the springs arise from the gravel bed on which the greater part of the town stands, and from quicksands lying above a stratum of clay. We have no wells. The pumps were gradually done away with since the construction of the waterworks in 1839. If still in existence they would no doubt hold noxious matter from sewage and other matters in solution, and although the water was clear and bright it would be unfit for domestic use.
RAMSBOTTOM	No springs tapped. No wells.
BACUP	Several springs were turned into the sewers during construction; about 10,000 gallons daily flow down them. The level of water in two wells has been depressed two feet.
HEYWOOD	Some small springs were tapped, but of not much consequence. Well water not depressed.
ROCHDALE	During the execution of the sewerage works in Drake street, Oldham road, and other streets on the southerly side of the river springs were tapped, and a large quantity (not ascertained) of water enters the sewers. In some places the well water was depressed, in others not; by sinking the wells from 5 feet to 10 feet lower the water has been regained.
CRUMPSALL, BEDFORD NEAR MANCHESTER and DROYLSDEN.	The Answers to Queries have not been received from this Local Board of Health.
NEWTON HEATH	No springs tapped.
FAILSWORTH	No springs tapped. Wells not depressed.
BRADFORD, OPENSHAW, ROYTON, and LEES.	Not answered.
GORTON	No springs tapped. Well water not depressed; the deepest sewer only being 20 feet below the surface, and all in stiff clay.
OLDHAM	Very few springs were tapped, the volume of water thus entering the sewers is from 5,000 or 6,000 gallons daily. The level of the well water not affected.
CROMPTON	Well water not affected.
	Watershed of the Bollin, Tributary of the Mersey.
CHORLEY	The Answers to Queries have not been received from this Local Board of Health.
MACCLESFIELD	No springs tapped. No wells.
BOLLINGTON	No springs tapped.

MERSEY BASIN—(RIVER WEAVER).

Series No. 3, Sewage Works.—Answers to Queries 6 and 7.—Page 83—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	Watershed of the Weaver, Tributary of the Mersey.
NORTHWICH	No springs tapped. No wells.
WITTON-CUM-TWAMBROOKES.	Not answered.
SANDBACH	No.
MONKS COPPENHALL	One spring was tapped on the north section, and the volume of water from that source entering the sewers is 39,000 gallons daily. In two or three cases the wells, from tapping of the springs, have been rendered useless.
TARPORLEY	See Answers to Queries 1 to 6, page 61.
NANTWICH	No springs tapped. The wells having been almost entirely disused.
CONGLETON	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
SOUTHPORT	All the sewers are cemented at the joints, and are perfectly water-tight. Well water not affected.
KIRKHAM	The Answers to Queries have not been received from this Local Board of Health.
FULWOOD	No springs tapped..
PRESTON	Several wells were laid dry with the construction of the sewerage works, but we have no means of stating about the volume of water thus entering the sewers daily.
LEYLAND	See Answers to Queries 1 to 6, page 64.
CLITHEROE	Not answered.
	Watershed of the Calder, Tributary of the Ribble.
CLAYTON-LE-MOORS, OSWALDTWISTLE, ACCRINGTON, and BURNLEY.	Not any springs tapped. Level of well water not affected.
BRIERFIELD and NELSON.	Not answered.
	Watershed of the Darwen, Tributary of the Ribble.
BLACKBURN	Several springs were tapped, and about 400,000 gallons of water from thence enter the sewers every 24 hours. There are very few wells.
GREAT HARWOOD	Many springs were tapped but no record was kept. The well water is not affected.
OVER DARWEN	A considerable number of springs were tapped. The level of well water not affected.
	Watershed of the Douglas, Tributary of the Ribble.
CROSTON	No springs tapped; no wells.
CHORLEY	Some springs were tapped, the volume not known. Only one or two wells are now used.
ORMSKIRK	No springs were tapped.
WIGAN	Not answered.

SERIES No. 3, SEWAGE WORKS.—QUERIES——8. Has irrigation of land with sewage of the town been contemplated by the governing body, or by any other persons?——9. Is there land available for irrigation over which the sewage of the town might be passed?——10. Are there any difficulties in the way of irrigation; if so, state them?——11. If irrigation works are established;—describe them, and state the cost.——12. The area of land to which sewage is applied.——13. The volume of sewage used every twenty-four hours.——14. The condition of the effluent water; and where it is discharged?——15. The extent and kind of crops (grass, grain crops, and green crops) which have been sewaged, and the amount of produce in the several cases?——16. The total working expenses per annum?——17. The profit and loss per annum.

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
HOLLINGWORTH -	The Answers to Queries have not been received from this Local Board of Health.
GLOSSOP - -	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
YEARDSLEY - CUM - WHALEY.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
HYDE - - -	The sewers do not pass any land available for irrigation, and this mode of dealing with the sewage has not been discussed. No irrigation works are established.
DENTON - - -	Irrigation has been contemplated, but found impracticable; the sewage would have to be raised upwards of 100 feet by pumping.
DUKINFIELD, HURST, and MOSSLEY.	Not answered.
STALYBRIDGE - -	There are considerable difficulties in the way; one of which is, that there is very little land in the district for irrigation; and another, that the level of the land is very high for such a purpose.
ASHTON-UNDER-LYNE	Very great difficulties in the way of irrigation. The country below is thickly populated, and no land suitable for the purpose.
	Watershed of the Mersey Proper.
LIVERPOOL - -	The Liverpool Sewage Utilization Company has obtained an Act of Parliament, and a concession from the Council of the Borough. There is land available for the purpose, and there are no difficulties in the way of irrigation. The works are not yet established, but are in progress. They are at first intended to be experimental, and will consist of a pumping station in Liverpool, with an engine capable of lifting to the requisite height of 2,000 tons of sewage per diem, and a line of pipes extending northwards for about eight miles in the meantime. The experimental farm is 60 acres in extent, but with power to extend to 1,500 acres. [D.E.]
WATERLOO - WITH - SEAFORTH.	There is doubtless much land available for the purpose of irrigation. It is believed there are no difficulties in the way.
GREAT CROSBY -	There is land available, and a landowner sought to have the sewage used for irrigation, but the probable cost and nuisance did not seem likely to be compensated by any sufficient money returns.
LITHERLAND - -	The district is small, and buildings increasing, and it is near other populous districts. The value of the sewage would not meet the expense of collecting it, besides the nuisance it would cause.
BIRKDALE - -	The Answers to Queries have not been received from this Local Board of Health.
WEST DERBY - -	The matter has been discussed by the Local Board, who consider it more advisable and economical to carry the sewage to the *Mersey*. There is not any land available within the district of this Board. Irrigation would not be carried out by gravitation; the sewage would have to be pumped.
WALTON - ON - THE - HILL.	The Local Board has at present under consideration a scheme for the effectual sewerage of the district, and it is contemplated to apply the sewage to the land by irrigation. The scheme has hitherto been retarded by the difficulty of obtaining land.
TOXTETH PARK -	No land available in this district; there is not the slightest facility for the purpose.
WAVERTREE - -	Not applicable to this district.
LITTLE WOOLTON -	There is land available for the purpose, and there are not any difficulties in the way of irrigation.
MUCH WOOLTON -	It is not at present contemplated to irrigate, but the subsidence tanks for the eastern portion of the district have been placed at such a level that the sewage can be applied to the land by gravitation. On the western side the Board have met with great

MERSEY BASIN—(MERSEY PROPER).

Series No. 3, Sewage Works.—Answers to Queries 8 to 17.—Page 86—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
MUCH WOOLTON—*cont.*	opposition from the landowners, and have been compelled in consequence to make arrangements for carrying the whole of the sewage into the already much fouled river *Mersey* at Garston, by means of an outlet sewer three miles long, and at an estimated cost of nearly 4,000*l.* The great difficulty is that of obtaining land, and until Local Boards are vested with more power for obtaining land, this difficulty will always remain to thwart them in their good intention. So long as things remain as they are the benefits of sewage irrigation will only be known to a few favoured places, and river pollution must be continued, although perhaps in a less degree, as hitherto. What is wanted is Conservancy Boards with powers to prevent river pollution over their respective water sheds, and Corporations and Local Boards vested with more power for obtaining land for irrigation and other purposes.
GARSTON - -	We consider it would require a large outlay, and the sewage would have to be conveyed to a great distance.
WIDNES - -	Irrigation has been contemplated, but many obstacles (chemical and other works) at present interfere with the schemes; the sewers in the district being most incomplete render a large outlay necessary.
SUTTON, PRESCOT, and PARR.	Not answered.
ST. HELEN'S - -	Irrigation has not been contemplated by the governing body. The drainage from alkali waste (upon which the town is in great measure built) would probably render the sewage useless for the purpose. There is available land, and there are no engineering difficulties in the way.
NEWTON-IN-MACKERFIELD.	Irrigation has not been contemplated; there is available land, and no serious difficulty in the way of irrigation.
WARRINGTON - -	There is not any land available without pumping.
PENNINGTON - -	Irrigation has been contemplated by the Local Boards of Pennington, Atherton, and Westleigh, near Pennington brook. The only difficulty in the way of irrigation is the apportionment of the cost of proposed works amongst the Local Boards of Pennington, Atherton, and Westleigh.
WESTLEIGH - -	Irrigation has been contemplated by the Local Boards of Pennington, Atherton, and Westleigh. There is land available, especially that portion of Westleigh included in the town of Leigh. The difficulty in the way of irrigation is in the apportionment of the cost between the Local Boards of Pennington, Westleigh, and Atherton.
HINDLEY - -	Sewage irrigation is contemplated. 80 acres of land available, but not much choice of land without pumping.
ATHERTON - -	It has been contemplated to use the sewage from Stock Platt Ditch locality for irrigating land in the township of Pennington, by the three Local Boards of Atherton, Pennington, and Westleigh.
TYLDESLEY - WITH - SHAKERLEY.	No engineering difficulties. The land for the purpose of irrigation is difficult to obtain.
RUSHOLME - -	There is considerable difficulty in the way of irrigation. The greater part of the district is built upon.
LEVENSHULME -	The Answers to Queries have not been received from this Local Board of Health.
STOCKPORT - -	It has been contemplated, but no feasible plan has been suggested; there is land available for the purpose.
BREDBURY -	Most of the land is higher than the level of the sewer; the sewage would have to be pumped.
WALLASEY & BIRKENHEAD.	No irrigation works established.
OXTON - - -	There is land available for irrigation; it has been contemplated by the governing body, the difficulties in the way is the cost of a tunnel through part of Oxton Hill, and the danger of causing a nuisance.
TRANMERE - -	There is not any available land, irrigation has not been contemplated.
HIGHER BEBINGTON -	The subject has never been considered by the Board.
RUNCORN - -	Irrigation has not been contemplated, and it is doubtful whether land could be obtained for the purpose. The sewage would have to be pumped.
LYMM - - -	There is land available for irrigation, and this mode of disposing of the sewage has been contemplated; there are no difficulties in the way.
ALTRINCHAM - -	Irrigation has been contemplated, but nothing has been done towards it on account of the unfavourable nature of the situation as to levels. The sewage will require to be pumped.
SALE - - -	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
BARTON, ECCLES, WINTON, & MONTON.	At two or three miles distance there is a considerable tract of moss land not yet, or only partially, cultivated.

Mersey Basin—(River Irwell).

Series No. 3, Sewage Works.—Answers to Queries 8 to 17.—Page 86—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Stretford, Moss Side, Salford, and Kearsley.	These Queries not answered.
Manchester - -	None established.
Prestwich - -	Irrigation has been contemplated, but nothing has been done; there is no particular difficulty.
Swinton - -	Small portions of land have been irrigated by the Local Board; the only difficulty in the way of irrigation is irregularity of the land in some parts of the district.
Farnworth - -	Irrigation would be very difficult; the sewage would have to be pumped, in consequence of the outlet of the sewers being at so low a level.
Bolton - - -	This mode of dealing with the sewage has not been contemplated by the Corporation or any other person. It is believed that there is no land within a suitable distance which can be made available; the general conformation of the district renders any scheme of sewage irrigation difficult of application.
Astley Bridge -	There is no land within a reasonable distance of the outlet, and the sewer being low the sewage would require pumping, the expense of which would be heavy to the township.
Halliwell - -	No land for irrigation available.
Radcliffe - -	Irrigation works are in course of construction. There is land available for irrigation, but it is of limited extent, and can be used only for the sewage of a part of the district.
Whitefield - -	There is land available for a portion of the District only. Sewage irrigation has been contemplated, but the sewage from a part of the District would have to be conveyed considerably beyond the limits of the Local Board and at a very heavy outlay.
Bury - - -	Not much available. If compelled, perhaps, the Board might be able to obtain land if they were armed with powers of compulsory purchase. The subject of irrigation has never been contemplated by the governing body, although it has been occasionally named by a few individuals not having seats at the Board, and possessing more zeal than practical knowledge. The chief obstacles in the way are the cost and difficulty of procuring land, the great length of conduit required, the cost of pumping, the extremely diluted and inferior agricultural qualities of the sewage, and the fact that any irrigation works done by us would not perceptibly improve the river. Again, as there are two outlets for the sewage, one in the *Irwell* the other in the *Roch*, situate wide apart, two systems of irrigation would be required, and much residential injury would be caused to houses and grounds of great value by the formation of such works in their vicinity.
Ramsbottom - -	Irrigation has not been contemplated; there is very little available land, and the ashpit system is adopted in the district, and consequently the sewage has little or no manuring quality.
Bacup - - -	Irrigation has not been contemplated. If pumping however was resorted to, mains laid and stations established at the most advantageous points, then land might be reached; but the great first cost would be the objection to irrigation in this part. About the excellence of irrigation, as a means of disposing of sewage well and profitably in suitable localities, we entertain no doubt. But here, situated between steep hills, disposal of sewage by irrigation would be most difficult.
Heywood - -	Waiting to see what is done at other places; land to a small extent could only be obtained, and the sewage would have to be pumped.
Rochdale - -	A committee of the Council has had the question of irrigation in hand, and, after visiting many towns, reported to the Council thereon. Differences of opinion exist as to the disposal of the sewage, and the ulterior mode of dealing with it has not yet been settled by the Council. The town is in a valley the ground on each side of which rises very rapidly; the river flows through a narrow gorge about half a mile below the borough boundary. There is not sufficient table land on its banks, and the sewage in the lower parts of the town would have to be pumped to a great height to be made available for irrigation, and then upon land which is very uneven.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath and Failsworth.	Irrigation has not been contemplated.
Bedford, near Manchester.	Sewage from town is conveyed by gravitation, and passes over 26 acres statute. About 20,000 gallons in 24 hours in ordinary weather; the effluent water flows clear into the brook.
Bradford - -	Insuperable difficulties in the way of irrigation. Bradford is closed in on all sides. On the opposite side of the river *Medlock* is the new cemetery of the city of Manchester, and beyond it lies the district of Newton Heath on one side, and Manchester on the other.
Openshaw - -	No land available.

Mersey Basin—(River Irwell).

Series No. 3, Sewage Works.—Answers to Queries 8 to 17.—Page 86—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Gorton - - -	The parts of the district where there is any available outlet for the sewage are so thickly populated that the land is entirely used for building and not for agricultural purposes, and abuts upon the city of Manchester.
Droylsden - -	Only a limited extent of agricultural land in the district.
Oldham - - -	Irrigation has been contemplated, but the principal difficulties would be in obtaining the necessary land, and the annual cost of distribution of the sewage, as it would have to be pumped wholly or partially.
Crompton - -	The question of irrigation has not at any time been entertained by or initiated at any meeting of the Board.
Royton - - -	Not answered.
Lees - - -	Irrigation has not been contemplated.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	There is land available for irrigation; the expense is the chief difficulty.
Bollington - -	Irrigation has not been contemplated.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	No land available for irrigation.
Witton-cum-Twambrookes.	We do not know of any difficulties in the way of irrigation.
Sandbach - -	There is land available for the purpose, but irrigation has not been contemplated by the governing body; there are not any difficulties in the way.
Monks Coppenhall	There is land available by pumping at two stations. Irrigation has been contemplated, but considered too expensive to pump. There are no other difficulties in the way.
Tarporley - -	Irrigation of land by sewage has been contemplated by the Local Board, and there are no difficulties in the way.
Nantwich - -	Irrigation has not been contemplated. There is no land near at a sufficiently low level for irrigation.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	There is not any land available without very great outlay in pumping.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	No land available for irrigation.
Preston - -	About three years ago the Corporation contemplated the irrigation of land with the sewage of the town. There is land lower down the river which might be used for irrigation. The sewage would have to be pumped, land obtained, and right of constructing conduit through, and the erection of works upon land obtained.
Leyland & Clitheroe.	Irrigation has not been contemplated.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	The land in the district is not available for irrigation.
Oswaldtwistle -	The land all around is too high and hilly.
Accrington - -	About 400 acres of land available; a great many difficulties in the way, the town lying very low and having a large and populous district below it.
Burnley - -	There is land available. Sewage would have to be raised by mechanical power. We are not aware of any great difficulties, but the matter would require very careful consideration before any definite opinion could be arrived at.
Brierfield - -	Not answered.
Nelson - -	There is land available for irrigation; there are no difficulties in the way, but irrigation has not been contemplated by the Local Board.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	There is land available about four miles below the outlet works. The question of irrigation is now being considered by the Corporation. There are not any difficulties in the way except that the town is already most heavily burdened with rates, and they could scarcely be increased to meet an additional loan.

Ribble Basin—(River Darwen).

Series No. 3, Sewage Works.—Answers to Queries 8 to 17.—Page 86—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Great Harwood -	There is land available for irrigation, but this mode of disposing of the sewage has not positively been determined by the Local Board; it has not been sufficiently considered.
Over Darwen -	Irrigation by sewage has been contemplated by the governing body, but the district is too hilly.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	Irrigation has not been contemplated. There is available land; the country is extremely flat.
Chorley - -	Irrigation has been contemplated, and is now being carried out by the governing body. There is land available for the purpose, and no difficulties in the way.
Ormskirk - -	The Board are now constructing utilization and irrigation works on a farm about a mile from the town, and the sewage is conveyed there by pipes 24 inches in diameter. The area of the farm is about 30 acres.
Wigan - - -	Not answered.

SERIES No. 4, WATER SUPPLY.

Queries——1. How is the town supplied with water for domestic purposes?——2. From what source is the water at present obtained, from wells, river or stream, or both?——3. When were the waterworks for the town first established?——4. To whom do they belong?——5. Where are the reservoirs or pumping stations situate?——6. If pumped or abstracted from river, give the daily volume pumped or abstracted?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	By waterworks authorized by Act of Parliament; supply obtained from streams and springs; the Act was passed in 1865; there were waterworks for some 10 or 12 years before; these are now enlarged under the Act, and belong to Lord Edward George Fitzalan Howard, of Glossop Hall. The reservoirs are situate at Swinesham.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Partly from the river *Goyt* and partly from springs. (Queries 3 to 42 not answered.)
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	From waterworks under an Act of Parliament; supply obtained from a gathering ground. Works established in 1832; belong to Mr. Thomas Mottram; the reservoirs are situate at Werneth, Hyde, and Godley. Extent of gathering ground is not known, it is rather small.
Denton - - -	The district is supplied by the waterworks of the Corporation of Manchester.
Dukinfield - -	From the Dukinfield waterworks. Established in or about the year 1839. Belong to the Corporation of Stalybridge, and the Dukinfield Board of Health. Reservoirs are in Dukinfield. No water taken from river.
Stalybridge - -	At present the borough is supplied with water from the Dukinfield Waterworks; but another supply will be shortly obtained from the Swineshaw Waterworks, which are being constructed under "*The Ashton-under-Lyne and Stalybridge (Corporation) "Waterworks Act*, 1864." The Dukinfield Waterworks were established in or about the year 1842, and are the property of the Corporation of Stalybridge and Dukinfield Local Board of Health. The reservoirs are at Dunkinfield. There is no water taken from the river.
Ashton - under - Lyne.	The town is at present supplied from waterworks belonging to the Corporation. The principal source at present is from a reservoir about two miles from the town constructed upwards of 30 years ago, and an additional supply is also obtained from a shaft sunk for a coal pit within the borough; extensive works are now being constructed at Swineshaw, in about a year this supply will be available, and then the water from the coal-pit shaft will not be required. The works were established in 1835 or 1836. The reservoirs at Knott Hill belong to the Corporation, and the Swineshaw reservoirs to the Corporations of Ashton and Stalybridge. The latter are intended to supply Ashton, Stalybridge, and Mossley. The impounding reservoirs are at Knott Hill, about two miles, and Swineshaw about five miles from the town.

Mersey Basin—(River Tame).

Series No. 4, Water Supply.—Answers to Queries 1 to 6.—Page 90—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Hurst - - -	The town is supplied by the Corporation of Ashton-under-Lyne. From a waterworks belonging to the Ashton Corporation.
Mossley - -	The district is insufficiently supplied from a small private waterworks, and from wells; a Bill is now before Parliament for a better supply.
	Watershed of the Mersey Proper.
Liverpool - -	Partly by gravitation and partly by pumping. From river and wells. The beginning of the present century. Before 1848 they belonged to two companies, since then to the Corporation of Liverpool. The Catchment Reservoirs are situate at Rivington near Bolton, distant about 30 miles from Liverpool. The pumping stations in and about Liverpool at present in use,—Green Lane, Bootle, Windsor, Dudlow Lane, Water Street, Toxteth Park. Not in use:—Hotham Street, Soho and Bevington Bush, and Devonshire Place. The Service Reservoirs are,—Prescot, Kensington, Aubrey Street, Park Hill, Atherton Street, Dudlow Lane, Woolton Hill. Not pumped but abstracted from river. The total drainage is taken from the water shed. A daily quantity of 6,465,000 gallons is sent down the streams as compensation, and 10,347,743 sent to Liverpool as per average of 1867. [W. E.]
Waterloo - with - Seaforth, Litherland, West Derby, Walton-on - the - Hill, Toxteth Park, Wavertree, Much Woolton, and Garston.	The district is supplied from the waterworks of the Corporation of Liverpool.
Great Crosby and Little Woolton.	By the Liverpool Corporation Waterworks, and from private wells.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
Widnes - -	At present temporarily, supply given by different manufacturers in the district; from wells. Waterworks are in course of construction by the Local Board of Health. Reservoir at Pea Hill, Cronton; pumping station at Stocks Well, Ditton.
Sutton and Parr -	From the St. Helen's Improvement Commissioners under powers vested in them.
Prescot - -	The district is principally supplied by the Liverpool Corporation Waterworks.
St. Helens - -	By gravitation from a service reservoir at the Eccleston Hill pumping station, situated 150 feet above the town, and from wells; but the water from the wells only is used for domestic purposes. The surface or gravitation waterworks were established in 1840, and the wells or pumping waterworks in 1852; they belong to the Corporation. The impounding reservoir of the gravitation waterworks, as also the pumping station and service reservoir, are situated in the township of Eccleston at short distances beyond the borough boundary.
Newton - in - Mackerfield.	By private wells and pumps.
Warrington - -	The borough is supplied with water by the Warrington Waterworks Company. *Queries 2 to 42 not answered.*
Pennington - -	From wells.
Westleigh - -	From wells principally; and surface water.
Hindley - -	Not answered.
Atherton - -	The district is about to be supplied with water by the Manchester Corporation through the Tyldesley Local Board of Health. Reservoir at Prestwich, near Manchester.
Tyldesley - with - Shakerley and Rusholme.	By the waterworks of the Corporation of Manchester.
Levenshulme - -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	But badly supplied with water; from Wells, from the Manchester Waterworks Company from Lyme Park reservoir, and from artesian wells. Established in 1826. To Stockport District Waterworks Co. Pumping stations at the Park Mills and New Bridge Lane Mills. The reservoirs at High Lane, Woodbank, Lyme Park, Gorton.
Bredbury - -	From wells and a small reservoir, where the bulk of the population is located, and the rest from springs and wells. Established about 20 years ago, and belong to John Sidebotham, Esq., of Kingston, Hyde, near Manchester.
Wallasey - -	From one well. Works established in 1863, and are the property of the Wallasey Local Board of Health. Service reservoir is situated in Liscard township. The pumping station in the township of Poulton-cum-Seacombe, both in the parish and (Local Board) district of Wallasey.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 1 to 6.—Page 90—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Birkenhead	The town is supplied with water from two reservoirs and pumping stations, one situated at Spring Hill, Birkenhead, and the second near Flaybrick Hill in Claughton. The whole supply water is obtained from wells. Established in the year 1845 by the Birkenhead and Claughton Gas and Water Company; transferred to the Birkenhead Commissioners under the provisions of the Act of 1858. None pumped or abstracted from river.
Oxton	The Wirral Waterworks Company. From a well established in 1859. No water pumped or abstracted from the river or streams. The reservoir is on Prenton Mount, about a mile from the Oxton township boundary. The pumping station is situated in the valley at a distance of 1,672 yards from the reservoir.
Tranmere	From a well. Works established in 1860, and belong to the Tranmere Local Board of Health. The reservoir is situate in Greenway Road, Tranmere, and the pumping station in Fountain Street, Tranmere.
Higher Bebington	By the Wiral Waterworks Company, who obtained their Act in 1859 for supplying parts of the parishes of Bebington and Woodchurch with water. The works were completed in 1862 or 1863. Reservoir in the township of Prenton.
Runcorn	At present by wells, but waterworks are in course of construction by a limited company under Act of Parliament, 26th May 1865. These works will be in operation early in the year 1869. *Queries 2 to 24 not answered.*
Lymm	By pumps and wells on private property and by a spring in the village.
Altrincham	By the North Cheshire Water Company. From the Manchester Corporation reservoirs at Woodhead. Established about nine years ago.
Sale	Not answered.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton.	From the waterworks of the Manchester Corporation, and also from wells.
Stretford & Moss Side.	From waterworks of the Manchester Corporation.
Salford	Water is supplied to the Salford district of the borough in bulk by the Corporation of Manchester, and the quantity delivered recorded by meters fixed at Blackfriars Bridge; the junction or boundary line between the city and the borough, and to the Broughton and Pendleton districts; also in the borough, direct by the Manchester Corporation. From the Manchester Corporation.
Manchester	From the Manchester Corporation Waterworks. From river and streams, including springs. The Manchester Corporation commenced to supply water in 1851. The water was previously supplied by the Manchester and Salford Waterworks Company. The works belong to the mayor, alderman, and citizens of the city of Manchester. The Storage Reservoirs are situate in the valleys of the river *Etherow*, and on the *Arnfield* and *Hollingworth* brooks, in the township of Tintwistle, in Cheshire, and Padfield, in Derbyshire; and the Service Reservoirs are situate at Godley, Denton, Gorton, and Prestwich. There is a pumping station at Gorton, which formed a part of the works of the old Manchester and Salford Waterworks Company; but the pump is rarely worked by the Corporation. Beyond the volume required to be sent down the rivers for the millowners on the Etherow, or about 14,000,000 gallons per day, the quantity of water now abstracted from the river, streams, and springs is about an average throughout the year of 13½ million gallons per day. When the pump at Gorton is worked it produces about 750,000 gallons per day.
Prestwich	By the Manchester Corporation, and by the Bury and Radcliffe Waterworks Company.
Swinton	From the Manchester Corporation Waterworks.
Kearsley	From the Bolton Corporation Waterworks. Reservoirs at Belmont and Heaton.
Farnworth	From the waterworks of the Corporation of Bolton. Reservoirs in the townships of Heaton, Sharples, and Entwistle.
Bolton	The town is supplied with water for domestic and manufacturing purposes by means of gravitation. The source of supply is the moorlands lying four to five miles north-west of the borough. The waterworks were first established in 1824, but have been much extended since that date, both as regards source of supply, and the district served. They originally belonged to a company but are now the property of the Bolton Corporation. The reservoirs furnishing the present supply are in the townships of Sharples and Heaton, but new works are in progress which, when complete, will enable the Corporation to take water from another reservoir, situate in the townships of, and known as the, Turton and Entwistle Reservoir.
Astley Bridge and Halliwell.	From the Bolton Corporation Waterworks.
Radcliffe	By a private company called the Bury and Radcliffe Waterworks Company. From springs and streams. Established about 10 years since.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 1 to 6.—Page 90—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Whitefield	By the Bury and Radcliffe Waterworks Company, whose supply is gathered principally from the hills between Blackburn and Haslingden. Established in 1845.
Bury	By the Bury and Radcliffe Waterworks Company. From streams; the upper sources of the Irwell taken in the hills above the populous towns and villages, and stored in reservoirs. They were begun in 1837, finished in 1839 or 1840, and much enlarged in 1855. The reservoirs are at Haslingden Grane, Walmersley and Shuttleworth, and Bury. The gathering ground is about 800 acres in extent.
Ramsbottom	The town is supplied with water by the Bury and Radcliffe Waterworks Company, whose reservoirs are not within the district of the Board. The Local Board do not use any of the Company's water for public purposes.
Bacup	Partly by springs and pumps, and small reservoirs, but principally by waterworks. Established in the year 1853, and belong to the Rosendale Waterworks Company. About one mile from the centre of the town.
Heywood	By a private company. From a watershed three miles from the town, and stored in reservoirs. The works were commenced in 1846, since enlarged, and belong to the Heywood Waterworks Company. Reservoir situate on the *Mayden* brook.
Rochdale	By waterworks belonging to the Corporation; obtained from catchwater drains and springs on Brown Wardle Common, running into five artificial reservoirs, made by a private company under two *Acts of King George the Third*, amended by an *Act* of the *2nd Victoria*, which was repealed by an Act of the 10th Victoria. The Corporation acquired the waterworks under powers contained in the Rochdale Waterworks Act, 1866, which amended the Act of 10th Victoria before mentioned. The reservoirs are situate at Buckley Wood, Fanny Brook, Hamer Pasture, and Brown House Wham, all within two miles of the borough boundary. There is no pumping.
Crumpsall	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath	The district is entirely supplied with water by the Manchester Corporation Waterworks, with the exception of a very few houses in the agricultural portion of the district, the occupiers of which houses obtain the water from wells.
Failsworth	By the Oldham Corporation Waterworks at present to about two-thirds of the district, and when the mains are completed water will be supplied to the entire district.
Bedford near Manchester.	From the wells and pumps.
Bradford, Openshaw, Gorton, and Droylsden.	By the waterworks of the Manchester Corporation.
Oldham	By impounding reservoirs. From the sources of the rivers *Irwell* and *Medloch*. Established in 1826. To the Oldham Corporation. There are no pumping stations. The reservoirs are situate at Strinesdale, about 2 miles east of the town, and at Piethorne, about 4 miles east of Rochdale.
Crompton	Generally by springs on the premises or arising from the adjoining lands; some houses are supplied by the Corporation of Oldham from their waterworks at Piethorn, pipes from which are laid through the district to convey the water to Oldham.
Royton	By the Oldham Corporation Waterworks and wells.
Lees	By the Oldham Corporation Waterworks.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield	By gravitation from reservoirs at Langley, principally fed by springs and streams above Langley, Ridge Gate, Nesset, Coopers, and Walker Barn streams; also from Rulow, Swine Park, and Round Fountain, passing through a conduit to Leadbeater's reservoir, from thence through filtering beds into a service reservoir. The old works were constructed nearly a century ago; the new works came into operation in 1850, and belong to the Corporation. The reservoirs are situate one at the Macclesfield Common and the other at Langley.
Bollington	From springs and pumps.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich	By the Northwich Waterworks Company (Limited). From *Wade* brook. Established in the year 1857. Reservoir at Wadebrook Witton.
Witton-cum-Twambrookes.	By a limited Liability Company; supply obtained from stream. Works established in 1847.
Sandbach	By wells.
Monks Coppenhall	The water supplied by the London and North Western Railway Company from a well. The works established in 1866. The reservoirs are at Whitmoor, about 14 miles from Crewe.

Mersey Basin—(River Weaver).

Series No. 4, Water Supply.—Answers to Queries 1 to 6.—Page 90—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Tarporley - -	From wells and pumps.
Nantwich - -	The town has been partially supplied by gravitation from Baddiley Mere, at a distance of 4½ miles from the town; a new storeage reservoir has just been completed of 5½ acres in extent, but not yet brought into use. Established in 1854, belonging to the Local Board. Reservoirs at Baddiley, in the county of Chester.
Congleton - -	The Answers to Queries have not been received from this Borough.

RIBBLE BASIN.

Watershed of the Ribble Proper.

Southport - -	By "The Southport Waterworks Company," from a deep well. Established in 1854. Reservoir is at Scarisbrick, about five miles from Southport.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	By the Preston Corporation Waterworks.
Preston - -	The water is principally gathered from Longridge Fell and conveyed by gravitation conduits into reservoirs; it is also conveyed by a conduit from the river *Loud* to the reservoirs. The waterworks were first established in 1832, remained the property of a private company to 1854, when they were purchased by the Local Board, and have since been considerably improved and extended. The reservoirs are situate to the north east of Preston at distances of from 3 to 8 miles. They are called Dilworth, Spade Mill, Alston, Grimsargh (three), and Fulwood. The Local Board, in consequence of the present very dry season (September 1868) and the fear that the town would be without water, have constructed pumping works, and taken other means for conveying the waters of the river *Hodder* into the *Loud* conduit, and thence to the reservoirs.
Leyland - -	By water pumped from wells.
Clitheroe - -	From springs on the moors. Established in 1854, and belong to the Clitheroe Waterworks Company. The reservoirs are at West Bradford.

Watershed of the Calder, Tributary of the Ribble.

Clayton-le-Moors	From gathering ground and reservoirs. Established in 1866. The Accrington Gas and Waterworks Company. Reservoirs at Harewood Dean. Not pumped or abstracted from river.
Oswaldtwistle -	From streams. Works established May 1868. Belong to the Local Government Board. Reservoirs at Jack House and Cocker Cobbs.
Accrington - -	By Accrington Gas and Waterworks Company. Springs, streams, and reservoirs. Established in 1841. Reservoirs at Burnley road, Accrington, Mitchell's house, and Higher Booth.
Burnley - -	From springs and gathering grounds by gravitation. The works were established in 1819, and belong to the Corporation of Burnley. The reservoirs, five in number, are situate at Swindon, about 3½ miles, and Heckenhurst, 2 miles from Burnley.
Brierfield - -	There are no water waterworks. The district, however, will shortly be supplied with water by the Local Board of Nelson, under the Nelson Water and Gas Act, 1866. At present the supply is from springs.
Nelson - -	From the *Walverden* stream, from springs, and gathering grounds. The waterworks are on the point of completion, and will, it is hoped, be in operation during the year 1869; they are the property of the Local Board; the reservoirs are situate on and adjoining the *Walverden* stream. The Local Board have power to abstract as much water as will pass through an aperture 15 inches wide and 3 inches deep.

Watershed of the Darwen, Tributary of the Ribble.

Blackburn - -	By the Blackburn Waterworks Company from gathering grounds. Established in 1848.
Great Harwood -	Principally by small wells and cisterns attached to the houses. The Accrington Gas and Waterworks Co. are putting down waterworks to supply the town. The reservoirs are situate above the town at a place called Dean Valley.
Over Darwen -	By waterworks from streams; works, established in 1847, belong to the Darwen Waterworks and Reservoirs Company. The reservoir is situate about a mile from the town; the water is not pumped or abstracted from the river *Darwen.*

Watershed of the Douglas, Tributary of the Ribble.

Croston - -	From private wells and the river.
Chorley - -	By waterworks. From gathering grounds and streams. Established in 1847. Belong to the Liverpool Corporation. Reservoirs situate in Chorley and Anglezark.

Ribble Basin—(River Douglas).

Series No. 4, Water Supply.—Answers to Queries 1 to 6.—Page 90—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Ormskirk - -	From wells. Works established June 1852, and belong to the Local Board of Health. The reservoir is situate in the township of Burscough.
Wigan - - -	By pumping and by gravitation. From a stream four miles north of the town; works established in 1853 and belong to the Corporation. The reservoirs are situated near Standish paper mills about three miles, and the pumping station about one and half miles north of Wigan. The volume pumped is about 700,000 gallons daily.

Series No. 4, Water Supply.—Queries——7. If impounding reservoirs, what is the area of gathering ground?——8. What is the area of reservoir; if more than one, give area of each separate?——9. What the maximum depth?——10. How many gallons of water will each contain?

MERSEY BASIN.

Watershed of the Etherow, Tributary of the Mersey.

Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	Not answered.

Watershed of the Goyt, Tributary of the Mersey.

Yeardsley - cum - Whaley.	Not answered.

Watershed of the Tame, Tributary of the Mersey.

Hyde - - -	None of the water is got from the river. There are five small reservoirs. Area, depth, and contents not known.
Denton - - -	Not answered.
Dukinfield - -	Gathering ground about 280 statute acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	feet.	feet.	gallons.
No. 1 - - -	113,364	24	11,351,475
„ 2 - - -	113,364		11,351,475
„ 3 - - -	100,902		12,753,450
„ 4 - - -	100,902		12,753,450
Total - -	428,532	—	48,209,850

Stalybridge - -	Gathering ground about 280 statute acres. There are four reservoirs of the following areas:—Two of 113,364 feet each, and two of 100,902 feet each. The maximum depth is 18 feet. Two contain 11,351,475 gallons each, and two 12,753,450 gallons each; total, 48,209,850 gallons.
Ashton-under-Lyne	Gathering ground, Knott Hill about 600 acres, but some of the water is unfit for use and is not used. Swineshaw 1,290 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	A. R. P.	feet.	gallons.
Knott Hill - - - -	15 2 0	54·75	90,000,000
Higher Swineshaw - - -	24 1 13	49·52	100,000,000
Lower Swineshaw - - - -	11 2 23	33·29	65,000,000
Brushes - - - - -	7 3 12	44·0	55,000,000
Walker Wood - - - -	25 0 35	61·0	140,000,000
Total - - -	84 2 3	—	450,000,000

The four last named are in course of construction, and the above estimates are those given before the excavations commenced, when completed the capacity will be probably increased one-third.

Hurst - - -	Not answered.

Mersey Basin—(River Tame).

Series No. 4, Water Supply.—Answers to Queries 7 to 10.—Page 95—*continued.*

Mossley - -

The water for the private works and supplies is from a spring. (*Queries 7 to 42 not answered.*)

Liverpool - -

Watershed of the Mersey Proper.

Gathering ground 10,000 acres. [W.E.]

Reservoir.	Area in Acres.	Greatest Depth in Feet.	Capacity in Gallons.	Remarks.
Roddlesworth, Upper	38	64	180 millions	
Do. Lower	16 4/10	78	99 7/10 „	
Rake - -	13 8/10	78	79 6/10 „	
Goit - -	—	—	—	Length, 3½ miles; average width at bottom, 21 feet.
Aglezark - -	191 6/10	35	1,019 4/10 „	
Chorley do. -	10 1/10	39	48 3/10 „	
Rivington - -	275	40	1,841 „	
Filter beds - -	4 1/10	—	—	In ordinary work will filter 14 million gallons daily.
Including filter beds	549	—	3,268 „	

Waterloo - with - Seaforth, Great Crosby, Litherland, West Derby, Walton-on-the-Hill, Toxteth Park, Wavertree, Little Woolton, Much Woolton, Garston, Widnes, Sutton, Prescot, and Parr.

Not answered.

Birkdale - -

The Answers to Queries have not been received from this Local Board of Health.

St. Helens - -

Gathering ground about 300 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	acres.	feet.	gallons.
No. 1 - - - - -	2	10 or 12	3,206,000
No. 2 - - - - -	3		4,900,000
Total - - -	5	—	8,106,000

Newton-in-Mackerfield, Warrington, Pennington, Westleigh, Hindley, Atherton, Tyldesley-with-Shakerley, Rusholme, Stockport, Bredbury, Wallasey, Birkenhead, Oxton, Tranmere, Higher Bebington, Runcorn, Lymm, Altrincham, & Sale.

Not answered.

Levenshulme - -

The Answers to Queries have not been received from this Local Board of Health.

Watershed of the Irwell, Tributary of the Mersey.

Barton, Eccles, Winton, & Monton, Stretford, Moss Side, & Salford.

Not answered.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 7 to 10.—Page 95—*continued.*

Manchester - -

Gathering ground about 19,000 statute acres.

	Area of Top Water.	Maximum Depth.	Capacity.
Woodhead reservoir - -	135 acres	72 feet	1,235,000,000 gallons.
Torside „ - -	160 „	84 „	1,474,000,000 „
Rhodes Wood „ - -	54 „	68 „	500,000,000 „
Arnfield „ - -	39 „	52 „	
Hollingworth „ - -	13 „	52 „	209,000,000 „
Godley „ - -	15 „	21 „	73,000,000 „
Denton „ - -	13 „	20 „	53,000,000 „
Gorton „ - -	57 „	29 „	223,000,000 „
Prestwich „ - -	4½ „	22 „	20,000,000 „
			3,787,000,000 „
In addition to the above, there are two reservoirs now being constructed in the valley of the *Etherow*, viz.:—			
Vale House reservoir - -	64½ „	40 „	335,000,000 „
Bottoms „ - -	46 „	50 „	399,000,000 „
Total - -	601 acres.	—	4,521,000,000 gallons.

Prestwich, Swinton, Kearsley, and Farnworth.

Not answered.

Bolton - - -

Area of gathering ground in Sharples and Heaton 1,047 acres, that in Turton and Entwistle 2,118 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	acres.	feet.	gallons.
In Sharples,—			
Spring - - - -	22	45	130,000,000
Dingle - - - - -	14	34	70,000,000
Sweetloves - - - -	17	35	88,000,000
Heaton - - - -	22	26	92,000,000
Turton and Entwistle - - -	100	120	555,000,000
Total - -	175	—	935,000,000

The Turton and Entwistle reservoir will contain 555,000,000 gallons. The water is free from pollution before entering the reservoirs; and is not filtered.

Astley Bridge -

See Answers to Queries 1 to 6, Water Supply, page 92.

Halliwell, Radcliffe, & Whitefield.

Not answered.

Bury - - -

Gathering ground 1,800 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	acres.	feet.	gallons.
Calf Hey - - - - -	30	50	137,500,000
Holden Wood - - - -	25	40	87,500,000
Shuttleworth - - - -	3	—	12,500,000
Gin Hall - - - - -	10	27	50,000,000
Spout House - - - -	5	16	25,000,000
Total - - -	73	—	312,500,000

These figures are only approximate estimates, and are somewhat overstated. Accurate returns cannot be obtained from the Company. Out of this quantity stored, compensation of six cubic feet per second for 12 hours of every day must be sent down the stream for the millowners; this volume will exhaust at least one-third of the power of the storage reservoirs.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 7 to 10.—Page 95—*continued.*

Ramsbottom - -

Not answered.

Bacup - -

Gathering ground 350 acres. Area of reservoir for domestic purposes, six acres; compensating reservoir for mills, about 3½ acres, containing 14,000,000 and 8,000,000 gallons respectively.

Heywood - -

Gathering ground 1,260 acres. Three reservoirs about 12 acres each, and two about three-quarters of an acre each; average about 30 feet deep. Three contain about 70,000,000 gallons each; two about 20,000,000 gallons each.

Rochdale - -

Gathering ground about 700 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	A. R. P.	ft. in.	gallons.
Buckley Wood, No. 1 - - -	3 0 13	32 4	24,271,312
Do. „ 2 - - -	0 3 5	21 6	3,404,197
Do. „ 3 - - -	0 0 20	9 6	294,822
Hamer Pasture - - - -	5 2 0	58 0	72,532,151
Brownhouse Wham - - -	6 2 11	26 6	47,010,448
Jepheys - - - - -	0 1 13	8 6	414,970
Total - - -	16 1 22	—	147,927,900

Crumpsall - -

The Answers to Queries have not been received from this Local Board of Health.

Newton Heath, Failsworth, Openshaw, Gorton & Droylsden.

Not answered.

Bedford, near Manchester, & Bradford.

See Answers to Queries 1 to 6, Water Supply, page 93.

Oldham - - -

Gathering ground at Strinesdale 660 acres, Brushes Clough and Besom Hill 900 acres, and Piethorn 1,340 acres. Total 2,700 statute acres. Height of Piethorn and Strinesdale upper reservoir above ordnance datum about 815 feet.

Reservoirs.	Area.	Maximum Depth.	Capacity.
	acres.	feet.	gallons.
Strinesdale, Upper - - -	10	38	76,000,000
Strinesdale, Lower - - -	15	56	140,000,000
Brushes Clough - - - -	5	45	40,000,000
Besom Hill - - - -	2¼	33	11,000,000
Norman Hill - - - -	9	40	47,000,000
Hanging Lees - - - -	4½	30	21,000,000
Piethorn - - - - -	40	58	344,000,000
Kitcliffe - - - - -	13	27	63,000,000
Total - - -	98¾	—	742,000,000

The water is not polluted before entering the reservoirs, and is not filtered.

Crompton, Royton, and Lees.

Not answered.

Watershed of the Bollin, Tributary of the Mersey.

Chorley - -

The Answers to Queries have not been received from this Local Board of Health.

Macclesfield -

Gathering ground 2,000 acres.

Reservoirs.	Area.	Maximum Depth.	Capacity.
	acres.	feet.	gallons.
Ridge Gate - - - -	25	42	129,272,500
Bottoms - - - -	8	41	38,937,500
Leadbeaters - - - -	3	26	9,345,000
Total - -	36	—	177,555,000

Bollington - -

See Answers to Queries 1 to 6, Water Supply page, 93.

Mersey Basin—(River Weaver).

Series No. 4, Water Supply.—Answers to Queries 7 to 10.—Page 95—*continued.*

Watershed of the Weaver, Tributary of the Mersey.

Northwich, Witton-cum-Twambrookes, Sandbach, and Monks Coppenhall.

Not answered.

Tarporley - -

See Answers to Queries 1 to 6, Water Supply, page 94.

Nantwich - -

The gathering ground is about 600 acres. There are two reservoirs. Baddiley Mere, the original one, is 2¼ acres in extent. The new storage reservoir, also situate at Baddiley, is 5½ acres. The maximum depth of Baddiley Mere available for supply is five feet. The gross maximum depth of the new reservoir is eight feet, all available. Baddiley Mere contains 2¼ millions gallons of water. The new storage reservoir will contain 11½ millions gallons.

Congleton - -

The Answers to Queries have not been received from this Borough.

RIBBLE BASIN.

Watershed of the Ribble Proper.

Southport - -

Not answered.

Kirkham - -

The Answers to Queries have not been received from this Local Board of Health.

Fulwood - -

Not answered.

Preston - -

The present area of gathering ground is 2,878 acres; rather more than one half is upon limestone, and consequently very hard water.

Reservoir.	Area.	Depth.	Capacity.
	A. R. P.	feet.	gallons.
Alston - - - - -	15 3 36	27	78,755,161
Dilworth - - - - -	7 1 5	20	23,929,741
Grimsargh, 1, West - - - -	7 0 9		
„ 2, East - - - -	10 3 12	12	52,173,000
„ 3, „ - - - -	4 3 12		
Fulwood - - - - -	1 1 35		
Spade Mill - - - - -	27 0 0	41	110,000,000
	74 1 29	—	264,857,902

Leyland - -

See Answers to Queries 1 to 6, Water Supply, page 94.

Clitheroe - -

Many hundreds of acres. There is only one small reservoir about a statute acre in area.

Watershed of the Calder, Tributary of the Ribble.

Clayton-le-Moors

Gathering ground 250 acres. Two, with an area of two acres, to be constructed with an area of 64 acres. The maximum depth when completed will be about 76 feet. The two reservoirs in use contain about 5,000,000 gallons, the one to be constructed will contain about 50,000,000.

Oswaldtwistle -

Gathering ground 240 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	A. R. P.	feet.	gallons.
Jack House - - - -	9 0 0	51	67,330,475
Residuium - - - -	1 0 4	—	4,225,000
Cocker Cobbs - - - -	2 2 6	25	10,646,775
Residuium - - - -	0 0 24	—	162,500
Total - - -	12 2 34	—	82,364,750

Ribble Basin—(River Calder).

Series No. 4, Water Supply.—Answers to Queries 7 to 10.—Page 95—*continued.*

Accrington

Gathering ground 600 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
		feet.	gallons.
Mitchell's House	Do not know.	60	80,000,000
Burnley Road		30	30,000,000
Total	—	—	110,000,000

Burnley

Gathering ground 1,090 acres.

Reservoir.	Area in Acres.	Maximum Depth.	Capacity.
			gallons.
Swindon	15	50	28,000,000
See Green Swindon Compensation	8	50	18,000,000
Heckenhurst (Store)	8	50	19,000,000
„ (Service)	—	—	3,000,000
	31	—	68,000,000

Brierfield

See Answer to Queries 1 to 6, Water Supply, page 94.

Nelson

Gathering ground 1,700 acres.

Reservoir.	Area.	Maximum Depth.	Capacity.
	A.	feet.	gallons.
Compensation	8¼	25	25,000,000
Service	1½	28	2,000,000
	9¾	—	27,000,000

Watershed of the Darwen, Tributary of the Ribble.

Blackburn

Gathering ground 800 acres, with power to increase to 2,420 acres. There are four reservoirs; the total area is 76 A. 2 R. 36 P. Maximum depth 40 feet, and capacity 447,755,000 gallons.

Great Harwood

See answer to Queries 1 to 6, Water Supply, page 94.

Over Darwen

The gathering ground has an area of 504 acres. Eamsdale reservoir has an area of 4 acres, and service reservoir 2,500 yards. Eamsdale contains 116 million gallons.

Watershed of the Douglas, Tributary of the Ribble.

Croston

Not answered.

Chorley

Gathering ground about 1,000 acres. Area of service reservoir, 4 A. 0 R. 25 P.; compensation reservoir, 8 A. 3 R. 13 P. 36 feet deep. Service reservoir contains 12⅓ million gallons; compensation reservoir, 60 million gallons.

Ormskirk

Not answered.

Wigan

Gathering ground 2,200 acres. Maximum depth of reservoirs 45 feet, and contains 117,000,000 and 120,000,000 gallons respectively.

Series No. 4, Water Supply.—Queries——11. Is the water polluted before entering the reservoirs? if so, state the nature of pollution.——12. Is the water filtered?——13. Describe the filtering medium?

MERSEY BASIN.

Watershed of the Etherow, Tributary of the Mersey.

Hollingworth

The Answers to Queries have not been received from this Local Board of Health.

Glossop

Not answered.

Mersey Basin—(River Goyt).

Series No. 4, Water Supply.—Answers to Queries 11 to 13.—Page 100—*continued.*

Watershed of the Goyt, Tributary of the Mersey.

Yeardsley-cum-Whaley.

Not answered.

Watershed of the Tame, Tributary of the Mersey.

Hyde

No doubt it is to some extent owing to its coming off cultivated land, and from the gathering ground having dwelling houses and farmsteads upon it. The water is not filtered.

Denton

Not answered.

Dukinfield

The water is obtained from the high arable lands in the immediate neighbourhood, and is slightly polluted at certain times of the year by stable manure. It is not filtered.

Stalybridge

The water is obtained from the high arable lands in the immediate neighbourhood of the reservoirs, and is slightly polluted at certain times of the year by stable manure. The water is not filtered.

Ashton-under-Lyne

The water from the Knott Hill reservoir is partially filtered through beds of gravel.

Hurst and Mossley

Not answered.

Watershed of the Mersey Proper.

Liverpool

The water is not polluted, and it is filtered through the following media:—

2 feet 6 in.	of sharp river sand.	
6 in.	of clean gravel	⅛ in. diameter.
6 in.	„	¼ in. „
6 in.	„	½ in. „
6 in.	„	1 in. „
6 in.	„	2 in. „
6 in.	broken stones	4 in. „
12 in.	„	6 in. „

Waterloo-with-Seaforth, Great Crosby, & Litherland.

Not answered.

Birkdale & Levenshulme.

The Answers to Queries have not been received from this Local Board of Health.

West Derby, Walton-on-the-Hill, Toxteth Park, Wavertree, Little Woolton, Much Woolton, Garston, Widnes, Sutton, Prescot, Parr, Newton-in-Mackerfield, Warrington, Pennington, Westleigh, Hindley, Atherton, Tyldesley-with-Shakerley, Rusholme, & Stockport.

The Corporations and Local Boards have not answered Queries 11 to 13.

St. Helens

The water is polluted by organic impurities incidental to highly cultivated grounds; it is not filtered, the water from these reservoirs being used for trade purposes only.

Bredbury, Wallasey, Birkenhead, Tranmere, Higher Bebington, Runcorn, Lymm, Altrincham, and Sale.

These Local Boards have not answered Queries 11 to 13.

Oxton

The water is not polluted before entering the reservoir, and does not require filtering.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 11 to 13.—Page 100—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, and Monton, Stretford, Moss Side, Salford, Prestwich, Swinton, Kearsley, Farnworth, Bolton, & Halliwell.	These Corporations and Local Boards have not answered Queries 11 to 13.
Manchester - -	The water is not polluted before it enters the reservoirs, and is not filtered.
Astley Bridge -	See Answers to Queries 1 to 6, Water Supply, page 92.
Radcliffe & Whitefield.	The water is not polluted and is not filtered.
Bury - - -	There is a little drainage from a mill and some houses falling into the Holden Wood reservoir, which it would be well to have diverted. The water is not filtered.
Ramsbottom - -	Not answered.
Bacup - - -	The gathering ground being principally bog or peat, the water is slightly coloured with it; it is not filtered, or pumped.
Heywood - -	The water is not polluted, is very pure and is filtered through rubble stone, gravel, and sand in layers.
Rochdale - -	The water is not polluted before entering the reservoirs and is not filtered.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath, Failsworth, Bradford, Openshaw, Gorton, Droylsden, Oldham, Crompton, Royton, & Lees.	These Corporations and Local Boards have not answered Queries 11 to 13.
Bedford, near Manchester.	See Answers to Queries 1 to 6, Water Supply, page 93.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	The water is not polluted; is filtered through small boulders, rough gravel, fine gravel, coarse sand, fine sand.
Bollington - -	See Answer to Queries 1 to 6, Water Supply, page 93.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	Not polluted; is filtered through gravel, sand, and charcoal into a reservoir.
Witton-cum-Twambrookes.	We believe the water is not polluted; it is filtered.
Sandbach & Monks Coppenhall.	Not answered.
Tarporley - -	See Answer to Queries 1 to 6, Water Supply, page 94.
Nantwich - -	The water is not polluted; is filtered through gravel, stones of various sizes, and finished and coarse sand forming a filtering medium 6 feet deep.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport and Fulwood.	Queries 11 to 13 not answered.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Preston - -	It is not polluted before entering the reservoir or tank and is not filtered.
Leyland - -	See Answer to Queries 1 to 6, Water Supply, page 94.
Clitheroe - -	It is not polluted, not filtered, not pumped.

Ribble Basin—(River Calder).

Series No. 4, Water Supply.—Answers to Queries 11 to 13.—Page 100—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors -	Not polluted, and does not require filtering.
Oswaldtwistle and Accrington.	Queries 11 to 13 not answered.
Burnley - -	The water is only polluted by sheep kept by farmers on the gathering grounds and is not filtered.
Brierfield - -	See Answer to Queries 1 to 6, Water Supply, page 94.
Nelson - - -	The water is not polluted.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn & Over Darwen.	The water is not polluted; it is not filtered.
Great Harwood -	Not answered.
	Watershed of the Douglas, Tributary of the Ribble.
Croston & Ormskirk	Queries 11 to 13 not answered.
Chorley - -	The water is not polluted, and is filtered through broken stone, gravel, and sand.
Wigan - - -	The water is not polluted before entering the reservoirs; it is filtered through 2 feet in thickness of sand washed clean.

Series No. 4, Water Supply.—Queries——14. Is the water pumped to a high-service reservoir or reservoirs; if so, describe machinery?——15. What is the area of the high-service reservoir?——16. What is the maximum depth?——17. How many gallons of water will it contain?——18. Is the high-service reservoir built entirely above the surrounding ground, or only partially so, and is it a covered one?——19. State the total cost of pumping, including labour, fuel, and materials?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley-cum-Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	The water is not pumped to a high-service reservoir.
Denton - - -	Not answered.
Dukinfield - -	There are two high-service reservoirs of the aggregate area of 226,728 feet. Maximum depth of each, 24 feet, and together contain 25,506,900; they are partially built above the surrounding ground, and neither of them is covered; there is not any pumping.
Stalybridge - -	The water is not pumped. There are two high-service reservoirs, of the aggregate area of 226,728 feet; maximum depth, 18 feet; contents, 25,506,900 gallons; they are partially built above the surrounding grounds and neither of them is covered.
Ashton-under-Lyne	The service reservoir is much higher than the town. No pumping to high-service reservoir.
Hurst and Mossley	Not answered.
	Watershed of the Mersey Proper.
Liverpool - -	The water after filtration at Horwich flows from the clear water tank through a main 44-inch diameter, 18 miles in length, to the service reservoir at Prescot; to break the pressure on this length there are two small reservoirs, one at Aspull and

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 14 to 19.—Page 103—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Liverpool—*cont.*	the other at Mountry House. From Prescot the line is continued by two pipes, a 44-inch diameter and a 36-inch diameter, to Old Swan, a distance of 5 miles, and thence to the service reservoirs at Kensington, Aubrey Street, Park Hill, and Dudlow Lane; these supply the lower part of the town; the upper part is supplied from the high-service reservoir at Everton, into which the water is pumped by a Cornish engine, while the neighbourhood of Mossley Hill and Woolton Hill are served by the Woolton Hill reservoir, which is filled from Dudlow Lane by a Bolton and Watts' coudensing engine. The area of the service reservoirs is 4,418 feet; the maximum depth is 10 feet; and the capacity is 250,000 gallons. The high-service reservoir is built to a height of 100 feet above the ground and roofed. The total cost of pumping is 1*l.* 3*s.* 5½*d.* per million gallons.
Waterloo - with - Seaforth.	Not answered.
Great Crosby, Litherland, West Derby, Walton-on - the - Hill, Toxteth Park, Wavertree, Little Woolton, Much Woolton, Garston, Widnes, Sutton, Prescot, Parr, Newton-in - Mackerfield, Warrington, Pennington, Westleigh, Hindley, & Atherton.	These Corporations and Local Boards have not answered Queries 14 to 19.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
St. Helen's - -	The water is distributed by gravitation from the two impounding reservoirs, which are situated about 60 feet above the level of the town.
Tyldesley - with - Shakerley, Rusholme, Bredbury, Wallasey, Birkenhead, Oxton, Tranmere, Runcorn, Lymm, Altrincham, & Sale.	These Boards have not answered Queries 14 to 19.
Levenshulme - -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	It entirely depends where it comes from; if from the river, it is bad; if from the pumps, it is hard and very unserviceable; if from Manchester waterworks, good; and if from Lyme reservoir, good.
Higher Bebington	It is pumped to a high-service reservoir on Prenton Hill. There are two reservoirs; one of them is entirely above the surrounding ground, the other is altogether underground.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, and Monton, Stretford, Moss Side, Salford, Prestwich, Swinton, Kearsley, Farnworth, Halliwell, Radcliffe, Whitefield, Ramsbottom, Bacup, Newton Heath, Failsworth, Openshaw, Gorton, Droylsden, Oldham, Crompton, Royton, and Lees.	These Corporations and Local Boards have not answered Queries 14 to 19.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 14 to 19.—Page 103—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Manchester - -	The Cornish engine at Gorton, when used, lifts water out of a well and deliver its (on the level of the ground where the engine stands) into the Gorton reservoirs, which are not high-service. Godley, Denton, and Prestwich reservoirs supply water to the higher levels of the district, and the Gorton reservoirs supply the lower levels. Denton and Prestwich reservoirs are built above surrounding ground, the other reservoirs partially so. None of the reservoirs are covered. When the engine was worked by the old waterworks company, the cost of pumping, for labour, coals, tallow, oil, hemp, flax, waste, candles, &c. (but not including interest of capital), was three farthings per 1,000 gallons.
Bolton - - -	No pumping apparatus is employed for furnishing the supply. The Sweetloves reservoir is treated as the high-service reservoir; the area is 17 acres, the maximum depth is 35 feet; it will contain 88,000,000 gallons; is constructed partially above the surrounding ground, and is uncovered.
Astley Bridge -	See Answers to Queries 1 to 6, Water Supply, page 92.
Bury - - -	The water is not pumped to a high-service reservoir. The area of the principal one, "Gin Hall," is about 10 acres; depth, 27 feet; contents, 50,000,000 gallons. It is not built above ground, and is not covered.
Heywood - -	The water is not pumped; area of reservoir about 12 acres; about 35 feet deep; and contains about 70,000,000 gallons; it is constructed in a valley and the water from the hills flows into the same; it is not covered.
Rochdale - -	The water is not pumped.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Bedford - in - Manchester, & Bradford.	See Answers to Queries 1 to 6, Water Supply, page 93.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	The water is not pumped. Area of high service reservoir 3,176 yards; depth 14 feet; contains 2,000,000 gallons; it is only partially built above ground, and not covered.
Bollington - -	See Answers to Queries 1 to 6, Water Supply, page 93.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	The water is pumped to high service reservoir by steam and water power. Area of reservoir, 675 feet; depth 10 feet, capacity 44,000 gallons, and is uncovered.
Witton-cum-Twambrookes, Sandbach, and Monks Coppenhall.	Queries 14 to 19 not answered.
Tarporley - -	See Answers to Queries 1 to 6, Water Supply, page 94.
Nantwich - -	No pumping required.
Congleton - -	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport - -	The water is filtered and pumped.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood, Leyland, and Clitheroe.	Queries 14 to 19 not answered.
Preston - -	The service reservoir will give a pressure sufficient to reach the top story of the highest building in the borough. The water enters the service reservoir by gravitation. Area 22a. 2r. 33p.; depth twelve feet; capacity 52,173,000 gallons. The high service reservoir is mainly above the surrounding ground; it is not covered. At the present time (September 1868) the town is entirely supplied with water which is pumped from the river *Hodder* at a distance of 13 miles from Preston. It is raised by two steam engines through iron pipes to a height of about 130 feet, from whence it flows mainly by an open cutting or trench to the *Loud* conduit, through which it flows to the reservoirs. These works are only for a temporary purpose, and to meet the wants occasioned by this very dry season.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	No pumping required.
Accrington - -	The water is not pumped or filtered.

Ribble Basin—(River Calder).

Series No. 4, Water Supply.—Answers to Queries 14 to 19.—Page 103—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Burnley & Oswaldtwistle.	Queries 14 to 19 not answered.
Brierfield	See Answers to Queries 1 to 6, Water Supply, page 94.
Nelson	The water is not pumped, and see Answers to Questions, No. 8, 9, and 10; the high-service reservoir is built partially above ground, and is uncovered.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn	The water is not pumped. There is 220 feet of fall from reservoir to centre of town.
Great Harwood	See Answers to Queries 1 to 6, Water Supply, page 94.
Over Darwen	The water is not pumped to a high-service reservoir.
	Watershed of the Douglas, Tributary of the Ribble.
Croston	Not answered.
Chorley	The water is not pumped. The area of high-service reservoir is 4a. 0r. 25p., the maximum depth 25 feet, and contains 12½ million gallons; it is but partially above ground, and is not covered.
Ormskirk	The water is pumped by engine power to a tower 71 feet below the base of water tower, at a distance of 370 yards from it. The tower is situated on the highest point of land in the neighbourhood of the town; its dimensions are, from the surface to the bottom of the tank, 55 feet 6 inches by 40 feet square, by 11 feet deep; will contain 107,000 gallons; the engine power is capable of filling it in eight hours, total height of the edifice being 75 feet. The greatest available head of water where mains are laid is 123, the least 74 feet.
Wigan	The water is pumped to a high-service reservoir by two 35 h.p. condensing engines; area, about 1,600 sup. square yards; depth, 18 feet, and contains about 1,000,000 gallons. The reservoir is built partially above ground, and is arched over. The cost of pumping is 5-16ths of a penny per million gallons, raised 100 feet high, exclusive of interest on capital.

Series No. 4, Water Supply.—Queries——20. If supply is obtained from wells, describe geological character of the water-bearing stratum into which the well is sunk?——21. Diameter and depth of well?——22. Diameter and depth of bore hole?——23. State the volume of water pumped each hour, and for how many hours daily?——24. The area and maximum depth of service reservoir?——25. How many gallons of water will it contain?——26. Is the service reservoir built entirely above the surrounding ground, or only partially so, and is it a covered one?——27. Describe pumping machinery?——28. State annual working cost, including labour, fuel, and materials?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth	The Answers to Queries have not been received from this Local Board of Health.
Glossop	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley-cum-Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde	There are no wells.
Denton and Dukinfield.	Not answered.
Stalybridge	There is no water obtained from wells.
Ashton-under-Lyne	Part of the town is supplied in the summer from a well or shaft before mentioned, which was sunk for a coal pit, but a fault was met with. The water filters 50 yards through a bed of red sandstones. The supply from this source will be abandoned next year.
Hurst and Mossley	Not answered.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 20 to 28.—Page 106—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Mersey Proper.
Liverpool	New red sandstone. The engines work the whole 24 hours; the quantity pumped is at present 6,000,000 per diem.

Service Reservoirs.	Area.	Mean Depth.	Contains gallons.
Prescot	30 acres	16 feet.	87,366,000
Kensington	4½ „	15 „	16,357,000
Aubrey-street	1⅓ „	15 „	5,937,000
Park-hill	½ „	15 „	2,100,000
Atherton-street	⅙ „	14 „	615,000
Dudlow-lane	⅓ „	12 „	1,014,000
Woolton-hill	⅓ „	12 „	1,164,000
	37⅓ „	—	114,553,000

The service reservoirs are built partially above ground, and covered. The pumping machinery is at—

Bootle:—2 Bolton and Watts' condensing engines; 1 Cornish engine in course of erection.

Green-lane:—2 Cornish engines; 1 Bolton and Watts' condensing engine.

Windsor:—1 Cornish engine.

Water-street:—1 Bolton and Watts' condensing engine.

Dudlow-lane:—This well is in course of construction. The permanent machinery will be a single-acting Cornish engine and a Bolton and Watts' condensing engine. See Statement D. [W.E.]

Waterloo-with-Seaforth, Great Crosby, Litherland, West Derby, Walton-on-the-Hill, Toxteth Park, Wavertree, Little Woolton, Much Woolton, Garston, Widnes, Sutton, Prescot, Parr, Warrington, Hindley, Tyldesley-with-Shakerley, Rusholme, Stockport, Higher Bebington, Runcorn, Lymm, Altrincham, and Sale.	These Corporations and Local Boards have not answered Queries 20 to 28.
Birkdale	The Answers to Queries have not been received from this Local Board of Health.
Widnes	Sunk in new red sandstone through the upper division of the Bunters. Well 10 feet diameter, 60 feet deep. No bore hole. Estimated volume of water to be pumped, 50,000 gallons per hour for 24 hours. Service reservoir area, 110′ 0″ × 140′ 0″. Depth, 20′ 0″. Capacity, 2,000,000 gallons. Only partly covered. Two double-acting, high-pressure, single cylinder, condensing beam engines.
St. Helen's	The wells or shafts are sunk in the new red sandstone formation through the middle or pebble beds division of the Bunters, and to a depth of about 18 feet into the lower division. Diameter of each well, 8 to 10 feet, and depth 210 feet. Diameter of bore holes, 6 inches, and depths 57 and 63 feet respectively, and additional to depth of wells (210 feet). During the past summer, and with a view to further increase the yield, an additional 18-inch bore hole was sunk, commencing at the surface, and extending downwards a total depth of 388 feet, or 115 feet below the maximum depth of the 6-inch bore holes, without meeting with a water-bearing strata, thus proving (in this instance, at all events), the futility of boring into the lower divisions of the Bunters to a greater depth than from 80 to 100 feet. The volume of water pumped is 27,500 gallons per hour, and for 24 hours daily. The area of service reservoir is about 810 square yards, maximum depth 10 feet, and contains about 456,000 gallons; it is partially built above surrounding ground in 42 compartments, and is a covered one. There are two wells and two Cornish engines (duplicates) of 50 h.p., each with two sets main pumps delivering the water in single lifts into the service reservoir. The engines were constructed by Mr. Robert Daglish. Cost of pumping, 1,000*l.*; and general yearly working charges, including interest on capital, 3,076*l.*
Newton-in-Mackerfield.	Wells are being sunk in new red sandstone.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 20 to 28.—Page 106—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Pennington	From wells in the new red sandstone.
Westleigh	From wells in the new red sandstone and the rocks overlying the coal measures. Various depths, 4 to 20 yards and more.
Atherton	Domestic wells supply some portion from the rock overlying the coal measures.
Levenshulme	The Answers to Queries have not been received from this Local Board of Health.
Bredbury	There are many small wells and springs, in shale, rock, and sand.
Wallasey	New red sandstone (reached by boring through boulder clay, marl, running sand, and white rock). Depth of shaft, 93 feet, diameter, 7 feet; bore hole, 12 inches diameter for a depth of 25 feet, then 8 inches for an additional depth of 118 feet. Volume of water pumped, 27,000 gallons per hour, for 12 to 16 hours daily. Service reservoir, area, 2,025 feet; 12 feet deep to overflow; capacity, 146 gallons (allowing for deductions). Built entirely above surrounding ground and covered. Pumping machinery; condensing beam engine (Watts') 40-horse nominal, works 14 to 15 strokes per minute. Draw lift and ram pump, together raising the water 200 feet. Annual working cost, 672*l.*
Birkenhead	The wells are sunk entirely in the red sandstone. There are two wells at Spring Hill each 8 feet diameter and 33 yards deep, and the well at Flaybrick Hill is 16 feet by 8 feet and 205 feet deep. There are two bore holes at Spring Hill each 100 yards deep below the bottom of the well, the diameter ranges from 26 to 7 inches; and one at the pumping station near Flaybrick Hill 18 inches diameter and 322 feet below the bottom of the well. The volume of water pumped each hour is 77,800 gallons, for 24 hours daily. The area of the reservoir at Spring Hill is 2,000 yards superficial; at Flaybrick Hill, 4,800 yards superficial. The maximum depth of the reservoir at Flaybrick Hill is 18 feet. The reservoir at Spring Hill will contain 800,000, and at Flaybrick Hill 4,500,000 gallons. The service reservoir at Spring Hill is below the surface and covered, that at Flaybrick Hill is partly below and partly above the surface, and is not covered. The high-service reservoir near Flaybrick Hill is entirely above the ground, being an iron tank at the top of the engine house and is covered in. The pumps at Spring Hill of one engine consist, one for lower lift 16 inches in diameter and 5 feet stroke, with 2 for the top lift 16 inches and 12 inches diameter, with 3 feet stroke each. The second engine lower lift pump is 16 inches diameter and 5 feet 6 inches stroke, with two top lifts, the one a ram 16½ inches diameter and 4 feet stroke and the second pump 13½ inches diameter and 2 feet stroke. Those at Flaybrick Hill are 18 inches lifting pump and 14 inch ram each 7 feet stroke. The total annual cost of working, including distribution rates and taxes, alterations, and repairs of mains and bad debt reserve is 6,907*l.*
Oxton	The upper and middle Bunter divisions of the new red sandstone. Well 30 feet long, 9 feet wide, and 130 feet deep from the surface, bore hole 18 inches diameter, 237 feet deep from bottom of well. Volume pumped, 500,000 gallons per diem. Area of high-service reservoir 800 yards, depth 17, and contains 700,000 gallons. The service reservoir is built entirely above the surrounding ground, and is roofed over; the water is raised by two Cornish engines of 10 h.p. each—lifting ram pumps at bottom, and forcing ram pumps from top of well to reservoirs; the average cost, including labour, fuel, and materials, is nearly 3*d.* per 1,000 gallons.
Tranmere	The new red sandstone, upper soft formation. Well 9 feet diameter, 128 feet deep, bore hole 250 feet of 9-inch, and 50 feet 4 inches diameter. Volume of water pumped 22,800 gallons per hour, about 15½ hours daily. Service reservoir, area, 4,248 feet; 22 feet deep; capacity, 588,550 gallons. High level tank, area, 653 feet; deep, 10 feet; capacity, 40,861 gallons. Service reservoir entirely under, one high-level tank above the ground, and both are covered. Pumping machinery, condensing engine, and ram, 30 horse. Annual working cost, 687*l.* 15*s.* 10*d.*
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, & Monton.	Red sandstone with a covering of clay, dipping from 6 inches to 10 feet, from which an ample supply of water could be had if needed. The wells are numerous and are all private property.
Stretford, Moss Side, Prestwich, Swinton, Kearsley, Farnworth, Halliwell, Radcliffe, Whitefield, Ramsbottom, Bacup, Newton Heath, Failsworth, Openshaw, Gorton, Droylsden, Oldham, Royton, and Lees.	These Corporations and Local Boards have not answered Queries 20 to 28.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 20 to 28.—Page 106—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Salford	The amount paid to the corporation of Manchester by the corporation of Salford for the delivery of 1,500,000 gallons daily is 6,500*l.* per annum, which sum includes the annuity of 1,000*l.* Interest on borrowed capital and working expenses in the Salford district amounted to 2,451*l.* for the year ended June 30, 1867.
Manchester	The well at Gorton is sunk in the red sandstone; the supply is not obtained from a bore-hole. The maximum yield of the well was at the rate of about 750,000 gallons per day.
Bolton	There is no supply from wells.
Astley Bridge	See Answers to Queries 1 to 6, Water Supply, page 92.
Bury	There is no supply from wells.
Heywood	The area of service reservoir, ¾ of an acre. 21 feet deep; about 20,000 gallons. It is built little above the ground, and not covered.
Rochdale	There is no supply obtained from wells.
Crumpsall	The Answers to Queries have not been received from this Local Board of Health.
Bedford, near Manchester, & Bradford.	See Answers to Queries 1 to 6, Water Supply, page 93.
Crompton	Sand or gravel. The wells are very shallow.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield	Not answered.
Bollington	See Answers to Queries 1 to 6, Water Supply, page 93.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich, Witton-cum-Twambrookes, Monks Coppenhall, and Nantwich.	Queries 20 to 28 not answered.
Sandbach	There are several natural springs about the town which yield good and abundant water, and these furnish a sufficient supply for the inhabitants.
Tarporley	See Answers to Queries 1 to 6, Water Supply, page 94.
Congleton	The Answers to Queries have not been received from this Borough.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
Southport, Fulwood, & Clitheroe.	Queries 20 to 28 not answered.
Kirkham	The Answers to Queries have not been received from this Local Board of Health.
Preston	None obtained from wells.
Leyland	See Answers to Queries 1 to 6, Water Supply, page 94.
	Watershed of the Calder, Tributary of the Ribble.
Clayton-le-Moors	No wells connected with the water supply.
Oswaldtwistle, Accrington, Burnley, and Nelson.	Queries 20 to 28 not answered.
Brierfield	See Answers to Queries 1 to 6, Water Supply, page 94.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn & Over Darwen.	Queries 20 to 28 not answered.
Great Harwood	See Answers to Queries 1 to 6, Water Supply, page 94.
	Watershed of the Douglas, Tributary of the Ribble.
Croston	The wells are sunk in gravel to depths varying from 10 to 40 yards.
Chorley	Queries 20 to 25 not answered.
Ormskirk	The strata are first marl 11 feet, sand 7 feet; the remainder is the new red sandstone. The well is 60 feet in depth, 7 feet 6 inches in diameter, and inlaid with bricks and cement, and iron kerb. The bore-hole is 90 yards deep by 6 inches in diameter. The annual working cost is 340*l.*
Wigan	The water supply is obtained from gathering grounds.

Series No. 4, Water Supply.—Queries——29. State the area of the district supplied.——30. Number of houses supplied, and for what purposes?——31. Number of works and manufactories supplied?——32. Is the supply constant or intermittent; if the latter how many hours daily are the service mains kept charged?——33. What volume of water in gallons is supplied to the district daily, for trade and for domestic purposes?——34. What volume of water in gallons is supplied daily for watering of streets and flushing of sewers, and during what months?

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
Hollingworth -	The Answers to Queries have not been received from this Local Board of Health.
Glossop - -	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
Yeardsley - cum - Whaley.	Not answered.
	Watershed of the Tame, Tributary of the Mersey.
Hyde - - -	The area of the district supplied is about 2,000 acres. We believe the number of houses supplied about 3,500 to 4,000; do not know the number of works or manufactories. In dry seasons, the town and district often suffer very severely from the inadequate and sometimes the total stoppage of the supply. Cannot give the volume supplied for trade and for domestic purposes; in the summer months of 1868, 300,000 gallons was used for watering streets; no charge has yet been made by the proprietor of the waterworks for flushing sewers, and the volume supplied for that purpose is not known.
Denton - - -	About 900 houses and 40 works and manufactories supplied. Constant. None for watering streets and flushing sewers.
Dukinfield - -	Area of district about 500 statute acres. About 3,000 houses for domestic purposes; about 10 manufactories supplied. Constant. About 90,000 gallons daily. The streets are watered when required in the months of May, June, July, August, and September; the volume of water used upon these occasions is 10,000 gallons daily. No sewers are flushed from the waterworks.
Stalybridge -	Area about 500 statute acres. About 5,000 houses supplied for domestic purposes, and 10 cotton mills for drinking purposes only. The supply is constant; about 100,000 gallons daily. The streets are watered when required in the months of May, June, July, August, and September, but the sewers are not flushed. The volume supplied for watering the streets is about 1,200 gallons daily.
Ashton-under Lyne	The area is about 7,000, but little more than 2,000 acres is at present supplied, the out-districts being principally agricultural. 10,000 dwelling-houses for domestic purposes; 188 inns and beer-houses (very few have brewers). 65 manufactories by meter. The supply has been constant during the whole of the late dry summer; about 600,000 gallons for domestic purposes, only a small quantity for manufacturing from the town works. The mills are supplied from the river, canal, and an old coal pit. About 1,800,000 gallons annually used for watering the streets, partly from the waterworks and partly from collieries, and the remainder from the river.
Hurst and Mossley	Not answered.
	Watershed of the Mersey Proper.
Liverpool - -	Area of district 60 square miles. The total number of assessments for 1867 was 99,284. There are 775 works and manufactories by meter; many of these are very trifling quantities supplied for power only. The most considerable supplies are to sugar houses, railway stations, and breweries. Originally constant supply given; at present intermittent. Usually from 12 to 15 hours daily; at present 7½ hours per day. See Table E. Street watering from March to October. Flushing drains and sewers is constantly carried on by a staff of men for the purpose. [W. E.]
Waterloo - with - Seaforth.	Water is used for watering streets only, between April and September; about 16,600 gallons daily.
Great Crosby -	For flushing sewers about 280,000 gallons per annum.
Litherland, Little Woolton, and Garston.	Queries 29 to 34 not answered.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby - -	There have been about 19,500 gallons of water supplied daily for watering of streets during 100 days of the months of April, May, June, July, August, and September of the present year, 1868.
Walton - on - the - Hill.	Supply constant.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 29 to 34.—Page 110—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Toxteth Park -	The streets were watered during the last summer in the months of May, June, July, August, and September. A daily average of 21,000 gallons used.
Wavertree - -	The village streets are watered during the summer months as required; the supply for last season was 211,000 gallons by the Liverpool Corporation, and about the same quantity from the Township Lake.
Much Woolton -	The supply is constant. And about 6,760 gallons for watering streets during summer months.
Widnes - - -	Area of district to be supplied, 10 square miles. Constant. No watering streets or flushing of sewers at present.
Sutton, Prescot, Parr, Newton-in-Mackerfield, Pennington, Westleigh, and Hindley.	Not answered.
St. Helen's - -	Area of district, 12,075 acres; about 6,138 houses supplied for domestic purposes, which includes waterclosets; and about 70 manufactories. The supply up to within the last 12 months has been constant, but recently, and by reason of the rapid increase of population and extensions of supply, it has been intermittent, and the service mains are accordingly only kept charged for about 10 hours per day. The daily volume of supply from gravitation waterworks is 60,000, from wells, 70,000, and about 3,000 gallons for streets during the months of July, August, and September.
Warrington - -	The quantity of water supplied by waterworks company is about 400,000 gallons per day, of which nearly *one-half* is supplied to mills and factories, so that about 200,000 gallons is used for domestic purposes, being at the rate of less than 7 gallons per head per day. Only about 4,500 houses are supplied with water. The water company has always discouraged waterclosets, in consequence of its inability to furnish the water, but when the new well at Winwick is completed it is expected there will be sufficient water for all purposes. The depth of the well will be 150 feet, and the bore hole 200 feet; total, 350 feet.
Atherton - -	Houses are in process of being supplied; about 100 only are now using water; and several works will take water eventually. Supply is constant. The minimum quantity is 200,000 gallons daily. None for watering streets and flushing sewers.
Tyldesley - with - Shakerley.	There are 960 houses supplied for domestic purposes, and 9 manufactories. Constant. 30,000, and are prepared to supply 300,000 gallons daily. Used for watering streets when required.
Rusholme - -	All the houses in the district supplied for domestic purposes. Constant. 6,000 gallons per day for watering roads from May to September.
Levenshulme -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	The Borough of Stockport and parts of Cheshire. It should be constant, but it is not at present; this year's drought has affected it.
Bredbury - -	About 100 houses supplied; constant, but limited in drought.
Wallasey - -	About 2,600 acres. Dwelling houses. 1,769 supplied for domestic purposes. Hotels and public houses, 59 for domestic and business purposes. Works and manufactories, 7, and breweries, 3, for business purposes. Constant; from 300,000 to 400,000 gallons daily. Streets not watered, except during very dry weather; then a few thousand gallons per week. Sewers are flushed once a month.
Birkenhead - -	The area embraces the whole of Birkenhead, including Claughton, 1,684 acres, and the shipping in the docks. About 7,600 houses for domestic use, and 20 manufactories. The district is supplied on Sunday, Monday, Tuesday, Thursday, and Saturday, from half-past 5 a.m. until half-past 10 p.m., and on Wednesday and Friday from noon until half-past 10 p.m., but several fire mains throughout the town are constantly charged; 1,867,200 gallons is daily supplied. The streets are chiefly watered with salt water; the quantity taken from town supply, from May to September, is about 1½ million gallons.
Oxton - - -	Area of district, 3¼ square miles nearly. Houses and cottages, 407; no works or manufactories; the supply is constant, and the daily volume 43,000 gallons for domestic purposes only. The quantity used for flushing sewers two or three times a week during summer months not known.
Tranmere - -	The area of the district is 1,059 acres. The mains extend through portions of the district not yet built upon. 2,350 houses supplied for domestic purposes. Fourteen manufactories. Constant; 353,400 gallons daily. About 15,000 gallons for streets from May to September inclusive.
Higher Bebington	In the district of Higher Bebington the sewers are flushed once a month, and the streets of a portion of the district are watered as required from March to September.
Runcorn, Lymm, Altrincham, & Sale.	Queries 29 to 34 not answered.

Mersey Basin—(River Irwell).

Series No. 4,—Water Supply.—Answers to Queries 29 to 34.—Page 110—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Irwell, Tributary of the Mersey.
Barton, Eccles, Winton, and Monton, & Stretford.	Queries 29 to 34 not answered.
Moss Side - -	Area of district, 420 acres. 790 houses. Constant supply.
Salford - -	The area of the Salford District is 1,329 acres, of which about 700 acres are covered with buildings, roads, &c. supplied with water, leaving about 600 acres as yet not built upon. There are about 1,500 houses, &c. in the Salford District supplied for domestic purposes, and 176 works or manufactories supplied for business purposes. The supply is constant, except in cases of excessive drought, as during last summer. The average supply in the Salford District is about 1,500,000 gallons daily, of which 11,000,000 may be considered as for domestic purposes, and 400,000 as for business purposes. The streets in the Salford District are watered from the middle of April to the middle of September, and the average quantity used is 28,000 gallons daily. The sewers are not flushed in the Salford District.
Manchester - -	Area of district, 81 square miles. 108,419 houses supplied for domestic purposes. 9,416 works and manufactories by agreement for trading purposes only. The supply is constant; but during the recent excessive and unprecedented drought the service mains have, for a limited period, been shut off from 6 p.m. to 6 a.m. About an average of 13½ million gallons of water is supplied to the district daily for trade and for domestic purposes. For watering streets, 846,000 gallons per week for four and a half months in the year.
Prestwich, Swinton, & Farnworth.	Queries 29 to 34 not answered.
Kearsley - -	About five mills are partly supplied from the Bolton Corporation Waterworks. Supply constant. None supplied for streets or flushing sewers.
Bolton - - -	The area of the district now supplied with water by the Corporation comprises, in addition to the borough, the townships of Tonge-with-Haulgh, Darcy Lever, Great Lever, Farnworth, Kearsley, Halliwell, Heaton, Rumworth. They have power to supply, under their Acts of 1864 and 1865, also the townships of Worsley, Little Hulton, Clifton, Longworth, Entwistle, Edgeworth, Turton, Quarlton, Bradshaw, Harwood, and Breightmet. About 20,000 houses receive a supply for domestic purposes. The water is supplied to 396 works or manufactories for trade purposes. The supply is constant. The volume of water now supplied to the district daily for trade and domestic purposes is 2,125,000 gallons. Very little water has been used for the streets, and none has been taken for flushing the sewers; the number of gallons used during the summer months—1863, 269,150; 1864, 925,500; 1865, 226,000; 1866, 267,750, and 1867, 381,700. Besides the reservoirs belonging to the Corporation as part of their waterworks undertakings they have a small one in the town known as the Bolton Moor reservoir, which was constructed about the year 1842 by the Great Bolton trustees, and derived its supply from the watershed of lands forming part of what was known as Bolton Moor. This reservoir has long ceased to be used for domestic purposes, but it furnishes a supply to some of the works in the town, and also for watering the streets. The present supply is not adequate to the requirements of the town and district, but when the extension works have been completed the supply will be abundant.
Astley Bridge -	All the houses within the district are supplied constant.
Halliwell - -	Not answered.
Radcliffe - -	All the houses in the most thickly-populated district are supplied with water for domestic and other purposes. The mills and other works requiring steam power are supplied either from private reservoirs or pumped from the canal, and returned under an arrangement with the Canal Company. The supply is constant. None used for streets or flushing sewers.
Whitefield - -	The supply is constant.
Bury - - -	The area in Bury 3,079 acres; other parts of their district about twice that area within the range of the pipes, but not twice the demand for water, as in Bury; probably Bury consumes more than one half the water supplied by the company. About 5,700 houses in Bury; probably 4,000 houses in other parts of the district; 116 manufactories in Bury, about as many in other parts of their district. The supply is constant, and about 20 gallons per head per day for all purposes. During the summer months and the dry period in spring, 965,000 gallons of water are used on the streets.
Ramsbottom - -	Not answered.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply—Answers to Queries 29 to 34.—Page 110—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Bacup - - -	Area of district, about 600 acres. 1,753 houses supplied for domestic purposes, including closets. 36 works and manufactories; usually constant; in dry seasons it is very intermittent; during the extraordinary drought of last summer, the Waterworks Company ceased for three months to supply any water for domestic purposes. The compensating reservoir, however, supplied its stipulated quantity throughout the drought, the daily supply for domestic purposes 96,000 gallons, for works 64,000 gallons. None supplied for streets or flushing sewers.
Heywood - -	Area of district, 12 miles. 5,200 houses supplied for domestic and other purposes, 30 manufactories. Constant supply. 100,000 gallons daily. For watering streets in summer time 100,000 gallons.
Rochdale - -	The town and borough of Rochdale is comprised within a circle of three quarters of a mile and a district of between three and four miles beyond. The powers to supply go into the several townships of Huddersfield, Spotland, Castleton, Wardleworth, Wuerdle and Wardle, Blatchinworth and Calderbrook, and Butterworth respectively. About 13,000 houses supplied, including stables, workshops, and offices for domestic purposes. Neither the Company nor the Corporation hitherto have professed to give a supply for trade purposes. The supply is constant; about 750,000 gallons per diem, nearly all for domestic purposes; only about eight steam engines for very small works supplied with water. During the summer months, in dusty weather, as much water as is required is used for watering the streets, but no fixed quantity.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.
Newton Heath, Bradford, Gorton, Lees, and Royton.	Queries 29 to 34 not answered.
Failsworth - -	It is a constant supply except in long droughts. None supplied for streets or flushing of sewers.
Bedford near Manchester.	About eight tons per day for watering streets in dry weather.
Openshaw - -	There are 2,241 houses supplied for domestic purposes; constant and abundant; during the past summer it was turned off from 6 p.m. to 6 a.m., but the supply was adequate for all purposes. None supplied for watering street or flushing sewers.
Droylsden - -	Constant supply.
Oldham - - -	Area of district, 13,000 acres. About 20,000 houses supplied for domestic purposes, and 400 manufactories. Constant supply; from 2,500,000 to 3,000,000 gallons daily.
Crompton - -	There is none except rainfall.
	Watershed of the Bollin, Tributary of the Mersey.
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	Area of the district, 1,000 acres. 8,637 houses supplied for domestic purposes; 40 silk mills; eight breweries; eight dye houses. Constant. About 1,000,000 daily; compensation to mill owners being three cubic feet a second. The water is fully used in summer for watering streets, but volume not measured.
Bollington - -	Queries 29 to 34 not answered.
	Watershed of the Weaver, Tributary of the Mersey.
Northwich - -	Area of district, 6 acres. 210 houses supplied, domestic and other purposes; mains kept charged 12 hours daily. The sewers are not flushed, as it is not thought necessary to do so here.
Witton-cum-Twambrookes.	Townships of Witton and others; probably 700 houses supplied for domestic purposes. The supply is ample and for 12 hours daily.
Sandbach and Tarporley.	Queries 29 to 34 not answered.
Monks Coppenhall	Houses supplied, 2,809, all for domestic purposes. Constant supply. The quantity consumed averages, in winter, 55,000 gallons, in summer, 85,000 gallons, including 6,000 gallons per day for watering the streets of the Local Board during the dry months.
Nantwich - -	Not answered.
Congleton - -	The Answers to Queries have not been received from this Borough.

RIBBLE BASIN—(RIBBLE PROPER).

Series No. 4, Water Supply.—Answers to Queries 29 to 34.—Page 110—*continued.*

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	RIBBLE BASIN.
	Watershed of the Ribble Proper.
SOUTHPORT - -	The supply is constant. For watering streets, 10,000 gallons per day is used during the summer months.
KIRKHAM - -	The Answers to Queries have not been received from this Local Board of Health.
FULWOOD and LEYLAND.	Queries 29 to 34 not answered.
PRESTON - -	In Preston, 16,500 houses; Ashton, 190; Fulwood, 74; Longridge, 300 supplied for domestic use. This number includes 480 hotels, inns, and beerhouses. There are in addition about 250 manufactories supplied. Constant. 506,840 gallons are daily supplied for trade, and 1,693,160 gallons for domestic purposes. No water supplied either for streets or flushing during present year.
CLITHEROE - -	Nearly all the houses in the town supplied for domestic purposes. Some manufactories are partially supplied. Constant. The principal streets are watered daily during the summer and in dry weather.
	Watershed of the Calder, Tributary of the Ribble.
CLAYTON-LE-MOORS	There are 603 houses supplied for domestic purposes; the number is increasing daily. One print works partially supplied. Constant. None for streets or flushing sewers.
OSWALDTWISTLE -	There are 800 houses supplied for domestic purposes; five manufactories. Supply constant, daily volume, 50,000 gallons; for watering streets, an average of 7,500 gallons daily.
ACCRINGTON - -	Part of Accrington and Church; 3,461 houses supplied for domestic purposes. Constant. 270,000 gallons daily. None for watering streets and flushing sewers.
BURNLEY - -	Area 6,213 acres. 7,100 houses supplied for domestic supply. 200 manufactories and works for trade purposes. Constant. Probable daily quantity for both 800,000 gallons. No account is kept of the volume supplied for watering streets and flushing sewers.
BRIERFIELD - -	Queries 29 to 34 not answered.
NELSON - - -	Powers to supply 1,850 acres, which includes the district of the Brierfield Local Board. None at present supplied, as the works are not quite completed. The supply will be constant.
	Watershed of the Darwen, Tributary of the Ribble.
BLACKBURN - -	Supply constant. 1,400,000 gallons daily to 17,068 houses and 236 mills.
GREAT HARWOOD -	Not answered.
OVER DARWEN -	The area of district supplied is 5,000 statute acres. Houses, 2,966 for domestic purposes; 32 mills; the supply is constant, and the daily volume supplied, 800,000 gallons.
	Watershed of the Douglas, Tributary of the Ribble.
CROSTON - -	Not answered.
CHORLEY - -	Area of district about 1,000 acres. About 3,000 houses supplied for domestic purposes, waterclosets, baths, and stables, and about 50 manufactories. Constant, 400,000 to 500,000 gallons daily for all purposes. For watering streets from 1 to 20,000 gallons during the spring and summer months.
ORMSKIRK - -	About three and a half miles' service mains. Houses, 1050. No manufacturing works, only brewers. The service mains are kept charged, 12 hours' full pressure, and 12 hours' half pressure. The daily volume supplied is 200,000 gallons. The streets are only watered about four months in the year, and the sewers flushed occasionally.
WIGAN - - -	Supply constant. 700,000 gallons daily.

SERIES No. 4, WATER SUPPLY.—QUERIES—35. Are the houses furnished with cisterns, or is the water supplied direct from the mains; if the former, is the overflow pipe from cisterns connected with the soil pipe from watercloset or with the sewer?——36. What is the rate of charge for water?——37. Is the present supply adequate to the requirements of the town or district?——38. What steps are taken to prevent waste?——39. From what source was the town or district supplied previous to the establishment of the waterworks?——40. What have the waterworks cost?——41. What effect has the improved water supply had upon the health of the inhabitants?——42. Has the water been analysed; if so, state by whom, and furnish copy of the analysis?

Names of Cities, Boroughs, and Districts.	ANSWERS TO QUERIES.
	MERSEY BASIN.
	Watershed of the Etherow, Tributary of the Mersey.
HOLLINGWORTH -	The Answers to Queries have not been received from this Local Board of Health.
GLOSSOP - -	Not answered.
	Watershed of the Goyt, Tributary of the Mersey.
YEARDSLEY-CUM-WHALEY.	The supply adequate.
	Watershed of the Tame, Tributary of the Mersey.
HYDE - - -	The supply is direct from mains, and *see* answer to No. 32. Occupiers of dwelling houses are charged at the rate of 5 per cent. upon the annual rack rent or value of their premises, but the proprietor must not charge more than 10*l.* for a year's supply, nor is he obliged to receive less than 8*s.* in any year when paid in advance, or 10*s.* a year when in arrear. Traders, manufacturers, and other business people have to agree with the proprietor. Do not know what steps are taken to prevent waste, or what the water works have cost. The former supply was from wells and springs. We doubt whether the present waterworks have improved upon the supply previously obtained. The water has been analysed by Dr. F. Crace Calvert, F.R.S., Manchester, a copy of analysis is forwarded herewith.
DENTON - -	The water is supplied direct from the mains, and is ample. Rate of charge, 8*s.* per year for cottages. For larger houses 5*l.* per cent. on the amount assessed to the poor's rate. To prevent waste vigilant inspection is made by the servants of the Manchester Corporation. Former supply, surface water collected in pits or ponds, and by rain water. The improved supply has had a very beneficial effect.
DUKINFIELD - -	The water is supplied direct from the mains. To meet the inadequate supply the joint committee of the Stalybridge Corporation and the Dukinfield Local Board of Health have been furnished by the Manchester Corporation with about 21,000,000 gallons per year, for the last 12 years. When supplied by meter it is at the rate of one shilling per 1,000 gallons. Cottages are supplied at the rate of 6*s.* and 9*s.* per year, each house of a better class at rates varying from 12*s.* to 20*s.* per year. Waterclosets are charged 10*s.* per year; baths 5*s.*; and publichouses and beerhouses, from 20*s.* to 40*s.* per year each. The only steps taken to prevent waste is a periodical inspection of fittings, &c. The entire cost of the Dukinfield waterworks was 39,980*l.*, the portion paid by the Dukinfield Local Board of Health was 23,800*l.* Former supply from wells. The improved supply has had a very beneficial effect. The Dukinfield water has been analyzed by Professor F. Crace Calvert, F.R.S., of Manchester. A copy of analysis herewith sent.
STALYBRIDGE - -	The water is supplied direct from the mains. When supplied by meter it is at the rate of 1*s.* per 1,000 gallons; cottages at the rate of 6*s.* and 9*s.* per year; houses of a better class at rates varying from 12*s.* to 20*s.* per year each; waterclosets are charged 10*s.* per year each; baths 5*s.*, and public-houses and beer-houses from 20*s.* to 40*s.* per year each. To meet the inadequate supply the joint committee of the Stalybridge Corporation and Dukinfield Local Board of Health have been furnished by the Manchester Corporation with about 21,000,000 gallons per year for the last 12 years. The only step taken to prevent waste is a periodical inspection of fittings, the borough being divided into districts, and men appointed to examine and repair the fittings. The supply formerly was from wells and pumps. The entire cost of the Dukinfield waterworks was 39,980*l.*, the portion paid by the Stalybridge Corporation was 16,700*l.* The Dukinfield water has been analysed by Professor F. Crace Calvert, F.R.S., of Manchester. A copy of the analysis is herewith sent.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply.—Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Ashton - under - Lyne.	All the houses are supplied direct from the mains. The supply will be ample when the new works are finished. Rate of charges in the Borough and Hurst houses up to 6*l.* rental are charged 4*s.* yearly, from 6*l.* to 10*l.* 6*s.*; 10*l.* to 12*l.* 8*s.*; above 12*l.* five per cent. on rental; other places under 5*l.* 6*s.*; from 5*l.* to 10*l.* 8*s.*; 10*l.* to 12*l.* 10*s.*; beerhouses and inns, extra. The provisions of the *Waterworks Act* are enforced, and two men are constantly going round repairing taps; they report to the Waterworks Committee, who inflict small fines on parties offending, and occasionally, but not often, a conviction takes place before the magistrates. Cost of old works, 33,000*l.* Extensions and improvements of same, about 17,000*l.* New works will cost about 65,000*l.* Former supply from wells, springs, and the river. The Knott Hill water was analyzed in 1850 by Dr. R. Angus Smith, F.R.S. We have no analysis of the Swineshaw water.
Hurst and Mossley	Not answered.
	Watershed of the Mersey Proper.
Liverpool - -	Part of the town is supplied direct from the mains and part from cisterns. It is now compulsory for all new property to be provided with cisterns, and that the overflow pipe be carried outside the premises, and not directly connected with the soil pipe or sewer. See printed scale F. The supply is inadequate. A special staff of men is employed to make house to house inspection of all water fittings and appliances. Former supply from springs and wells. Cost of water works about two millions (2,000,000*l.*) The water has been analysed by Mr. J. T. Way and by J. Baker Edwards, P. L. W., Royal Inst., Laboratory, Liverpool. Copies of the analyses are forwarded herewith.
Waterloo - with - Seaforth.	There are few houses in the district furnished with cisterns, but the general supply is from the mains. The overflow pipes from cisterns are connected with the soil pipes. There are complaints, but altogether the supply may be considered adequate. The rate of charge, nine pence three farthings in the pound upon the poor rate assessment. Former supply from wells. As the water is very good there can be no doubt that the change has been beneficial to health.
Great Crosby -	Chiefly from the main; the supply is adequate, and the rate of charge is 9*d.* in the pound. Former supply from private wells.
Litherland - -	Supply direct from the main. The rate of charge is 9¼*d.* in the pound. The supply is adequate. Previous to being supplied by the Liverpool waterworks the district was supplied from wells and pits.
Birkdale - -	The Answers to Queries have not been received from this Local Board of Health.
West Derby - -	Some houses are furnished with cisterns; others are supplied direct from the mains. The present water rate is 9¾*d.* in the pound on the poor rate assessment; this is for water for domestic purposes. An extra charge is made for water supplied for other purposes. In general the supply is satisfactory.
Walton - on - the - Hill.	About 4½ per cent. on the rateable value. There is an adequate supply. Former supply from wells.
Toxteth Park -	The houses have usually cisterns. It is not known how the overflow is discharged. Rate of charge, 5 per cent. on the rental, with extra charges for stables, carriages, and gardens. The supply is adequate, except in very long drought. The Corporation of Liverpool employ inspectors to examine the various premises from time to time to prevent waste.
Wavertree - -	The supply is principally from the mains. There are a good many cisterns, particularly where there are waterclosets. 11*d.* per 1,000 gallons for watering streets. 9*d.* in the pound on rateable value for domestic purposes. Supply adequate. No waste. Former supply, wells and rain-water cisterns.
Little Woolton, Sutton, Prescot, and Parr.	Queries 35 to 42 not answered.
Much Woolton -	Supply direct from the mains. Rate of charge 1*s.* in the pound on the rateable value. The supply is adequate. The former supply from wells.
Garston - -	Partly by cisterns and partly direct from the mains; the present supply is adequate. The rate of charge is 9*d.* in the pound on the assessable value of the premises supplied. Former supply from wells. We have no doubt the health of the inhabitants has been greatly promoted by the improved water.
Widnes - - -	The water is to be supplied direct from the mains. The present supply is from private wells, and is inadequate.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply—Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
St. Helens - -	The houses are supplied direct from the mains. The Corporation are now making application to Parliament for extensions to existing waterworks. The rate of charge for domestic purposes, 10*d.* in the 1*l.* on the yearly value of the house. For trade purposes 7*d.* per 1,000 gallons. The steps taken to prevent waste is, better control of plumbers, and doing away with outside or exposed water-taps. Former supply from wells and streams. The water has been analyzed, but the Corporation is not in possession of a copy of the analysis. Cost for the new or pumping waterworks, 28,443*l.* 19*s.* 5*d.*; for the old or gravitation waterworks, 12,000*l.*
Newton - in - Mackerfield.	Present supply very inadequate in the Earlestown end (west) of the district, and very hard.
Warrington - -	Not answered.
Pennington - -	Supply adequate.
Westleigh - -	The northern portion of the district is insufficiently supplied.
Hindley - -	Queries 35 to 42 not answered.
Atherton - -	It is intended that the supply shall be direct from the mains. It will be ample for a long time to come. Rate of charge 18*d.* in the pound for domestic purposes per year; and 18*d.* per 1,000 gallons for trade and other purposes, if used by measure, The works are estimated to cost 7,414*l.* Close supervision of all water fittings and taps to prevent waste. Former supply, wells and streams. The water has not been analyzed on this Board's account.
Tyldesley - with - Shakerley.	Supply from the mains and cisterns. Rate of charge 7½ per cent. on annual value for domestic consumption. Adequate supply. No steps have as yet been taken to prevent waste. Former supply from wells and the storage of rain water. Cost of works 5,862*l.* 6*s.* 8*d.* Cannot say the effect on health by improved supply, as the water has been supplied only since April 1st, 1868, but the inhabitants must have suffered very severely during the late drought but for the improved supply.
Rusholme - -	The water is supplied direct from the mains, and is ample. Rate of charge 5*l.* per cent. on the rental. The Corporation of Manchester employ inspectors to prevent waste. Former supply from wells.
Levenshulme - -	The Answers to Queries have not been received from this Local Board of Health.
Stockport - -	Do not think the present supply adequate. The former supply from wells, streams and rivers. It is not considered that we have a good water supply. The water varies so much as to make any analysis of it of little value.
Bredbury - -	Supply direct from mains. The charges for water supplied from reservoir is 2*d.* per week for cottages; large houses in proportion. The supply inadequate. Former supply from wells and springs.
Wallasey - -	It is not compulsory for the houses to be supplied through cisterns so long as the fittings are approved; the majority are supplied direct from the main. The rate of charge for domestic use is 6 per cent. on annual value of the premises. Trade purposes by meter, at 14*d.* per 1,000 gallons. All irregular supplies by agreement. The supply is adequate. Waste preventors for closets and screw-down taps are now insisted on. Former supply, private wells. Cost of water works, including preliminary and other expenses to December 31, 1867, 40,941*l.* The water was analyzed by Mr. Wm. Dantee, of Liverpool, 5th May 1863, a copy of the analysis sent herewith.
Birkenhead - -	The houses are chiefly supplied with cisterns, and the overflow is generally connected with the nearest house drains or pipes. The present supply is fully adequate: The rates allowed under the *Act of 1858* vary according to the rental of the house, from 7½*d.* to 5 per cent. From these rates the Commissioners have made an abatement of 20 per cent. The means adopted to prevent waste is by inspection. Waterworks have cost 130,000*l.* Former supply from private wells. The water has been analyzed by Dr. Sheridan Muspratt, and a copy of the analysis is forwarded.
Oxton - - -	The supply is direct from the mains in most cases, and is more than adequate. Rate of charge, according to Company's schedules, about 6 per cent. on the amount of rent. The means adopted to prevent waste is by inspection of taps occasionally, and service pipes and mains once a month; nevertheless a great waste occurs. The waterworks for Oxton and the districts of Upper and Lower Bebington, New Ferry, Rock Ferry, and Noctorum has cost upwards of 40,000*l.* The former supply from wells, which were much polluted by infiltration from sewers and cesspools sunk in the soft sandstone.

Mersey Basin—(Mersey Proper).

Series No. 4, Water Supply—Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Tranmere - -	The water is supplied direct from the mains. The charge is 9*d.* in the pound on the rateable value of the premises. The supply is adequate. To prevent waste a house to house examination is daily made by an inspector. Former supply, rain water and a few wells belonging to private individuals. Water works cost, 38,250*l.* There is apparently much less sickness in the district, and certainly the death rate has been reduced, moreover, the improved supply has added to the comfort and convenience of the inhabitants. An analysis was made at the time the works were in progress.
Higher Bebington	Some houses have cisterns and others are supplied direct from the mains. We believe the supply is adequate. Former supply from private wells. The new water supply has proved a great convenience to the residents.
Runcorn, Lymm, and Sale.	Queries 35 to 42 not answered.
Altrincham - -	Former supply from wells. The supply is adequate and can be much increased when required.
Watershed of the Irwell, Tributary of the Mersey.	
Barton, Eccles, Winton, & Monton.	The water is supplied direct from the mains. The rate for domestic purposes, 5 per cent. on rental, for manufacturing purposes as per quantity consumed and indicated by meter. Supply adequate. Former supply from pumps and wells.
Stretford - -	Not answered.
Moss Side - -	Very few cisterns, supply chiefly direct from the mains, and is ample. Former supply from wells.
Salford - -	In some few cases in the Salford District the houses are furnished with cisterns, but the great majority are supplied direct from the mains. The supply in the Salford District is adequate. The charge is 10*d.* in the pound on the rent for dwelling houses, 9*d.* in the pound for houses and shops, and 1*s.* for beer houses and public houses. Cottages of 10*l.* and under are compounded for by the owner, who is allowed a discount of 25 per cent. To prevent waste two inspectors are employed, whose duty it is to make a systematic and periodical inspection of the water fittings throughout the district; the fittings are also required by the regulations to be of the best and most improved description. The Salford Corporation is purchasing the original plant in the Salford District from the Manchester Corporation, agreed to pay for the plant an annuity of 1,000*l.* in perpetuity, and have since expended in laying down new mains, &c. a sum of about 22,000*l.* Former supply partly by the Old Manchester and Salford Waterworks Company, and partly by wells; the improved supply has had a beneficial effect on the health of the inhabitants. The water has been analyzed by Dr. R. Angus Smith, F.R.S., and a copy of the analysis is herewith sent. The fittings are also required by the regulations to be of the best and most improved description. The Salford Corporation, in purchasing the original plant in the Salford District from the Manchester Corporation, agreed to pay for the plant and the estate and interest of Manchester an annuity of 1,000*l.* in perpetuity as before stated, and have since expended in laying down new mains, &c. a sum of about 22,000*l.*
Manchester - -	Generally direct from the main, but baths and waterclosets from cisterns. If from the cistern, the overflow pipe is connected in some cases with the sewer, and in other cases with the soil pipe. The present supply is adequate to the requirements of the town and district. Public rate of charge for water is threepence in the pound on the poor's rate assessment on all property within the city, and payable by the owner. Domestic rate of 9*d.* in the pound on the same assessment on all dwelling-houses in the city. Weekly property paid by the owner, quarterly by the tenant. Beyond the city, 1*s.* in the pound on the rack-rent of all dwelling-houses. Water for trading purposes is charged according to special agreement, and either with or without meter, both in and out of the city. To prevent waste, a staff of watermen constantly looking over the piping in the streets, and a staff of sub-inspectors and plumbers examining the piping and fittings inside houses and other premises. Previous to the establishment of the present Manchester Corporation Waterworks the district was supplied by the (now defunct) Manchester and Salford Waterworks Company, by water obtained from the river Medlock, and from drainage ground in and about the reservoirs at Gorton, and from the pump at Gorton. An unlimited and constant supply of pure and wholesome water must be a great advantage in every point of view to the enormous population dependent upon the Corporation; but it is difficult to say what effect the improved supply may have had upon the health of the inhabitants. The water has been analyzed by Dr. R. Angus Smith, F.R.S., and a copy of the analysis is forwarded herewith.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.—Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Prestwich & Swinton.	Not answered.
Kearsley - -	Supplied direct from the main. For manufacturing purposes 9*d.* per 100 gallons, and for domestic use according to gross rateability. Former supply from wells.
Farnworth - -	Supply direct from the mains. 9*d.* per 1,000 gallons. Adequate supply. Former supply, wells and cisterns. The improved supply has had good effect.
Bolton - - -	The rate of charge for water is shown by the scale herewith forwarded. The Corporation by their officers exercise vigilant supervision of the mains and service pipes to prevent waste, and enforce penalties against persons detected wasting or misusing the water. Previously to the establishment of the waterworks, the town was supplied from wells in the subsoil. The works established and now in operation have cost 231,629*l.* 11*s.* 2*d.* The quality of the present water supply is excellent, and is considered to have had a very beneficial effect upon the health of the inhabitants. The water of the Heaton reservoir was analyzed by Dr. F. Crace Calvert, F.R.S., of Manchester, in 1854, and a copy is sent herewith. Mr. H. W. Watson, of Bolton, analyzed the water of the Turton and Entwistle reservoir in 1864. The Corporation has no analysis of the Belmont water, but it is considered quite equal in quality to that of Turton and Entwistle.
Astley Bridge -	The supply is direct from the mains.
Halliwell - -	Not answered.
Radcliffe - -	Houses supplied direct from the mains. The charge varies according to rental. The proportion is 1*s.* 6*d.* in the pound on the rental, and the supply is adequate. No steps taken to prevent waste. Former supply from wells.
Whitefield - -	The supply is adequate. Former supply from wells.
Bury - - -	The supply is direct from the mains, no cisterns being required; it is sufficient except in dry weather; but in the drought of 1868 the reservoirs were exhausted, and the Bury and Radcliffe Company purchased an adequate supply of excellent water from the Haslingden and Rawtenstall Company, and supplied their district from that source for about seven weeks. Table of rate of charges are herewith forwarded. As waterclosets are the chief causes of waste in waterworks, and there are not more than 147 in Bury, there is really not much waste of water here. The waterworks have cost 142,137*l.* Former supply from shallow wells. Medical men state that the construction of the waterworks had a beneficial effect upon the public health. They are a necessity, for although the wells might and did suffice when the population was less, the public health would now suffer greatly if the waterworks were not in existence. The water has been analyzed by Thomas Spencer, Esq., 32, Euston Square, London, N.W., but have not a copy of the analysis. It is soft water, differing very slightly from that supplied to Manchester.
Ramsbottom - -	Not answered.
Bacup - - -	Most of the houses are furnished with cisterns, and the overflow pipes, we are sorry to say, are connected with the soil pipes. Rate of charge, an average of about 6*l.* 10*s.* per cent. upon the rental, no single owner paying more per annum than 10*l.*, nor less than 6*s.* *The supply is inadequate; instance last summer's drought, before alluded to.* The reservoir is also situated too low to supply many requirements; no adequate pressure is to be obtained in cases of fire. A notice was served upon the Company during last summer to provide proper water supply to the town (they have failed in so doing), the quantity which we demanded for all purposes being 400,000 gallons per 24 hours. No special means taken to prevent waste, except looking well after the taps, valves, plugs. The former supply from spring and small reservoirs. Cost of waterworks, 16,000*l.* We have no analysis.
Heywood - -	Supply direct from the mains and is ample. Rate of charge, 10*s.* per annum for cottages, and others $7\frac{1}{2}$ per cent. on 20*l.*; 7 per cent. on 40*l.*; $6\frac{1}{2}$ per cent. on 60*l.*; 6 per cent. on 80*l.*; $5\frac{1}{2}$ per cent. on 100*l.*; 5 per cent. on 150*l.* To prevent waste men are appointed to examine. The former supply was from wells and springs. Cost of works, 70,811*l.* The water has been analyzed, and a copy of analysis is forwarded herewith.
Rochdale - -	The supply is direct from the mains. See printed scale for rate of charge. The present supply is about 13 gallons per head per diem to a population of about 60,000. The *Act of* 1866 was obtained for the purpose of an increased supply from another common having about 15,000 acres of gathering ground, the water from which is to flow into new reservoirs to be constructed at Cown and Spring Mill, about four miles from Rochdale, and the supply from which and the old reservoir will be more than adequate to the requirements of the town for many years to come. The waterworks have cost about 7,000*l.*, and annuities amounting to 7,459*l.* 4*s.* Former supply from wells and springs in and about the town. Analyzed by Dr. Letheby of the London Hospital.
Crumpsall - -	The Answers to Queries have not been received from this Local Board of Health.

Mersey Basin—(River Irwell).

Series No. 4, Water Supply.— Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Newton Heath -	Not answered.
Failsworth - -	The supply is direct from the mains. The rate of charge is 6½ per cent. on the annual rack rent of the property supplied for domestic purposes; the supply is adequate. Former supply from wells, and partially so yet. No doubt the improved supply has had a good effect.
Bedford near Manchester, Bradford, & Gorton.	Queries 35 to 42 not answered.
Openshaw - -	The supply is direct from the mains, and adequate.
Droylsden - -	Supply direct from the mains, and is ample. Rate of charge, 8*s.* per year for cottages. For larger houses according to the amount at which they are assessed to the poors rate. The servants of the Manchester Corporation inspect vigilantly to prevent waste. Former supply principally from a spring which is out of the district, and partly from private wells. The present supply has had a good effect.
Oldham - -	There are no cisterns. The water is supplied direct from the main. Rate of charge, 6½ per cent. on the rack-rent for domestic purposes. From 8*d.* to 3*d.* per 1,000 gallons for manufacturing purposes. The present supply is barely adequate. By periodical inspection of taps and apparatus. Former supply from springs. Waterworks have cost 229,000*l.* Analyzed by Professor F. Crace Calvert, F.R.S., of Manchester, 21st December 1866. Copy of analysis is herewith sent.
Crompton - -	Some of the houses have cisterns to store water gathered from the roofs. In cases where the Oldham Corporation supply the water for domestic purposes they charge 6*l.* 10*s.* per centum per annum on the gross rental of the dwelling-houses. Former supply from wells, springs, and small streams, the Board have not any waterworks.
Royton - - -	Former supply, wells and springs.
Lees - - -	Former supply from wells in the district. The improved supply has had good effect.
Watershed of the Bollin, Tributary of the Mersey.	
Chorley - -	The Answers to Queries have not been received from this Local Board of Health.
Macclesfield -	The houses are in very few instances supplied with cisterns; and where cisterns are allowed the overflow pipe does not communicate with any pipe belonging to sewer or soil pipe, but opens on to the surface. Supply is adequate. No house charged less than 5*s.*, the rest about 1*s.* in the pound. Water supplied to manufacturers and others, 6*s.* per thousand gallons. Men employed by the Corporation are always looking after the mains, service pipes, and taps. Plumbers only who are authorized are permitted to interfere with fittings inside of houses. The waterworks cost 50,000*l.* Former supply from wells and springs in different parts of the town; most of the houses had cisterns and water tubs for the purpose of catching rain-water from roofs of buildings. The new supply has had a very beneficial effect in a sanitary point of view, and has proved a source of great comfort and convenience to the inhabitants, as well as to the trade. Analyzed by Dr. Lyon Playfair, F.R.S.
Bollington - -	Not answered.
Watershed of the Weaver, Tributary of the Mersey.	
Northwich - -	Supplied direct from the mains. Rate of charge, 1*s.* in the pound on the rental, or 1*s.* per 1,000 gallons by meter. Supply adequate. Former supply from wells in the neighbourhood.
Witton-cum-Twambrookes.	Supplied direct from mains. Rate of charge, 1*s.* per 1,000 gallons. Former supply, wells.
Sandbach - -	Not answered.
Monks Coppenhall	Supply is direct from the mains. Some blocks of cottages have one tap fixed in the back yard to supply the whole. There was a scarcity during the very hot weather of last summer, but owing to the mains from Whitmoor not being large enough. No part of the town was ever shut off, but the pressure was reduced so that a few houses in the highest part of the town could not obtain water in the day time. Rate of charge, 5 per cent on rateable value. No means taken to prevent waste. The Local Board have only had to pay the cost of laying mains within their district, which amounts to 4,850*l.* The water is supplied by the railway company to the Board at 6*d.* per 1,000 gallons. The former supply was from wells and springs within the district,—a very inadequate one. The improved water supply is considered to have been a great boon. The town would have suffered very much during last summer had it not been well supplied. Formerly the inhabitants were subject to complaints of gravel, said by the medical men to be caused by the water of the district. Now there are very few cases of the kind, except where they yet use the water from the old wells.

Mersey Basin—(River Weaver).

Series No. 4, Water Supply.—Answers to Queries 35 to 42.—Page 115—*continued.*

Names of Cities, Boroughs, and Districts.	Answers to Queries.
Nantwich - -	Queries 35 to 42 not answered.
Tarporley - -	The supply is adequate.
Congleton - -	The Answers to Queries have not been received from this Borough.
RIBBLE BASIN.	
Watershed of the Ribble Proper.	
Southport - -	Watercloseets have cisterns; overflow into soil pipes. The supply is ample. Rate of charge, waterclosets, 8*s.* per annum; houses, 5*s.* per cent. on rent; garden 8*s.* per rood; 6*d.* per 1,000 gallons to the Corporation. Legal proceedings are taken to prevent waste. Waterworks first cost 17,000*l.*, since increased to 70,000*l.* Former supply from wells. The whole district is saturated with water of a good quality, which is found at about five feet below the surface. Wells are still very extensively used. Mr. Spencer analyzed the water, a copy of the analysis is herewith forwarded.
Kirkham - -	The Answers to Queries have not been received from this Local Board of Health.
Fulwood - -	Constant supply direct from the mains. Rate of charge 5 per cent. on the rental; the supply is adequate.
Preston - -	The water is supplied direct from the mains. Table of charges sent herewith. The supply has been adequate until the present dry season. The Corporation intend to apply to Parliament for powers to obtain an additional supply of water to the town. Men are constantly employed by the Corporation to prevent waste; they visit the houses of the inhabitants to inspect the waterclosets, pipes, and taps. The former supply was from wells and springs in the town. The waterworks have cost 235,000*l.* A good supply of water must be of the greatest service to every town. The water has not been recently analyzed.
Leyland - -	The supply is adequate.
Clitheroe - -	The water is supplied direct from the mains. The charge is moderate, and supply adequate. The former supply was from public and private wells in the town. The new supply has improved the health of the town.
Watershed of the Calder, Tributary of the Ribble.	
Clayton-le-Moors	Supplied direct from the mains. No cisterns. Rate of charge about 7½ per cent. on the rack-rent; minimum charge 6*s.* 6*d.* per annum. Supply perfectly adequate. Means adopted to prevent waste, five pounds penalty and liability to make full compensation for the water wasted. Former supply from rainfall, two private wells, and water fetched by hand from *Norden brook*. Cost of works about 15,000*l.* to the present time. The improved supply has had a very beneficial effect. The late John Mercer, Esq., F.R.S., analyzed the water. We have not a copy of the analysis.
Oswaldtwistle -	Supplied direct from mains, and ample. Rate of charge, see printed table forwarded. Former supply from springs. The water has not been analyzed.
Accrington - -	Supplied direct from mains and is ample. All taps are examined each quarter. Former supply from springs.
Burnley - -	Very few houses within the borough have cisterns attached, and the supply is generally direct from the mains. Where cisterns are attached, and pan waterclosets used, there is an overflow pipe connected with the soil pipe, but many sanitary closets are used without any pan, and with a branch direct from the main. Persons offending by permitting pipes to remain out of order, or causing wilful waste, are summoned before the magistrates under the provisions of the *Waterworks Clauses Act*, 1847, incorporated with the *Burnley Improvement Act*, 1854, and a fine generally inflicted. Former supply from wells and springs in and near the town. The waterworks have cost 76,735*l.* The new supply has made a decided improvement in the health of the inhabitants. In 1846 the water was analyzed by Dr. Lyon Playfair, F.R.S., who pronounced an opinion that the water was very good and under two degrees hardness. A copy of the analysis cannot be obtained.
Brierfield - -	Not answered.
Nelson - -	The water has not been analyzed.

Ribble Basin—(River Darwen).

Series No. 4, Water Supply.—Answers to Queries 35 to 42.—Page 115—*continued*.

Names of Cities, Boroughs, and Districts.	Answers to Queries.
	Watershed of the Darwen, Tributary of the Ribble.
Blackburn - -	The supply is direct from the mains, except waterclosets, which are supplied through cisterns. Domestic supply charged at the rate of 6*d.* per cent. on the assessment to the poor rate; trade supply according to agreement; total cost of waterworks 171,979*l.* Town formerly supplied by wells and from a small private waterworks. The present supply has contributed to the health of the inhabitants. The water was analyzed by Dr. Lyon Playfair, F.R.S.
Great Harwood -	The houses are nearly all furnished with cisterns. The supply will be adequate when the waterworks are completed. Former supply from shallow wells.
Over Darwen -	About 60 houses are supplied with cisterns. Cisterns have ball taps to prevent waste. The Company are applying to Parliament in the present Session for powers to construct additional reservoirs to supply a higher level. Continued thorough inspection is made in order to prevent waste. The former supply was from springs. Town is more healthy since the improved supply.
	Watershed of the Douglas, Tributary of the Ribble.
Croston - -	Not answered.
Chorley - -	Supply direct from the mains. See printed scale of charges. The supply is adequate. No special means are taken to prevent waste. The former supply from wells and springs. Cost of waterworks, 40,000*l.* The improved supply has had a very beneficial effect. The water has been analyzed by Dr. Holland.
Ormskirk - -	The cisterns are not supplied direct from the mains; the overflow pipes not connected with the watercloset. The present supply is adequate. The rate of charge 5 per cent. on the rateable value and 6*d.*, 9*d.*, and 1*s.* per 1,000 per meter. To prevent waste daily inspection is made of the taps. The cost of the works was 9,280*l.* The former supply was from wells and pumps erected by the town in the public streets. The improved supply has had a beneficial effect on the health of the inhabitants. The water has been analyzed by R. H. Brett, B.M.D. and C.
Wigan - - -	The houses are supplied direct from mains. The rates of charge are 2*d.* a week for cottages, 8*s.* 8*d.* a year for houses under 8*l.* yearly rent, and 5 per cent. on rental of houses above 8*l.* and up to 50*l.* per annum, increasing less rapidly afterwards up to 3*l.* 12*s.* 6*d.* a year for houses of a rent of 100*l.* and upwards per annum.

EVIDENCE.—PART II.

QUERIES (SERIES A., B., C., AND D.) RELATING TO THE TRADES AND MANUFACTURES (CARRIED ON IN THE BASINS OF THE RIVERS MERSEY AND RIBBLE AND THEIR TRIBUTARIES) WHICH USE AND POLLUTE THE WATER.

Series A.—Cotton and Woollen Manufacturers, Calico and Silk Printers, Dyers, and Bleachers.—Queries.——1. Name of your Firm and situation of works? —— 2. Trade or manufacture carried on by you? Number of Hands employed? and rateable annual value of works?—— 3. Name of River or Stream on which your works are situated?——4. Has the Bed of the River or Stream silted up? If so, to what cause do you attribute it?——5. Are your works affected by floods owing to the silting up of the Bed of the River or Stream?——6. Describe the past and present condition (within your knowledge) of that part of the River or Stream opposite your works?——7. Is the River or Stream polluted by works situated above yours? If so, to what extent? ——8. Is the River or Stream polluted by refuse from Mines?—— 9. From whence do you obtain Water; from the River or Stream; from Wells or Boreholes; from Waterworks; from what other source? What is the annual consumption at your works in gallons?—— 10. If the River or Stream from which you might derive your supply of Water were rendered clear and colourless, what would be the direct money value to you?——11. What quantity of liquid refuse from washing, bleaching, printing, dyeing, and soap suds, do you produce at your works annually?——12. Have you depositing Tanks, and do you filter the waste liquid?——13. Does this Waste liquid flow into Sewers or direct into the River or Stream?——14. What description of Dye Wares do you use, the quantity in lbs. per annum, and what is done with the spent dye stuffs?——15. What description of Bleaching Materials do you use, and the quantity in lbs. solid and liquid per annum?——16. What quantity of Soap do you use per annum? Are the soap suds treated for the recovery of grease?——17. If you use Steam or Water Power at your works, state the nominal horse-power?—18. What quantity of Coal do you use per annum?——19. What quantity of Ashes do you make, and what is done with them?——20. How are the excrements of your workpeople removed or got rid of?——21. Have you any suggestions to offer as to the best means of avoiding pollution in future?——22. Have you any suggestions to offer as to Conservancy of Rivers and Streams?

Series B.—Alkali and Chemical Works.—(Queries 1 to 10 and 17 to 22 of Series A. repeated.)—Queries.—11. What quantity of materials do you use and produce at your works annually. Common Salt, Sulphur, Sulphuric Acid, Pyrites, Limestone, Chalk, Lime, Oxide of Manganese, Bleaching Powder, Bicarbonate of Soda, Alkali, or Black-ash Waste, Volume and strength of Acid condensed for use, Volume and strength of Acid condensed and run to waste?——12. What are the names and quantities of any other materials used or produced at your works?——13. What are the number and dimensions of Condensing Towers at your works?——14. What quantity of Liquid Refuse do you produce at your works annually?——15. Have you depositing Tanks, and do you filter the waste liquid?——16. Does this Waste Liquid flow into Sewers or direct into the River or Stream?——17. Do you recover Sulphur from Alkali Waste; if so, state the quantity of waste operated upon yearly, the cost of working the process, and quantity, quality, and value per ton of the Sulphur recovered?

Series C.—Paper Manufacturers.—(Queries 1 to 10 and 17 to 22 of Series A. repeated.)—Queries.——11. What quantity of materials do you use at your works annually. Rags, Esparto, Soda-ash, Caustic Soda, Crystals of Soda, Sulphate of Soda, Bleaching Powder and Bleaching Salt, Alum, Lime, Antichlor, Vitriol, Sulphate of Alumina, Pearl-ash, Salt, Manganese, and Soap?——. 12. What description of Paper and quantity of each kind do you produce at your works annually?—— 13. What quantity of Rag-dust or Waste do you produce annually; and what is done with it?—— 14. What quantity of Liquid Refuse do you produce at your works annually?——15. Does this Waste Liquid flow into Sewers or direct into the River or Stream?——16. Have you depositing Tanks, and do you filter the waste liquid?

Series D.—Tanners.—(Queries 1 to 10 and 17 to 22 of Series A. repeated.)—Queries.—10. What quantity of materials do you use at your works annually. Lime, Bark, Valonia, Sumach, Gambir, or Terra Japonica, Gali Nuts?——11. What are the names and quantities of any other materials used at your works?——12. Do you use pigeons', fowls', or dogs' dung, bullocks' blood, or human excrement; if so, give the quantities you use of each annually?——13. What quantity of Hair do you obtain in the process of "depilation," and what is done with it?——14. What quantity of Fatty Matter do you obtain in the process of "fleshing," and what is done with it?——15. What are the number and dimensions of Tan Pits at your works?——16. Do you dye; if so, what description of Dye Wares do you use, the quantity in lbs. per annum, and what is done with the spent dye stuffs?——17. What quantity of Liquid Refuse do you produce at your works annually, have you depositing Tanks, and do you filter it, or does this Waste Liquid flow into Sewers or direct into the River or Stream?

ANSWERS TO QUERIES, SERIES A., B., C., AND D., RELATING TO THE TRADES AND MANUFACTURES (CARRIED ON IN THE BASINS OF THE RIVERS MERSEY AND RIBBLE AND THEIR TRIBUTARIES) WHICH USE AND POLLUTE THE WATER.

Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
		MERSEY BASIN.
		Watershed of the Etherow, Tributary to the Mersey.
Edmund Potter & Co., Calico Printers.	Dinting, Glossop.	Our works are situated on the *Gorse brook*, which flows into the Etherow. The rateable value is 2,441*l.* We employ 750 hands. Bleach, print, and dye goods of the value of 600,000*l.* to 650,000*l.* per annum. The bed of the river has not silted up. Our works are not affected by floods. The condition of the stream is getting gradually worse. It is considerably polluted by sewage of the town of Glossop, and by a paper mill; but not by refuse from mines. We use from 650,000,000 to 700,000,000 gallons of water annually, which we abstract from *Gorse* brook. Chemical purity is of more value to us than mere cleanness, as we filter the water. We produce from 600,000,000 to 650,000,000 gallons of liquid refuse annually from washing, bleaching, printing, dyeing, and soap suds, which flows through a goit into the river. We filter the dye woods and use as dye wares 1,200 tons of madder or garancine, which is a prepared madder, 300 tons of logwood, minor quantities of peach wood, quercitron bark, and sumach. Use bleaching materials: 300,000 lbs. of lime, 8,000 lbs. of caustic soda, 54,000 lbs. of crystals of soda, 58,000 lbs. of resin, 98,000 lbs. of sulphuric acid, 1,000,000 lbs. of muriatic acid, and 160,000 lbs. of chloride of lime per annum. We use 450,000 lbs. of soap per annum, but after frequent trials have found it impossible to recover the grease from the soap suds. We use steam power, engines 400 horse-power, boiler power over 1,000 horse-power. Consume 25,000 tons of coal, and make about 3,000 tons of ashes per annum, which latter is deposited in heaps on to land, or on roads, at considerable expense to us. The excrements of our workpeople are partly used on land and partly carried by main sewer into river. As members of the Manufacturers' and Millowners' Committee we will answer questions relating to the best means of avoiding pollution in future, and suggestions as to conservancy of rivers separately.
George Andrew & Sons, Cotton Spinners and Manufacturers, Calico Printers, and Colliery Proprietors.	Compstall -	Our works are situated on the *Etherow*. Employ 950 hands in the mills, 270 in printworks, and 52 in colliery. The rateable value of the mills 2,010*l.* 3*s.* 4*d.*, printworks 561*l.*, and colliery 180*l.* 9*s.* 2*d.* per annum. The bed of the river has silted up, caused by ashes and refuse thrown in from mills above. Our works are not affected by floods. The river is polluted by refuse from print and other works, and by sewage of towns and villages, but not by mines. We use in printworks 28,957,500 gallons of water annually, and abstract it from the river, produce liquid refuse from washing 18,150,000, bleaching 165,000, printing 412,500, dyeing 1,650,000, and soap-suds 330,000 gallons annually. We do not filter the refuse but it flows direct into the river. Use as dyewares: Madder 19,665, garancine 58,942, sumach 24,903, bark 3,787, logwood 222,880 lbs., and barwood 8,145 lbs. per annum. Use as bleaching materials: soda-ash 50,676, bleaching powder 9,689, lime 40,824, spirits of salts 129,924, and bleaching liquor 81,390 lbs. per annum, and 17,937 lbs. of soap per annum, but do not treat the suds for the recovery of grease. We use both steam and water power; at the mills 702, printworks 207, and colliery 49 nominal horse-power, and consume 11,295 tons of coal per annum. The excrements of our workpeople are mixed with stable manure and used on land for agricultural purposes.
		Watershed of the Goyt, Tributary of the Mersey.
Edward Hall, Bleacher.	Horwich End, Whaley Bridge.	My works are situated on the *Goyt*. Employ 50 hands. The rateable value of the works is 110*l.* per annum. The bed of the river has not silted up, but on the contrary, it is one foot lower than it was 30 years ago. My works not affected by floods. The river is polluted by water from colliery. I obtain water from river and

Series A, B, C, D, Trades and Manufactures.—Mersey Basin—(River Goyt)—*continued.*

Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Edward Hall, Bleacher—*cont.*	Horwich End, Whaley Bridge.	springs, but do not know the volume. The waste liquid (except bleaching liquor) flows into sewers, and from thence into river. I use as bleaching materials: bleaching powder, 20 tons, soda-ash, 15 tons; muriatic acid, 40 tons, and sulphuric acid, 10 tons; also soap. 2 tons, but do not treat the suds for the recovery of grease. I use water as power, nominal, 20 horse-power, but in time of drought, a small steam-engine. Consume 1,000 tons of coal, and make 300 tons of ashes annually; the latter is carted away for ballast, the excrements of workpeople are used for agricultural purposes.
Charles Saxby, Calico Printer.	Furness - -	My works are situated on the *Goyt*. I employ 170 hands. Rateable value of the works, 487*l.* 3*s.* My works are not affected by floods. The condition of the river is much the same as when I came here 10 years ago; it has not been to any great extent polluted by works above mine, but it is polluted by water from coal mines, which sometimes stops my works for a few hours. I obtain water from the river, and, in such a summer as 1868, abstract the entire volume of the river. I do not filter the waste liquid, but pass it direct into the river. I use as dyewares; madder, peachwood, bark, sumac, chalk, sapanwood, and logwood, in all, 529,850 lbs. per annum; use parts of spent dye stuffs again. I use as bleaching materials: soda-ash, 40,500 lbs., muriatic acid, 210,000 lbs., gum, 36,000 lbs., lime, 117,600 lbs., and bleaching powder, 8,400 lbs. I also use 41,150 lbs. of soap, and a portion of the suds are treated for the recovery of grease. I use water, 20 horse-power, steam, 130 horse-power, nominally; consume 4,500 tons of coal. The ashes are taken for ballast by London and North-western railway; the excrements of the workpeople are mixed with soil, and applied to land. I have no suggestion to offer as to the best means of avoiding pollution in future, or as to conservancy of rivers.
The Hayfield Printing Company, Calico Printers.	Hayfield, Derbyshire.	Our works are situated on the *Kinder brook* which flows into the *Goyt*. We employ 200 hands. Rateable value of works, 500*l.* The bed of the brook has not silted up. The works are not affected by floods. The condition of the brook during the past twenty years has not, within our knowledge, altered. It is not polluted by works above. All the fluid refuse from the Kinder Printing Works is conducted by pipes into our mill goit to be used by us as power. We derive our supply of water from the *Kinder* and *Phoside* brooks, which are both clear and colourless. We are not able to give a just estimate of the volume of water used or the liquid refuse produced by us annually; the liquid refuse from our works is conducted by pipes (under the brook) into a goit at the works below to be used for power. We have no depositing tanks. Our mill goit is cleaned out once a year, and the deposit is used on meadow land. We use as dyewares; madders, sumac, bark, logwood, peachwood, garancine. All spent madder is collected in large tanks and used again. We use as bleaching materials: soda-ash, chloride of lime, resin, spirit of salts, hydrochloric acid. We also use twelve tons of soap annually; the suds are not treated for the recovery of grease. We use water 25 horse-power; steam 60 to 80 nominal horse-power. Consume 6,000 tons of coal, and make about 1,500 tons of ashes annually; the latter are carted on to the railway for ballast. The excrements of our workpeople are collected in a large tank, mixed with flue ashes, emptied twice a year, and sold or given away to the farmers. We do all we can to avoid unnecessary pollution, and the situation of our works helps us to do so. We use less madders than most printers. We suggest, as the best means of avoiding pollution in future, that either filters or settling tanks be used, and the liquid refuse from all works be allowed to flow a considerable distance, in order to settle, and that the tanks be cleaned out two or three times a year.
The Kinder Printing Company, Calico Printers.	Hayfield, Derbyshire.	Our works are situated on the *Kinder brook*, which flows into the *Goyt*. We employ 250 hands. Rateable value of works 696*l.* The bed of the stream has not silted up. Our works are not affected by floods. It is not polluted by works or mines above us, but is a pure stream. We derive our supply of water from the stream, and (in full work) we consume 500,000,000 gallons per annum. We produce liquid refuse in washing 318,000,000, bleaching 150,000,000 (the waste liquid in bleaching includes the washing water used in the bleach croft), printing 10,000,000, dyeing 20,000,000, and soapsuds 2,000,000. We have a series of filters and settling lodges which remove all solid matter, and the liquid flows from thence into sewers and into the brook. We use as dye wares: principally madder from 200 to 250 tons annually,

Series A, B, C, D, Trades and Manufactures.—Mersey Basin—(River Goyt)—*continued.*

Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
The Kinder Printing Company, Calico Printers—*cont.*	Hayfield, Derbyshire.	a small quantity of peachwood, 3.8 tons ; logwood, 26 tons ; and sumach, 7.9 tons. The spent dye stuffs are periodically taken out of the settling lodges and put upon land or burnt and mixed with other material and applied to agricultural purposes. We use as bleaching materials : from 100 to 125 tons of vitriol and muriatic acid, 50 tons of soda-ash, 14 tons of bleaching powder, about 30 tons of lime, 19 tons of liquid arseniate of soda, 157 tons of cow's dung, 49 tons of starch, and 19 tons of British gum. We also use 44 tons of soap ; the suds are not treated for the recovery of grease. Use steam 130 horse-power. Consume about 9,000 tons of coal, and make about 1,300 tons of ashes per annum, which we use for the purpose of levelling land. The excrements of our workpeople are mixed with fine flue ashes and used as manure. We do not imagine any better plan (for avoiding pollution) than those we have adopted, viz., not to allow any solid matter to enter the river, and we should be very glad to see every means taken to keep the streams clean, without serious injury to the staple trade of the district.
John Slack, Paper Manufacturer.	Bank Vale, Hayfield, Derbyshire.	My mill is situated on the *Kinder brook*, which flows into the *Goyt*. I employ 70 hands. Rateable value of mill 600*l*. The mill is not much affected by floods. Do not perceive any difference in the condition of the stream. It is polluted by printworks above, but not by mines. Obtain supply of water from the stream. I use rags, 1,300 tons ; soda-ash, 24 ; bleaching powder, 48 ; alum, 48 ; lime, 96 ; anticlor, 2 ; and vitriol 10 tons, annually ; and produce 936 tons of paper. The waste liquid is partly filtered and flows into stream. The rag dust is used as manure. Use both steam and water power to the extent of 100 horse-power. Consume 4,680 tons of coal, the ashes from which are used partly by railway company, partly on the highways. The excrements of workpeople are mixed with the rag dust and used as manure. No suggestions to offer.
John Bennett, Calico Printer.	Birch Vale Print Works near Stockport.	My works are situated on the *Kinder brook*, which flows into the *Goyt*. I employ 700 hands. Rateable value of the works 973*l*. The bed of the stream has silted up, caused by the railway embankment. My works are not affected by floods. The brook is polluted by works situated above, but not by mines. I obtain water from the brook and consume 55,000,000 a year. I have sufficient clear water, except in drought. I take the water from the *brook* into the reservoir at the works at night and on Saturdays, when the water is clear. The waste liquid is not filtered, but flows direct into the brook. I use as dye wares : madder, garancine, sapanwood, logwood, indigo, &c. ; the spent madder runs into pits and is made into garancine. Use as bleaching materials : soda-ash, bleaching powder, resin, and lime, also from 80 to 90 tons of soap per annum ; the suds not treated for the recovery of grease. I use steam 82 nominal horse-power. Consume 9,000 tons of coal, make 6,000 tons of ashes which are carted on to waste land. The excrements of my workpeople are used for agricultural purposes. Have no suggestions to offer either as to avoiding pollution in future or conservancy of rivers.
The Strines Printing Company, Calico Printers.	Strines, Derbyshire.	Our works are situated on the *Goyt*. We employ 600 hands. Rateable value of the works 814*l*. The bed of the river has not silted up. Our works are not affected by floods. The condition of the river has steadily deteriorated, caused by increased amount of sewage and the refuse from various works and mines turned into it. We obtain our supply of water from river and two small streams which flow into it, and use, when in full work, 1,500,000,000 gallons annually. If the water of the river were rendered clear and colourless, the benefit to us would be very great. The bulk of the water obtained from the *Goyt* is used for washing and flows back into the river very little contaminated. The refuse from the bleaching process is pumped into depositing tanks and utilized ; this is also done to a considerable extent with the dyeing refuse ; the refuse from the printing process is of small amount ; the waste liquid flows into sewers and from thence into the river. We use as dye wares : madder, garancine, peachwood, bark, and sumach ; about 1,507,666 lbs. annually. The spent dye stuffs are utilized as far as possible. We use as bleaching materials : soda-ash, bleaching powder, muriatic acid ; 320,356 lbs. liquid, and 469,628 lbs. solid per annum ; also 219,473 lbs. of soap, and are now fitting up apparatus for the recovery of the grease. We use steam 200 nominal horse-power, and water 20 horse-power ; consume 13,500 tons of coal ; and dispose of as many ashes as possible on roads, some in levelling hollows in fields, and some of the finest are cast into the river. The excrements of the workpeople are used on

Series A, B, C, D, Trades and Manufactures.—Mersey Basin—(River Goyt)—*continued.*

Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
The Strines Printing Company, Calico Printers—*cont.*	Strines, Derbyshire.	our farm. We would suggest, as the best means of avoiding pollution in future and for the conservancy of rivers and streams :—*First*, prohibit the flowing in of town sewage. *Second*, prevent solid refuse from manufactories, mills, and works from being cast in. *Third*, settling tanks should be formed by manufacturers and others, and they should be compelled to filter on their own premises such of the fluid refuse as may require to be so treated before allowing it to flow back into the river. In our case the sewage of Hayfield, New Mills, Whaley Bridge, Brookbottom, and other places is discharged into the streams, and from observation we can testify that the chemical matters discharged by us into the stream renders the sewage less offensive. *Fourth*, in any proposed legislation it should be borne in mind that our trade is now being strongly competed with by French, Belgian, German, and Prussian printers, and that the Governments of those countries use every care to foster and encourage their trade,* and that very little oppressive legislation on the part of our own Government would shut up many works in this country, and throw the hands out of employment.
Heywood, Higginbottom, Smith, & Co., Paper Manufacturers.	Bredbury, Cheshire.	Our mill is situated on the *Goyt*. We employ 80 hands. Rateable value of the mill, 509*l*. The bed of the river has not perceptibly silted up. Our mill is affected by floods, but not aware that such floods are induced or made more destructive by the silting up of the bed. No perceptible change in the condition of the river except an occasional washing away of the banks during floods. It is polluted by gas-tar. Ashes are continually washed down, causing great trouble, cost, and inconvenience. We derive our supply of water from the river, and use about 12,000,000 gallons annually. If the river were rendered clear and colourless it would be impossible to estimate its value to us, but we think it is supposing a state of things which will never be achieved. We use rags, 1,550 tons, esparto 220, soda-ash 55, caustic soda 6, bleaching powder 40, alum 3, lime 120, vitriol 4, sulphate of alumina 120, resin 50, ochre 10, and starch 50 tons annually. Produce 5,000,000 gallons of liquid refuse annually, which is not filtered, but flows direct into the river. Produce 1,200 tons of paper for paper hangings annually, also 110 tons of rag dust, which we sell as manure to farmers. We use both steam and water power. 160 nominal horse-power. Consume 3,500 tons of coal ; the ashes from which are used for repairing roads. The excrements of the workpeople pass into river, but this could be easily altered. Have no suggestions to offer as to avoiding pollution or conservancy of rivers.

Watershed of the Tame, Tributary of the Mersey.

Edmund Butterworth & Sons, Calico Printers.	Denshaw Vale, near Delph, Saddleworth.	Our works are situate on the *Tame*, within 2½ miles of the source. We employ 120 hands. Rateable value of works, 295*l*. 6*s*. The bed of the river has not silted up. Our works are not affected by floods. The condition of the stream is very little different to what it was 28 years ago (the time we came here). We do not pass so much solid matter into the river as we did. The colouring matter of madder is now concentrated in a third of its former bulk. The stream is polluted by a small fulling mill above us, but it is only in severe drought that it does much harm. It is a comparatively pure stream, and the water is clear and is not polluted by mines. We derive our supply of water from the river, but cannot give the volume we use or of the waste liquid we produce, which is not filtered, and flows into the river. We have a depositing lodge to catch the spent dye stuffs. They are mixed with lime and used as manure. We use as dye-wares : garancine 55,328 lbs., madder 18,424 lbs., sumac 2,700 lbs. per annum, and as bleaching materials : soda-ash 28,000 lbs., resin 13,440, lime 48,000, chloride of lime 8,960, muriatic acid 90,000, and caustic soda 10,500 lbs. per annum ; also five tons of soap annually, but do not treat the suds for the recovery of the grease. Use steam, 24 nominal horse-power, water six horse-power. Consume 2,750 tons of coal, and cart away the ashes and deposit them in waste places. The excrements of the workpeople are mixed with the spent dye-stuffs and used as manure. We have no suggestions to offer except as regards our own works. If we had room to make dams or reservoirs for both our solid and liquid refuse to subside we should pass the water into the river as clear as we receive it. Our liquid refuse will very soon precipitate.

* *See* regulations in force in Prussia, France, and Belgium, Part IV., pp. 283–288.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
F. W. Ashton & Co., Calico Printers.	Newton Bank Print Works, Hyde.	Our works are situated on the *Godley brook*, which flows into the *Tame*. We employ 341 hands. Rateable value of the works, 650*l*. 13*s*. The bed of the stream has not silted up. Our works are not affected by floods; the stream is clear, it is not polluted by works above or by mines. We derive our supply of water from the stream and use 300,000,000 gallons annually, produce liquid refuse in washing 100,000,000, bleaching 150,000,000, printing and dyeing 25,000,000, and soap-suds 25,000,000 gallons annually. We have two small tanks; the waste liquid is imperfectly filtered and flows through sewers into the river. We use madder and dyewoods, 857,000 lbs. yearly, and collect the spent dye-stuffs and apply as manure; use as bleaching materials: 287,000 lbs. of solid and 382,000 lbs. of liquid, and 198,600 lbs. of soap annually, but do not treat the suds for the recovery of the grease. Use steam, 250 horse-power. Consume 10,800 tons of coal and make 3,600 tons of ashes. The greater portion of the excrements of workpeople used as manure, the remainder turned into brook. No suggestions to offer as to the best means of avoiding pollution or as to the conservancy of rivers.
Thomas Hoyle & Sons (Limited), Calico Printers.	Sandy Vale, Dunkinfield.	Our works are situated on the *Tame*. We employ 190 hands. Rateable value of the works, 704*l*. 10*s*. The bed of the river has silted up. Our works are affected by floods, the river is polluted by works above us to a considerable extent. We obtain our supply of water from the river, but are unable to give the volume we use, or a reliable estimate of the liquid refuse we produce; this latter is not filtered but flows direct into the river. We have depositing tanks to collect spent madder. We use as dye wares: madder 8,181 cwts., garancine 685 cwts., dyewood 496 cwts., and as bleaching materials: bleaching powder 380 cwts., lime 1,708, vitriol 440, spirit of salts 1,315, resin 740, soda-ash 1,315 cwts., and 310 cwts. of arseniate of soda per annum; also 2,320 cwts. of soap yearly, but the suds are not treated for the recovery of grease. Use steam, 70 nominal horse-power. Consume 7,200 tons of coal, the ashes from which are carted away to repair roads. The excrements of the workpeople are removed from the privies periodically. We have no suggestions to offer, as to best means of avoiding pollution or as to the conservancy of rivers.
Ralph Thomas Bradbury, Woollen Manufacturer.	Kinders and Haybottoms and Andrew Mill.	My mills are situated on a tributary of the *Tame*. I employ 83 hands. Rateable value of Kinders mill 116*l*. 7*s*., Andrew mill 51*l*., and Heybottoms mill 8*l*. 10*s*. The bed of the stream has silted up by débris brought down. Andrew mill is affected by floods. The stream is slightly polluted by works above but not by mines. I obtain supply of water from the stream, but cannot give the volume I use or of the waste liquid produced, which latter is not filtered. Use steam 13 nominal horse-power at Kinders, and water 8 horse-power at Andrews mill. Consume 400 tons of coal, the ashes from which are used to repair footpaths. Excrements of workpeople carted away. No suggestions to offer.
George Cheetham & Sons, Cotton and Merino Yarn Spinners to Weavers.	Castle Street and Bank Wood Mills, Stalybridge.	Our mills are situated on the *Tame* and *Acres brook*, a tributary of the *Tame*. We employ 400 hands at Castle Street, and 1,100 at Bankwood mills. Rateable value of Castle Street 1,200*l*., and Bankwood 1,200*l*. The beds have silted up, caused by sand from foundries, rubbish from mills, and soil washed down in floods. Castle Street mill is affected by floods, often causing engines to stop. The *Tame* was formerly quite clear; fish existed in it; it is now a dull dirty brown colour, and polluted by every kind of refuse from gasworks, printworks, and from cotton and woollen mills. It is not polluted by mines. We obtain our supply of water from the river *Tame*, from the waterworks company, and from wells. If the river was freed from sewage, dyeing and bleaching refuse, the water would be of the value of 50*l*. per annum to us. Cannot give the volume of soapsuds. They are not treated for the recovery of the grease, and, with other fluid refuse, flow direct into the river. We use steam power, at Castle Street 220, and at Bankbrook mills 400 horse power, nominal. Consume 8,000 tons of coal. Produce 2,000 tons of ashes, which are carted to different convenient tipping places. About three-fourths of the excrements of the workpeople are carted by the farmers for manure; the remainder is turned into the *Tame* and *Acres brook*. The most practical way of avoiding pollution in future would be by laying a large main pipe down the centre and beneath the bed of the river, connecting all the sewers and drains with it, and pumping the sewage on to the land between Ashton-under-Lyne and Stockport.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Henry Johnson & Sons, Cotton Spinners and Weavers.	Stalybridge -	Our works are situated on the *Tame*. We employ 750 hands. Rateable value of the works 2,300*l*. The bed of the river has silted up, caused by throwing in of refuse. Our works are sometimes affected by floods. The condition of the river is much the same as formerly. It is polluted by refuse from dye, print, bleach, and gas works above. We derive our supply of water from the river. Do not produce any fluid refuse. Use steam, 200 nominal horse-power. Consume 5,000 tons of coal, the ashes from which are used chiefly by railway company, and partly used to repair roads. The excrements of the workpeople are cast into the river. Have no suggestions to offer.
J. Ashton Harrison & Co., Cotton Spinners and Manufacturers.	Stalybridge -	Our mill is situated on the *Tame*. We employ 500 hands. The bed of the river has silted up in the last 50 years from four to six feet, caused by rubbish and earth thrown into it. Our mill is affected by floods. The river is polluted by works above. We obtain our supply of water from the river. Do not produce any fluid refuse. Use steam, 180 nominal horse-power. Ashes carted to Sheffield railway for ballast. Excrements of workpeople turned into river. No suggestions to offer.
Henry Bayley & Son, Cotton Spinners and Manufacturers.	Bayley Street and Bridge Street Mills, Stalybridge.	Our mills are situated on the *Tame*, and in full work we employ over 1,000 hands. Rateable value of Bayley Street mill 1,670*l*. 15*s*. and Bridge Street 735*l*. 15*s*. The bed of the river has silted up from ashes and rubbish emptied into the river. Our mills are slightly affected by floods. The river is polluted by print and other works above. We obtain our supply of water from the river. Do not produce any fluid refuse. Use steam, 360 horse-power at Bayley Street, and 120 horse-power at Bridge Street Mills. Consume from 9,000 to 10,000 tons of coal, the ashes from which are carted on to our own land to fill up hollows. The excrements of the workpeople are conveyed by a sewer into the river.
Benjamin Handforth, for self and Trustees of the late George Adshead, Cotton Spinner.	Staley New Mills, Stalybridge.	Our mill is situated on *two small brooks*, which flow into the *Tame*. We employ 280 hands. Rateable value of the mill 1,053*l*. The mill is not affected by floods. The *brooks* are not polluted by works or mines above. We obtain our supply of water from the brooks. Do not produce any fluid refuse. Use steam, 110 horse-power. Consume 2,220 tons of coal per annum, the ashes from which are used in repairing roads. The excrements of the workpeople are used as manure. We suggest as the best means of avoiding pollution in future that all refuse arising from houses, mills, manufactories, &c. be collected and used for agricultural purposes, instead of being emptied into rivers and streams, as is now the case.
John Wagstaff & Co., Cotton Spinners.	Stalybridge -	Our mill is situated on the *Tame*. We employ 110 hands. Rateable value of the mill 715*l*. 4*s*. The bed of the river has silted up three feet, and it is polluted to a great extent by works above, but not by mines. Our works are affected by floods. We obtain our supply of water from the *Tame*, but only use it for condensing purpose, so produce no fluid refuse. Use steam, 90 nominal horse-power. Consume 1,600 tons of coal annually, the ashes from which are carted on to our own land. The excrements of our workpeople are removed from our premises. No suggestions to offer.
Water Street Mill Company, Cotton Spinners.	Stalybridge -	Our mill is situated on the *Tame*. We employ 120 hands. Rateable value of mill 376*l*. 15*s*. The bed of the river has silted up two feet within the last 20 years. Our mill is affected by floods. The river is polluted by mills and works above. The water is perfectly red and thick. We obtain our supply of water from the *Tame* and from jack wells. If the river were rendered clear and colourless it would be of *inestimable* value to us. We do not produce any fluid refuse. Use steam, 72 nominal horse-power. Consume 1,800 tons of coal, and make 300 tons of ashes annually, which are used by the railway company. The excrements of our workpeople are conveyed into the river. We suggest that the weirs should not be allowed to be raised above the original height. This has been done in a great many instances by millowners lower down the stream, to the inconvenience of the mills above. Our own case is an example.
Hyde and Gittons, Woollen Manufacturers.	Castle Street and Spring Grove Mills, Stalybridge.	Our mills are situated on tributaries of the *Tame*. We employ 220 hands. Rateable value of the mills, 320*l*. The beds of the streams have not silted up. Our mills are not affected by floods. The streams are polluted by bleach and dye works above, but not by mines. We obtain our supply of water from the *brooks*. If the water were clear and colourless it would be of the value of 20*l*. per annum to us. We cannot tell the volume we use, nor the quantity of fluid refuse we produce from wool washing which is not filtered, and flows direct into the streams. We

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Hyde and Gittons, Woollen Manufacturers—*cont.*	Castle Street and Spring Grove Mills, Stalybridge.	use about three tons of soap per annum, the suds are not treated for the recovery of grease. Use steam 40 horse-power, consume 1,050 tons of coal annually, the ashes from which are used to repair roads. The excrements of the workpeople are mixed with shoddy and willow dirt, and used as manure. We suggest that the mill owners should be compelled to keep the gas and other refuse out of the river and streams.
Bradshaw, Hammond, & Co., Bleachers and Calico Printers.	Reddish Vale, near Stockport.	Our works are situate on the *Tame* about 1½ miles from its junction with the *Mersey*. We employ 250 hands. Rateable value of works 750*l*. The bed has silted up above our weir, which of course dams up all kinds of refuse. We attribute the silting up more to floods washing away the banks than to cinders and other materials thrown into the river. Our works, as a rule, are not affected by floods, owing to the silting up of the bed. The river has a good scour below, but the great flood of 1866 affected the works. We have only a personal knowledge of the river for the past eight years, and cannot say that it is more polluted now than at the commencement of that period. It is however polluted by refuse from many large works above, but in our opinion not so much as by the sewage of towns, and if the former did not counteract the effect of the latter no one in hot weather could live on the banks of the stream. The river is also polluted by gas refuse and by water from coal mines. This latter increases the hardness of the water. We obtain the whole of our supply of water from the river, do not filter it, but have a series of settling reservoirs, and after abstracting the water allow the top water only to flow from one reservoir to another, and store it for a month before using it. This process makes the water as bright and as clear as if filtered, and preserves its softness. We have repeatedly tested the water so settled against that supplied by the Manchester Corporation from their Woodhead reservoirs, and found it for the purposes of bleaching and dyeing quite equal (the Woodhead water is considered here the best for printing). We use over 300,000,000 gallons annually, and as we have already formed reservoirs for settling and clearing we could not attach a money value to the river water if it were rendered clear and colourless, unless made as chemically pure and soft as at the source. We produce fluid refuse in bleaching, approximately, 150,000,000, dyeing 150,000,000, soapsuds 4,000,000 annually, the whole of which flows direct into the river unfiltered. We use as dye-wares: madder, garancine, sapanwood, bark, sumac, logwood, cow-dung, in all about 640 tons annually. The whole of the spent dye-stuffs are turned into the river, except madder, which is collected and used again as garancine; after this it too goes into the river half reduced in bulk. We use as bleaching materials: lime, bleaching powder, soda-ash, vitriol, muriatic acid, in all about 350 tons. Also 75 tons of soap annually. We do not treat the suds, as the 75 tons will not give more than 30 tons of fatty matter, and this dissolved in 4,000,000 gallons of water will render the extraction of the grease an unprofitable operation. We use steam, 150 nominal horse-power; and water, 80 horse-power. Consume about 10,000 tons of coal and make 1,200 tons of ashes annually, none of which are put into the river, but are sold for repairing roads in the neighbourhood. The excrements of the workpeople are collected and used as manure on our farm. We suggest as the best means of avoiding pollution (of this and similar rivers) in future: *First*, removal of all weirs that obstruct and which pound up the mud and filth, and prevent it being washed away in flood-time, or floodgates to be put in all weirs to facilitate the cleansing of the bed of the river above. *Second*, Public authorities (Local Boards of Health, &c.) should be compelled to intercept the sewage of the town or district, and filter it before it is allowed to flow into the river. *Third*, that for waste liquid, as in the dyeing of hats, where the volume is small, although a large quantity of copperas and logwood is used, a filtering press similar to that mentioned by the Rivers Commission in their Third Report (Aire and Calder Basin) might with great advantage be used. *Fourth*, that water from mines should not be allowed to flow into the river (the water pumped from a coal mine at Denton just above our works gives 340 grains of solid matter to the gallon, principally sulphate of lime and saline salts, and indicates 88 degrees of hardness). *Fifth*, the volume of water used in calico printing and bleaching works seems an almost insurmountable barrier to any plan of filtering, settling, and purifying the waste liquid. Of two alternatives we should prefer settling, as the simplest, and as the most likely to be carried out by all persons where they have the convenience. *Sixth*, we should prefer the conservancy of rivers to be in the hands of Government officials rather than entrusted to local authority.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
		Watershed of the Mersey Proper.
James Muspratt & Sons, Manufacturing Chemists.	Vauxhall Road, Liverpool.	Our works are situated on the Leeds and Liverpool canal. We employ 130 to 150 hands. Obtain our supply of water (in part) from the canal, and from the Corporation waterworks. Have not estimated the volume of water we consume annually. We use yearly, common salt 3,000 to 3,250 tons, pyrites 6,000 to 6,300, limestone 3,000 to 3,300, lime 400 to 450, oxide of manganese 900 to 1,000, nitrate of soda 180 to 200, sulphate of soda 3,500, and muriate of potash 100 to 120 tons. Produce yearly, alkali or black ash 5,600 tons, soda-ash 1,900 to 1,950, rt. vitriol 700 to 750, brown vitriol 1,900 to 2,000, caustic soda 175 to 200, and chlorate of potash 120 to 175 tons. Condense 5,000 to 6,000 tons of muriatic acid. Volume of acid condensed and run to waste not ascertained. Strength about 1·05 sp. gr. We have eight condensing towers. Capacity about 12,000 cubic feet. The waste liquid flows into sewers and thence into river unfiltered. We use steam power from 60 to 70 horse power. Consume 12,000 to 12,500 tons of coal, the ashes from which are carted away. The excrements of our workpeople are conveyed into the sewers, and thence to the river. Have no suggestions to offer.
Slack, Ashcroft & Co., Manufacturing Chemists.	Vauxhall Road, Liverpool.	Our works are about half a mile from the *Mersey*, and employ 100 hands. Rateable value of works, 548*l*. The works are not affected by floods. We obtain our supply of water from the corporation water works, and consume 2,332,000 gallons annually. Use yearly 12,000 cwts. of common salt, 20,000 cwts. of sulphur, 18,000 cwts. of limestone, make 30,000 cwts. of alkali or black ash waste; also unknown quantities of muriate of potash, saltpetre, and brimstone. Condense yearly 107,000 gallons, 30 per cent. Twad. of acid, for use. We have two condensing towers 4 ft. 6 in. by 3 ft., and 40 ft. high, and two condensing tanks. Do not produce any refuse in a liquid state. Consume 7,500 tons of coal a year. Use a portion of the ashes, and cart the remainder away. The excrements of the workpeople are conveyed into sewers, and thence into river. Have no suggestions to offer.
Charles Kurtz & Sons, Coal Tar and Naphtha Distillers and Ammonia Manufacturers.	Vauxhall Road, Liverpool.	Our works are situated on the *Leeds and Liverpool Canal*. Employ 70 hands. Rateable value of the works 671*l*. The works are not affected by floods. We obtain from the Corporation Waterworks 700,000 gallons a year, and the remainder of our supply of water (quantity not ascertained) from a well in our own premises. We use, yearly, chalk 150 tons, lime 50, sulphuric acid 780, muriatic acid 600, caustic soda 50 tons, coal tar 2½ million gallons, and ammonia water 2¾ million gallons. Produce, yearly, coal pitch 8,000 tons, ammoniacal salts 1,000 tons, naphtha 130,000 gallons, oils and varnish 1,200,000, and carbolic acid 15,000 gallons. Produce about 2,000,000 gallons liquid refuse, chiefly weak muriate and sulphate of ammonia. This flows direct into the sewers, and from thence into the *Mersey*, which is about half a mile distant. In addition to this volume of liquid refuse there is constantly flowing into the sewer a volume of about 1,500,000 gallons a year of clean water. We have no depositing tanks, and do not filter the waste liquid. Use steam power, 20 horse-power nominal. Consume 7,000 tons of coal, and make ashes and other solid refuse about 1,600 tons a year. This is removed from our premises in carts and boats. The excrements of the workpeople are partly conveyed away by sewers, and partly by men employed by the Corporation. We suggest, as a means of avoiding pollution in future, that the sewage of towns should be conveyed into proper reservoirs and converted into manure.
Gaskell, Deacon, & Co., Alkali Makers.	Widnes - -	Our works are situate on the banks of the St. Helen's canal, which joins the *Mersey* about a quarter of a mile below. Employ 500 hands. Rateable value of works 2,575*l*. The works are not affected by floods. The bed of the river has silted up; formerly vessels drawing from seven to eight feet of water were able to enter the canal from the river at high water of any tide, but now they are only able to do so at the highest spring tides. The river is polluted by all kinds of fluid and solid refuse. We obtain our supply of water from wells and bore-holes. Consume 40,000,000 gallons annually. If the river were rendered clear and colourless, it would not be of any value to us. We use yearly common salt 15,000 tons, pyrites 8,000 tons, limestone 17,000, lime 2,000, and oxide of manganese 2,500 tons. Produce bleaching powder 3,000 tons, bicarbonate of soda 1,500, alkali or black ash 30,000, and alkali 10,000 tons, which we sell partly as ash, partly as caustic, partly as crystals and bicarbonate. We also make 1,000 tons per annum of chloride

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Gaskell, Deacon, & Co., Alkali Makers—*cont.*	Widnes - -	of calcium, also chlorides of barium and manganese. We have eleven condensing towers of about 1,900 cubic feet each. Have not ascertained the volume and strength of acid condensed for use or run to waste or the volume of liquid waste produced annually. This latter flows into sewers, and from thence into the river. We have ample depositing tanks, but no filters. We use steam power about 50 engines, varying from 2 to 20 horse-power. Consume 50,000 tons of coal, and make about 10,000 tons of ashes yearly, which are used for repairing roads and for building purposes. The excrements of the workpeople are used as manure. Have no suggestions to offer.
John Hutchinson & Co., Alkali Makers.	Widnes - -	Our works are situated on the banks of the St. Helen's canal, which joins the *Mersey*, about a quarter of a mile below. Employ 500 hands. Rateable value of works, 3,011*l.* There was a good entrance to the St. Helen's canal, opposite our works, before the railway bridge over the *Mersey* at Runcorn Gap was built, now the bed of the river at that point has silted up 2 ft. 6 in. above canal lock sill. The river is polluted to a very great extent by refuse from towns and works above. We derive our supply of water from wells and bore holes, and consume about 53,000,000 gallons annually. The river is tidal, and the water from thence of no value to us. We use yearly, common salt 16,500 tons, pyrites 13,000, limestone 21,000, lime 2,000, bleaching powder 25, and nitrate of soda 750 tons. Produce, alkali or black ash 32,500 tons, soda-ash 8,000, soda crystals 1,550, bicarbonate of soda 1,550, caustic soda 2,000, and sulphur 200 tons. In the manufacture of bicarbonate of soda and sulphur, we condense 15,000 gallons of acid daily at 1·030 sp. gr., and condense and run to waste 105,000 gallons at 1·015 sp. gr. We have eight condensing towers 6 feet 6 inches diameter, 52 feet high, and two 8 feet square, 55 feet high, and cooling space about 7,200 cubic feet. We produce 7,000,000 gallons liquid refuse yearly, exclusive of weak acid run to waste, which is not filtered but flows into sewers and thence into the river. We use steam-power engines of various size, total 115 nominal horse-power; consume 55,000 tons of slack, 1,000 tons of coke, 250 tons of coal, and make about 6,000 tons of ashes, which are used on roads, and as ballast on railways. Excrements partly used as manure, and partly conveyed by sewers into river. *Recovery of sulphur from alkali waste.* We have up to the present time (January 4th, 1869), worked this process on a comparatively small scale, having operated only on the waste from 60 to 70 tons of salt-cake per week; the result has been so satisfactory that we some time ago decided upon extending the use of the process to the whole of the waste which we produce when we expect to recover from 35 to 40 tons of sulphur per week. About one half of the sulphur contained in the waste is recovered at a cost inclusive of royalty of 50*s.* per ton, the remainder being left in an insoluble state, as sulphate and sulphite of lime; the quality of the sulphur made is scarcely equal to that known to the trade as best seconds, the present market value being about 6*l.* 10*s.* per ton.
William Pilkington & Sons, Alkali Makers.	Widnes - -	Our works are situate on the *Mersey*. Employ 100 to 150 hands. Rateable value of the works, 560*l.* Our works are not affected by floods. Obtain our supply of water from wells and bore-holes, and use in condensing towers 13,000 to 14,000 gallons every 24 hours. We use yearly, common salt 6,000 tons, pyrites 4,000, lime 2,000, and oxide of manganese 2,000 tons; produce bleaching powder 2,000 tons, and nitrate of soda about 170 tons per annum. We have two condensing towers 7 ft. 6 in. square, and one 4 ft. square, all 40 feet high. We condense for use about 8,000 gallons of acid, 26 Twaddle, every 24 hours. Condense and run to waste 4,000 to 5,000 gallons of acid, 1–2 Twad., every 24 hours. Do not know volume of liquid refuse produced. It flows into sewers and thence into river. We have depositing tanks and prevent any solid refuse being cast into river. Use steam power, 12 nominal horse-power. Consume 8,000 to 9,000 tons of coal, the ashes from which are used as ballast for roads. The excrements of workpeople are mixed with lime and used for manure. We suggest that all persons should be prohibited from casting solid refuse into rivers and streams.
Thomas Fleetwood, Manufacturing Chemist.	Widnes - -	My works are situate on the *Mersey*. Employ 40 hands. Rateable value of works 188*l.* My works are not affected by floods. The river is polluted by refuse from works above. Obtain my supply of water from bore-holes. Consume 62,899,200 gallons yearly. Use yearly common salt 70,000 cwts., pyrites 70,000, lime 10,000, and oxide of

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Thomas Fleetwood, Manufacturing Chemist—*cont.*	Widnes - -	manganese 12,000 cwts. Produce yearly salt cake 4,000, and bleaching powder 750 tons, also unknown quantity of superphosphate of lime. Do not know volume of acid condensed for use, which is sp. gr. 1·14, but condense and run to waste yearly 1,008,000 gallons of acid sp. gr. 1·01. I have three condensing towers, two 48 feet high, 4′ 6″ and 5′ 6″ square, and one 40 feet high, 5 feet square. Produce yearly, in addition to the waste acid, 2,000,000 gallons of manganese refuse, both of which flow into sewers and thence into river. Use steam power, 20 nominal horse-power. Consume 4,000 tons of coal. Make 1,000 tons of ashes, which are used for road making. Excrements of workpeople conveyed into sewers. No suggestions to offer.
G. H. Bolton, Secretary to the Widnes Alkali Company (Limited).	Widnes - -	Our works are situated on a *brook* or tributary of the *Mersey*. Employ from 100 to 120 hands. Rateable value of the works 550*l.* The bed of the stream has silted up. Our works are occasionally affected by floods. The stream is a small one with a course of about three miles. It is partially polluted by works above. We obtain our supply of water from wells and bore-holes. Consume from 7,000,000 to 8,000,000 gallons annually. The volume of the stream is small and uncertain, and if rendered clear it might still be impregnated with acid, and therefore useless. We use yearly, common salt 300 tons, limestone 2,500, and lime 2,000 tons. Produce yearly, alkali or black ash 5,000 tons, caustic soda 2,500 tons. Have no condensing towers, no depositing tanks, and do not filter the waste liquid. Use steam power. Consume 15,000 tons of coal. Make 1,500 tons of ashes, which are taken away by the farmers. Excrements of workpeople discharged into sewers, and from which flow into the *Mersey*. Have no suggestions to offer.
James Muspratt & Sons, Manufacturing Chemists.	Widnes - -	Our works are situate on the *Mersey*. Employ 240 hands. Rateable value of works 1,445*l.* The bed of the river has silted up owing to obstructions caused by building railway bridge. The works are not affected by floods. The river is polluted by refuse from towns and works and collieries above. We obtain our supply of water from wells. The river is tidal, and the water of no use to us. We use yearly, common salt 7,000 tons, pyrites 7,000, limestone 6,750, lime 1,600, oxide of manganese 1,800, nitrate of soda 250, and muriates of potash 73 tons. Produce yearly, bleaching powder 1,350 tons, alkali or black ash 15,000, soda-ash 3,800, caustic soda 600, and chlorate of potash 70 tons. We have depositing tanks. Do not filter the waste liquid which flows into sewer and thence into river. Use steam power; have several engines from 2 to 25 horse-power. Consume 26,000 tons of slack, the ashes from which are removed by farmers. The excrements of workpeople are conveyed by sewers into river. Have no suggestions to offer.
Wells, Taylor, & Edwardson, Alkali Makers.	Earle Street, Widnes.	Our works are situated on a small brook a tributary of and not far from the *Mersey*. Employ 30 hands. Rateable value of works 150*l.* The bed has not silted up. Our works are not affected by floods; the stream is polluted by works above, and is acid, and unfit for use; it is not polluted by mines. We obtain our supply of water from wells and bore-holes; consume from 2,000,000 to 3,000,000 gallons annually; if the stream was rendered clear and colourless *it would be now worth 100l. per year to us, but more as our works increase.* We use yearly, limestone 2,500 and sulphate of soda 2,500 tons; produce alkali or black-ash 5,000 and soda-ash 1,500 tons. Have no condensing towers, no depositing tanks, and do not filter the liquid waste. Use steam power, 25 nominal horse-power. Consume 5,000 tons of coal, the ashes from which are used to repair roads. Excrements of workpeople are carried by sewers into the river.
Richard Powell & Co., Alkali Makers.	Widnes -	Our works are situated on *Stuart's* brook, a tributary of the *Mersey*. Employ when in full work 70 hands. The river is polluted by muriatic acid, which probably destroys the fish, but is not otherwise injurious. We obtain our supply of water from wells and *Stuart's* brook. Consume, when in full work, 9,000,000 gallons annually. We use yearly; common salt, 3,000 tons; pyrites, 2,600 tons; and lime, 750 tons. Produce yearly: alkali, or black ash, 5,000 tons; caustic soda, 1,000 tons; and salt cake, 2,000 tons. About 7,000,000 gallons of acid, sp. gr. 2 or 3, condensed and run to waste. We have five condensing towers, in all 11,000 cubic feet. We have no depositing tanks. Do not filter the waste liquid, which flows direct into the stream. Use steam power, 10 nominal horse-power. Consume 10,000 tons of coal per annum. Make about 1,000 tons of ashes, used by us to fill up

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Richard Powell & Co., Alkali Makers —*cont.*	Widnes -	hollows on our own land. We consider that the muriatic acid poured into the rivers and streams acts beneficially upon the other unpleasant and pestilential pollutions.
Hall, Brothers, and Shaw, Manufacturing Chemists.	West Bank, Chemical Works, Widnes.	Our works are situated on the *Mersey*. Employ 45 hands. Rateable value of works 280*l*. The bed of the river has silted up, caused by the building of the railway bridge across the river at Runcorn Gap. Our works are not affected by floods. The river is polluted by towns and works above. We obtain our supply of water from wells and bore-holes. Consume 3,000,000 gallons annually. If the river were rendered clean and colourless it would be of no value to us. We use yearly, common salt 5,000 tons, pyrites 5,000 tons, lime 750 tons, and oxide of manganese 800 tons. Produce yearly, bleaching powder 1,000 tons, and salt cake about 5,500 tons. We have three condensing towers (two 50 feet high and 5 feet square, and one 35 feet high and 4 feet in diameter). We condense annually for use about 2,000 tons of acid 27° Twad., and also condense and run to waste 1,000,000 gallons of acid 1° Twad. The liquid waste produced flows unfiltered into sewers and thence into the river. We have depositing tanks. We use steam, 6 nominal horse-power. Consume 4,000 tons of coal annually, the ashes from which are used on land. The excrements of our workpeople are carried into sewers. We have no suggestions to offer.
Crosfield, Brothers & Co., Manufacturing Chemists.	St. Helens -	Our works are situate on the *Sankey canal*. Employ 310 hands. Rateable value of works 1,500*l*. *Sankey canal* and *Sankey brook* are polluted by works above, by town sewage, and by mines. We obtain our supply of water in part from waterworks of the Corporation of St. Helens, and from *Rainford brook*. Consume 94,900,000 gallons annually. We use yearly: common salt 10,450 tons, pyrites 9,000, limestone 9,700, lime 2,515, oxide of manganese 1,160, bleaching powder 1,200, and nitrate of soda 500 tons. Produce yearly, alkali or black-ash 22,000 tons, soda ash 7,500, and caustic soda 1,610 tons. We condense yearly for use 1,232,500 gallons of acid, specific gravity 1·12, and condense and run to waste 500,000 gallons of acid, specific gravity 1·005. We have three condensing towers of 2,205 cubic feet each, one of 3,000 and two of 1,470 cubic feet each. We have depositing tanks or wells. Do not filter the waste liquid which flows direct into the *Windle brook*. Use steam power, 49 nominal horse-power. Consume 45,000 tons of coal, make 100 tons of ashes weekly, which are removed either by boats, railway, or carts. Excrements of workpeople removed by farmers for manure. Do not know of any means for preventing pollution of rivers.
Andrew George Kurtz, Alkali Maker.	Sutton Alkali Works, St. Helens.	My works are situate on the *Sankey brook*, which flows into the *Mersey*. Employ 360 hands. Rateable value of works 2,796*l*. The bed of the stream has not (near my works) silted up. The works are not affected by floods. The condition of the stream has for the last 20 years been the same, viz., a dirty stinking sewer. It is polluted by works above, by town sewage, and by coal mines. I obtain my supply of water in part from St. Helen's Water Works and Messrs Bourne's and Robinson's Colliery. I use common salt, yearly, 15,600 tons, sulphuric acid 14,518, pyrites 8,000, limestone 1,590, lime 2,600, manganese 2,300, bleaching powder 1,900, and bicarbonate of soda 1,800 tons. Produce yearly, alkali or black-ash 30,310 tons, sulphate of soda 15,589, soda crystals 5,200, alkali 10,400, caustic soda 1,300, and chlorate of potash 52 tons. I have four condensing towers, 60 feet high, 6 feet square, and from 6 feet by 5 feet 6 inches. Also two 40 feet high, 10 feet square. Condense yearly for use 7,856,856 gallons of acid, 27° Twad., and condense and run to waste 3,491,936 gallons of acid, not quite 1° Twad. Produce about 11,348,792 gallons of waste liquid. Have two depositing pans, but do not filter this liquid, which flows by a drain into the *Sankey brook*. Use steam power, 170 nominal horse-power. Consume 62,400 tons of coal. Make about 2,730 tons of ashes, which are used chiefly by railway company as ballast. The excrements of workpeople are taken away by farmers for manure. No suggestions to offer.
Gillespie & Mason, Paper Manufacturers.	Newton - in - Mackerfield.	Our mill is situate on a small *brook* which flows into the *Sankey brook*. Employ 150 hands. Rateable value of the mill 235*l*. The bed of the brook has not silted up. Our mill is not affected by floods. There is little alteration in the condition of the brook; the water is more discoloured since the erection of our works and the introduction of the Newton sewage. It is slightly polluted by cotton mills above. Not, within our knowledge, polluted by mines. We obtain our supply of water from the brook and from wells, and consume 864,000,000

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Gillespie & Mason, Paper Manufacturers—*cont.*	Newton - in - Mackerfield.	gallons annually. If the brook were rendered clear and colourless it would not be of more value to us than at present. We use annually, esparto 1,720 tons, soda-ash 300 tons, bleaching powder 250 tons, alum 100 tons, lime 200 tons, and vitriol 7 cwt. Produce annually 800 tons of paper for printing and newspapers; also 400,000,000 gallons of liquid refuse, which flows into settling tanks belonging to the Newton Improvement Commissioners. We produce as little waste as possible. It is all used for the manufacture of coarser papers. Use steam, 100 nominal horse-power. Consume annually 4,500 tons of coal, the ashes from which are used to repair roads. The excrements of workpeople fall into a large pit. No suggestions to offer.
The Rev. Frank George Hopwood, M.A.	The Rectory, Winwick, near Warrington.	I am rector of the parish, and reside at Winwick Hall. The injury done to the land overflowed by the *Sankey brook* can be no matter of dispute. It seems to have been admitted, when several years ago the Canal Company agreed, instead of going into Court as defendants in the suit instituted against them, to take on lease, at a fair agricultural rent, all lands so damaged and situated above the junction of the *brook* with the *canal*. The waters of the brook, corrupted by the manufacturers above, and received into the *canal*, are passed on in their polluted state only partially diluted by the Canal Company after they have used them, and the lands lying immediately below the outfall from the canal having become profitless and untenantable, and compensation in damages only obtainable through expensive legal proceedings, an attempt has just been made to redeem them to a certain extent by embanking the course of the *brook*. The nuisance and injury caused by the effluvium from the *brook* is of so serious a nature that, were I not compelled by circumstances to remain in Winwick, I should certainly remove my family from the constant annoyance caused by the stench. Not only does it beset us out of doors, but it penetrates into every room of the house, and the clothes in the laundry, with *the windows closed*, and also in the drying ground, are discoloured, and have frequently to be re-washed. On one occasion this winter (1869), in a few moments all the copper vessels in the kitchens were turned almost blue. It makes this place perfectly odious. The nuisance is constant, as the prevailing winds are from the west and north-west. The condition of the *brook* is also a positive injury to the property near it. The water is rendered worse than useless for the land, the cattle, and for domestic purposes; and beyond this, if I wished to let this house (Winwick Hall) with such a nuisance besetting it, I should either be unable to let it at all, or should have to do so at far less than its real value. As to health, I am not competent to judge chemically of the effects of continually inhaling strong doses of this impregnated air, but I and my family feel that it does not contribute to our health.
Davies and Brook, (late Beamont and Davies,) Solicitors and Law Clerks to the Local Board of Health, Newton-in-Mackerfield.	Warrington -	The state of the *Sankey brook*, 24th January 1870, has never been so bad before. In the neighbourhood of Sankey water mill, close to the Bank Quay side of Warrington, there are many acres of land flooded producing a stench which is perceptible for more than a mile from the mill; the cottages into which the mill has been converted, were, when painted, very soon covered with a metallic enamel, like fresh lead in color, caused by the effluvium from this horribly polluted *brook*. When the Rivers Pollution Commissioners visited Warrington, notice had been given, and the *brook* was comparatively clear. We are satisfied that the present condition of the *brook* cannot be too strongly condemned, and we are fully supported in this by the opinion of two county magistrates and landowners who have this day seen the *brook* and meadows near to Sankey water mill.
William Reynolds, Tanner.	Mersey Street, Warrington.	My tanyard is situated about a third of a mile from the *Mersey*. Employ 25 to 30 hands. Rateable value, 220*l*. Works not affected by floods. Obtain supply of water from wells. Use yearly: lime, 30 tons; bark, 300 to 400; valonia, 150 to 200; divi divi, 30 to 40; gambir, 50 to 60; and myrambolam, 40 to 50 tons. Do not use either dung, blood, or human excrement. Obtain 60 tons of hair in the process of "depilation," sold, and, with the fatty matter in "fleshing," carted away periodically. I have 185 tanpits, of sizes 6 ft. by 4 ft. and 12 ft. by 8 ft., and 8 ft. square. Do not dye. Produce, say, two pits a day of spent lime and bark liquor, which flows unfiltered into a sewer, and so into into the *Mersey*. I use steam, 10 nominal horse-power. Consume 300 tons of slack, the ashes from which are used to repair roads and fill up hollow places in my land. The excrements of workpeople carted to my farm as manure.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
J. Hutchings, Tanner.	Howley Quay, Warrington.	My tanyard is situate on the *Poulton brook*, a tributary of the *Mersey*. Employ 22 hands. Rateable value, 211*l*. The bed of the brook has not silted up, and it is not polluted by works above. Obtain my supply of water from the brook. Consume from 2,000,000 to 3,000,000 gallons annually. I use yearly: lime, 80 tons; bark, 100; valonia, 120; gambir, 150; and myrabolam, 80 tons. Do not use dung, blood, or human excrement. Obtain 25 tons of hair in "depilation," and 100 tons of fatty matter in "fleshing;" sold to dealers. I have 130 tanpits; average dimensions, 6 ft. 6 in. by 5 ft. 5 in. Do not dye. Produce from 1,000,000 to 1,500,000 gallons of liquid refuse, which flows unfiltered into the *brook*. Use steam, 12 nominal horse-power. Consume 250 tons of coals, the ashes from which is used in repairs to roads near works. Excrements of workpeople flow into a cesspool, which is cleared out periodically. No suggestions to offer.
Henry H. Benkbane, Tanner.	Foundry Street, Warrington.	I employ 20 hands. Rateable value of tanyards, 100*l*. Obtain my supply of water from waterworks company. Use yearly: lime, 13 tons; valonia, 30 to 35 tons; gambir, 100 tons. Do not use dung, blood, or human excrement, or anything of the like nature. Obtain 20 tons of hair in "depilation," sold to plasterers; 25 tons of "fleshings," sold to glue and size makers or oil refiners. I have 90 tanpits, of various sizes. Do not dye. The waste liquid flows into sewers, and thence into river, unfiltered. Use steam, 6 nominal horse-power. Consume 200 tons of coal, the ashes from which are carted away. Excrements of workpeople carted away. The modern water-closet system must add in a very large degree to the pollution of rivers and streams. The excrements were formerly taken away by farmers, and applied to land.
Reynolds & Mortimer, Tanners.	Orford, near Warrington.	Our tanyard is situate on a *brook* without a name which flows into the *Mersey*. We employ 25 hands. Rateable value of tanyard 90*l*. Obtain our supply of water from springs and wells; consume 70,000 gallons annually. Use yearly: lime 50 tons, bark 30 tons, valonia 200 tons, gambir 100 tons, marabolams 100 tons. Do not use pigeons', fowls', or dogs' dung, blood, or human excrement. Obtain yearly 150 tons of "hair in depilation," which is dried and sold to plasterers, and 150 tons of "fleshings," sold to size makers. We have 160 tanpits, 6 ft. by 5 ft. by 5 ft. Do not use any dyewares; produce 40,000 gallons of liquid refuse yearly, which flows into a settling pond, and thence along a brook course into the river, distant about two miles. We use steam, 4 nominal horse-power; consume 150 tons of coal, and make about 20 tons of ashes yearly, which are used to repair roads. The excrements of workpeople are used on land for agricultural purposes. Have no suggestions to offer.
Melland & Coward, Cotton Spinners, Weavers, Bleachers, and Dyers.	Heaton Mersey, near Manchester.	Our mill is situate on the *Mersey*. The bed of the river has silted up, caused by rubbish thrown into it. Our mill is affected by floods; the condition of the river is not changed since our occupancy of the mill, it is polluted by works above us. We derive our supply of water from the river and from springs; consume 150,000,000 gallons annually, and produce liquid refuse from washing 6,000,000 gallons, bleaching 2,000,000 gallons, and dyeing 60,000 gallons a year. We have not filters or depositing tanks, and this waste liquid flows direct into the river. We use as dye wares, 30 tons a year of indigo, and drugs, logwood, barwood, peachwood, and fustic; use as bleaching materials, 50 tons of soda-ash, chloride of lime, sulphuric and muriatic acid; do not use soap. Use steam, 220 nominal horse-power; and water, 25 horse-power. Consume 12,000 tons of coal. Make 1,200 tons of ashes, which are used entirely for road making and repairing. The excrements of workpeople are partly used on land and partly discharged into river. Have not any suggestions to offer.
Philip Parker, Indigo-blue Calico Printer.	Daw Bank, Stockport.	My works are situate on the *Mersey*. Employ 180 hands. Rateable value of the works 632*l*. The works not affected by floods. Condition of river has not changed for several years. I obtain my supply of water from the river, consume about 140,000,000 gallons annually. The liquid refuse flows through sewers into river; and, as indigo is of great value, I endeavour to extract all colouring matter. Use annually as dyewares, indigo 123,000 lbs., copperas 123,000 lbs., lime 800,000 lbs., and other drugs, formed into mordants and fixed in the cloth. No spent dye stuffs. Use as bleaching materials, soda-ash 25,000 lbs., bleaching powder 10,000 lbs., spirits of salts 296,000 lbs. Use steam, 45 nominal horse-power. Consume 1,800 tons of coals, the ashes from which are used to repair streets and highways. Excrements of workpeople used as manure. No suggestions to offer.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Richard Sykes & Co., Bleachers.	Edgeley, Stockport.	Our works are situate on a small *brook* which flows into the *Mersey*. Employ 250 hands. Rateable value of the works 1,505*l*. Works are not affected by floods. The brook has not silted up; is not polluted by works above; and the condition of it has never varied. We derive our supply of water from wells and springs. Consume 45,000,000 gallons yearly. The liquid refuse from bleaching and washing flows direct into stream. We use as bleaching materials, chlorine, alkali, and oil of vitriol. Use steam, 212 nominal horse-power. Consume 10,500 tons of coal, the ashes from which are used as ballast for railways. The excrements of workpeople are used on land for agricultural purposes. Have no suggestions to offer.
Godfrey Barnsley, Tanner.	Canal Street, Stockport.	My tanyard is situate on *Carr* brook, a tributary of the *Mersey*. Employ 10 hands. Rateable value 120*l*. Tanyard not affected by floods. Course of brook has been narrowed by rubbish being deposited on the banks. It is polluted by refuse from 3 breweries, 3 cotton mills, 3 hat manufactories, 1 tanyard, and the sewage from upwards of 2,000 houses. I derive my supply of water from a well. Use annually, lime 3 tons, bark 35 tons, valonia 5 tons, sumach half ton, gambir 4 tons, and pigeons' dung 12 bushels. Obtain in "depilation," 26 packs of hair yearly, and 5 tons of "fleshings" which are sold to size makers. I have 28 tan-pits 5 ft. 6 in. by 4 ft. 6 in., 12 6 ft. by 5 ft. 6 in., and 11 6 ft. by 5 ft. Do not dye. Produce from 20,000 to 30,000 gallons of liquid refuse a year, which flows unfiltered into the stream. Use steam, 4 nominal horse-power. Consume 104 tons of coal, the ashes from which and also the excrements are carted away. It was suggested that when the corporation obtained the loan for sanitary purposes an intercepting sewer should be laid along Canal street; this would have prevented the sewage and refuse from a district half-a-mile in breadth from flowing into the *Carr* brook.
Syddall, Brothers, Calico Printers.	Chadkirk, near Stockport.	Our works are situate on the *Mersey*. Employ 160 hands. Rateable value 404*l*. The bed of the river has silted up, and our works affected by floods, caused by a weir on the river 500 yards below our works. The condition of the river has not, within our knowledge, changed. It is polluted by works above, this is more perceptible in dry weather. We obtain our supply of water partly from river and from a small brook. Consume yearly 160,000,000 gallons, and produce liquid refuse from washing and bleaching 80,000,000 gallons, from printing and dyeing 82,800,000 gallons, soap-suds 340,000 gallons; this waste liquid (with the exception of that from madders, which is filtered to make garrancine,) flows unfiltered into river. We use annually as dye-wares, madder, garrancine, and dyewoods 178,500 lbs.; as bleaching materials, soda-ash 13,216 lbs., soda crystals 14,000 lbs., resin 5,900 lbs., muriatic acid 118,000 lbs.. sulphuric acid 11,000 lbs., and chlorine liquors 84,000 lbs. Also use soap 4 tons, the suds are not treated for the recovery of grease. We use steam, 100 nominal horse-power; and water, 25 horse-power. Consume 4,300 tons of coal. Make 460 tons of ashes, which are used for highways and railways. The excrements of workpeople are all put on land as manure. No suggestions to offer.
Runcorn Soap and Alkali Company (Limited).	Weston - -	Our works are situated on the *Weaver* canal. Employ 450 hands. Obtain our supply of water from wells and bore holes, and consume yearly 31,000 tons; also use common salt 17,000 tons, pyrites 10,000 tons, limestone 14,000 tons, lime 2,900 tons, oxide of manganese 3,700 tons. Produce yearly alkali or black ash 20,000 tons, bleaching powder 3,700 tons. We have 11 condensing towers 40 feet high, 6 ft. by 6 ft. 6 in. Produce for use 18,600 tons of acid, 26° Twad., and make 10,000 tons of spent liquor, which latter is not filtered, but flows direct into the *Weaver* canal. We use steam, 122 nominal horse-power. Consume 50,000 tons of coal, the ashes from which are carted away by farmers for road making. The excrements of workpeople used on land. Have no suggestions to offer.
Runcorn Soap and Alkali Company (Limited).	Runcorn -	Our works are situated on the *Bridgwater canal*. We obtain our supply of water from the canal, and consume in condensing towers 1,580,000 gallons yearly. We use yearly, common salt 3,000 tons, pyrites 3,500, and limestone 3,000 tons. Produce yearly alkali or black ash 7,000 tons. Condense for use 528,000 gallons of acid yearly, strength 28° Twad. Condense and run to water 1,000,000 gallons of acid yearly, capacity of condensing towers 4,000 cubic feet. Produce about 50 tons weekly of spent lye, consisting principally of salt and water, which is run into settling tanks but not filtered, but flows from thence into the river. We use steam power, 60 nominal horse-

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Runcorn Soap and Alkali Company (Limited)—*cont.*	Runcorn -	power. Consume 16,000 tons of coal, the ashes from which are used on roads. Excrements of workpeople used as manure. No suggestions to offer.
Hazlehurst and Sons, Soap and Alkali Makers.	Runcorn -	Our works are on the river *Mersey*. Employ 165 hands. Rateable value 800*l*. Our works are not affected by floods. The river is polluted, but to what extent cannot say, but not by mines in our neighbourhood. We obtain our supply of water from the *Bridgwater canal*, and consume 35,000,000 gallons yearly. We use steam power, 28 nominal horse-power. Consume 17,251 tons of coal, and make about 3,000 tons of ashes, which are used in repairing roads. The excrements of the workpeople are used as manure. Have no suggestions to offer.
Robert Pierpoint, Tanner.	Runcorn -	My tanyard is situate on the *Bridgwater canal*. Employ 20 hands. Rateable value, 120*l*. Obtain supply of water from the canal. Use yearly, lime 25 tons, bark 100, valonia 25, and gambir 10 tons. *The excrements of 25 persons*, also fowls' dung. Obtain in the process of "depilation," 30 packs of hair which is sold to plasterers; and in "fleshing," 4 tons of fatty matter sold to size makers. I have 50 tanpits. Do not dye. The waste liquid flows in sewers, and thence into the *Mersey*. Use steam power, 6 nominal horse-power. Consume 50 tons of coal yearly, the ashes from which are used to repair roads. No suggestions to offer.
John L. Wright & Sons, Tanners.	Runcorn -	Our tanyard is situate on the *Bridgwater canal*, about 500 yards from the *Mersey*. Employ four men. Rateable value 56*l*. We obtain our supply of water from the canal. Use yearly, lime 26 tons, bark 78, and valonia 13 tons. The hair obtained in "depilation" is sold to builders. We have 74 tanpits, 6 ft. by 4 ft. by 3 ft. 10 in.; 15 leaches, 8 ft. by 4 ft. by 3 ft. 10 in. Do not dye. The waste liquid flows into a ditch, and from thence into the canal. Use steam power, 6 nominal horse-power. The ashes from the coal used go to repair roads The excrements of workpeople used as manure. Have no suggestions to offer.
James Nicholson, Esquire.	Thelwall Hall, Warrington.	I am lord of the manor of Thelwall, which lies upon the Cheshire side of the *Mersey*, about three miles from Warrington. Formerly the river at that point abounded with fish, and was a clear stream; now unfortunately it is a fearful nuisance, black as ink at most times, and most offensive in smell. Salmon have been taken in the river frequently within my knowledge during the last 30 years, but none for a dozen years past owing to the greatly increased pollution of the water. From the accounts of the stewards of the manor, it is evident there was anciently a very valuable fishery at Thelwall, and even so late as the years 1749 and 1750, salmon of large size were taken here, as appears from the following entries (viz.): "1749, May 30, a salmon was "caught near Laskey bridge, one yard and half a quarter long, weighed "19½ lbs." "1749, June 30, a salmon taken by Thelwall Lock, "23¾ lbs." "1750, March 22, a salmon taken that weighed 19¾ lbs." These circumstances may now be mere matters of history, but I cannot but hope that the result of the inquiries of this Commission will bring about a better state of things as regards the river. At present its condition is a scandalous reproach to the age in which we live.
Thomas Ditchfield, Farmer.	Thelwall -	I am tenant of a farm belonging to James Nicholson, Esq., in Thelwall, and also of the ferry over the *Mersey* at that place. I am 48 years of age; was born at Thelwall, and have resided there all my life. When I was a lad the river was quite clear and had plenty of fish of every kind in it. The fishery in the river used always to be let with the ferry. My great uncle, James Ditchfield, and my uncle, Robert Ditchfield, tenants under Mr. Nicholson's predecessors, used to fish the river regularly. I have helped them to take salmon, pike, eels, flukes, and other fish. There used to be a regular fish weir at Thelwall, and while tending cows I frequently saw shoals of fish going up the river. Of late years there has not been a fish seen, except dead ones floating on the surface. In flood time, when the brooks overflowed, I have seen quantities of gudgeon, dace, eels, and other fish killed as soon as they entered the river. I used regularly to supply the table of Mr. Nicholson's predecessor with fish caught from the river. I have known the Bridgwater Canal all my life. There used to be abundance of fresh-water fish in it. Of late years, owing to its foul condition, no fish could live in it. About 12 months since an improvement was made in its condition, and the fish are returning to it again. During the summer of 1868 I have

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Thomas Ditchfield, Farmer—*cont.*	Thelwall -	seen persons angling, and dace and eels caught. The river *Mersey* has been gradually getting worse for the last 25 years. It is most offensive in smell, and in colour like ink.
S. Reynolds, Tanner.	Latchford, near Warrington.	My tanyard is situate near the river *Mersey*. I employ 22 hands. Rateable value of tanyard 135*l*. I have great difficulty in time of flood in passing off spent liquor. The river is polluted as much as a stream can be by dye, chemical, and other works. I obtain my supply of water from wells, and consume about 3,100,000 gallons yearly. I use yearly, lime 60 tons, bark 300 tons, valonia 80 to 100 tons, terra japonica 40 to 50 tons, divi divi 20 to 25 tons, and myrabolams 20 to 25 tons. Do not use pigeons', fowls', or dogs' dung, blood, or human excrement. Obtain from 60 to 65 tons of hair in "depilation," and 50 to 55 tons of "fleshings," sold to merchants. I have 123 tanpits of various sizes. Do not use dye wares. Produce 3,100,000 gallons of liquid refuse yearly, which flows unfiltered into sewers, and thence into river. I use steam, 6 nominal horse-power. Consume 200 to 240 tons of coal, and make from 30 to 40 tons of ashes, which are sold to farmers. The excrements of workpeople are used as manure. I suggest as the best means of avoiding pollution in future that filth of every description should be kept out of the river from its source to the estuary.
Charles Broadbent, Tanner.	Latchford, near Warrington.	My tanyard is situate near the *Mersey*. I employ 11 hands. Rateable value of tanyard 135*l*. The water backs up my drains in time of flood. The condition of the river becomes more dirty and offensive every year, and is greatly polluted by Manchester and the other large towns and districts above us. I obtain my supply of water from wells. If the river, from which I might derive a supply of water, were rendered clear and colourless it would increase the value of my house property. I use, yearly, lime 12 tons, bark 180 tons, valonia 120 tons, gambir 5 tons, and divi divi 4 tons. Do not use pigeons', fowls', or dogs' dung, blood, or human excrement. Obtain 20 tons of hair in "depilation," sold to builders. Do not obtain any fatty matter. The fleshings from salted hides are sold and sent weekly to dealers. I have 142 tanpits of various sizes, and 23 lecks. Do not use dye wares. The liquid refuse produced flows into a drain and settling tanks, and thence to river. The solid matter in settling tanks is used for manure. I use steam, 8 nominal horse-power. Consume 120 tons of coal, the ashes from which are used on roads. The excrements of workpeople used as manure. The spent bark is sent to Chester to be used in lead-works, and valonia and other materials is taken away by farmers for use on land. I suggest, in order to avoid pollution in future, that all excrements of man and beast should be kept out of rivers and streams and used as manure, and that chemical works should be banished to the coast. Also that a proper conservancy of rivers and streams is much required, as private individuals do not like to inform of one another when anything is done to injure a river.
William Long & Son, Tanners.	Grappenhall, near Warrington.	We have two tanyards both in this parish, one called Grappenhall and the other Cliff lane for distinction. Employ 50 hands. Rateable value of both tanyards 350*l*. Grappenhall tanyard is situate on the *Godley Ford brook*, and Cliff lane on the boundary *brook* of the parishes of Grappenhall and Thelwall; these *brooks* flow into the *Mersey*. The beds of the brooks have not silted up. Our works are not affected by floods. The brooks are not polluted by works above. Obtain our water supply for Grappenhall from *Godley Ford brook*, and for Cliff lane from an artesian well; have an abundant supply. We use yearly: lime 40 tons, bark 800, valonia 200, gambir 50, myrabolam 16, and divi divi 15 tons. Do not use dung, blood, or human excrement. Obtain 80 tons yearly of hair in "depilation," and 100 tons of fleshings, which are sold in a wet state. Do not dye. The liquid refuse consists of spent tan and lime liquor, and flows unfiltered into the *Mersey*, about 2 miles from works. We use water power at Grappenhall, 5 horse-power, steam power at Cliff lane, 8 horse-power. Consume 240 tons of coal, the ashes from which are sold and carted for repairs to roads. The excrements of workpeople are used as manure. Have no suggestions to offer.
William Henry Reynolds, Tanner.	Grappenhall, near Warrington.	My tanyard is situated on the *Godley brook*, which flows into the *Mersey*. Employ 8 hands. Rateable value 126*l*. The bed of the brook has not silted up. The yard is seldom affected by floods. The brook is slightly polluted by works above, but it is much better since

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William Henry Reynolds, Tanner—*cont.*	Grappenhall, near Warrington.	the Bridgwater canal was cleansed. Obtain my supply of water in part from the brook, from the canal, and from a well in my premises. I use yearly, lime 36 tons, bark 50, valonia 85, gambir 41, and divi divi 6 tons. Obtain 38 tons of hair yearly in depilation, and 15 tons of fleshings, which are both sold weekly. I have 12 tanpits 6 ft. by 5 ft. by 5 ft.; 37 5 ft. 9 in. by 3 ft. 6 in. by 5 ft.; 57 6 ft. 6 in. by 4 ft. 6 in. by 5 ft.; and 18 8 ft. by 8 ft. by 5 ft. Do not dye. The waste liquid flows unfiltered into the brook. I use water power, 4 horse-power. Consume for heating purposes 20 tons of coal. The excrements of workpeople used as manure. Have no suggestions to offer.
Ambler & Brookes, Tanners.	Timperley, nr. Altrincham.	Our tanyard is situate on the *Timperley* brook. Employ nine hands. Rateable value, 45*l.* Our tanyard is flooded whenever the overflow from the Bridgewater Canal is allowed to pass into the brook. 20 years ago the brook was clear, but now it is polluted by the sewage of the district and by refuse from gasworks at Altrincham. We obtain our supply of water from the brook, and consume 100,000 gallons per annum. We use yearly: lime 5 tons, bark 100 tons, sumach 1 ton, gambir 10 tons, and small quantity of pigeons' and fowls' dung. We obtain in "depilation" 3 tons of hair and 5 tons of "fleshings," which are sold to plasterers and size boilers. We have 40 tanpits, 7 ft. by 4 ft. by 5 ft. 6 in. Do not dye. Produce yearly 50,000 gallons of liquid refuse, which flows into the brook unfiltered. We use steam, 4 horse-power. Consume 50 tons of coal annually, the ashes from which are used to repair roads. The excrements of workpeople are used as manure. We suggest that the gas company and the Local Board of Health of Altrincham should be prohibited from turning their gas refuse and town sewage into the *brook*.
		Watershed of the Irwell, Tributary of the Mersey.
H. D. Pochin & Co., Manufacturing Chemists.	Salford - -	Our works are drained by the sewers of the corporation of Salford. Are not affected by floods. We obtain our supply of water from the waterworks company. Consume yearly 200,000 gallons. Use 1,500 tons of pyrites. Produce patent aluminous cake, but not muriatic acid. Use steam, 10 nominal horse-power. Consume 1,000 tons of coal, the ashes from which are carted away. The excrements of workpeople sold to night-soil men.
James Brown, Dyer and Finisher.	Hodge Lane, Cross Lane, Salford.	I employ 90 hands. Rateable value of works, 116*l.* Obtain supply of water from wells and bore-holes. Consume yearly 31,000,000 gallons. Produce liquid refuse from washing, 12,400,000 gallons; dyeing, 6,200,000 gallons. This waste liquid flows unfiltered into sewers, and thence into river. Use as dyewares, logwood, fustic, and sumach. Spent dye stuffs carted away. Use steam, 20 nominal horse-power. Do not know quantity of coal used, ashes from which are carted away. Excrements are in part conveyed into river, and part carted away. No suggestion to offer.
Henry Williams & Company, Fustian Finishers.	Brown Street Works, Salford.	Our works are situate on the *Irwell*. Employ 60 hands. Rateable value of works 280*l.* The bed of the river has silted up. Works are affected by floods and often stopped when the water is high. The river is polluted both above and below our works, and is almost as bad as it can be. We obtain our supply of water from the river and from the waterworks company, but we only use the river water for condensing purposes. If the river were clear and colourless it would be money value to us in thus preserving the boilers and the cylinders and valves of the engine from grit and sand. We use steam, 50 nominal horse-power. Consume 1,032 tons of coal. Make 156 loads of ashes, which, together with the waste products, are carted away. Excrements of workpeople are removed by men employed by Corporation. We suggest, as the best means of avoiding pollution in future, that ashes and all other manufacturing refuse be prohibited from being cast into rivers and streams.
Longworthy, Brothers, & Company, Cotton Manufacturers, Spinners, Printers, and Dyers.	Greengate Mills, Salford.	Our works are situated on the *Irwell*. Employ about 900 hands. Rateable value of works, 1,845*l.* The bed of the river has (within our knowledge) silted up between three and four feet, and in some places six feet during the last 12 years, caused in a great measure by the throwing in of ashes and other rubbish beyond the boundary of the borough. Our works are affected by floods. The river is now greatly polluted; 30 years ago it was much clearer, and floods passed off more rapidly. We obtain our supply of water from the river, 76,000,000

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Longworthy, Brothers, & Company, Cotton Manufacturers, Spinners, Printers, and Dyers—*cont.*	Greengate Mills, Salford.	gallons, from wells and springs 75,000,000, and waterworks 2,500,000. If the river were rendered clear and colourless, so that we could obtain the whole of our supply from thence, it would be worth to us 200*l.* per annum. We produce liquid refuse from washing 20,000,000, bleaching 10,000,000, printing 10,000,000, dyeing 10,000,000, and soapsuds 1,000,000 gallons annually, which flows unfiltered into river. We use as dye-wares, logwood 60,000 lbs., sumach 5,000. The spent dye-stuffs and solid refuse from dyeing and bleaching, mixed with the ashes and carted away. We use as bleaching materials, soda-ash 45,000 lbs., liquid chlorine 50,000 lbs.; also soap 5,000, but do not treat the soap-suds for the recovery of grease. Use steam, 276 nominal horse-power. Consume 7,800 tons of coal. Make 936 tons of ashes, the whole of which latter we cart away. The excrements of workpeople are conveyed by sewers into the river. We are of opinion that cinders, solid matter, and refuse are to a very great extent (beyond the jurisdiction of this borough) thrown into the river and streams, and we suggest, as the best means of avoiding pollution in future, that this practice be strictly prohibited.
Walker Norris, Dyer and Finisher.	Adelphi, Salford.	My works are situated on the *Irwell*. Employ 50 hands. Rateable value of works 260*l.* Not affected by floods. Obtain supply of water jointly from river and from waterworks company. The waste liquid produced flows unfiltered into the river. Use steam, 60 nominal horse-power. Consume 1,200 tons of coal. Make about 400 tons of ashes. These, with the spent dye-stuffs, are carted away. Excrements of workpeople removed from privies by men employed by the Corporation. No suggestions to offer.
Thomas Williams, Dyer of Linen and Cotton Yarns.	Brindle Heath, Pendleton.	My works are on a small *stream* which flows into the *Irwell*. Employ 30 hands. Rateable value of works 83*l.* 10*s.* Not affected by floods. The stream is much polluted, and in fact is a common sewer of this locality. Obtain supply of water from Manchester and Bolton canal. Consume 3,500,000 gallons annually. Produce liquid refuse from bleaching 200,000 and dyeing 2,200,000, this flows from depositing cesspools into the sewers and thence into the *Irwell*. I use annually as dye-wares, logwood, peachwood, fustic, barwood, and sumach, 30,000 lbs. Indigo, lime, prussiate of potash, chromate of potash, lead 2,000 lbs. The spent dye-woods are partly burnt, partly used in brick-making, the other spent dye-stuffs are carted away. I use as bleaching materials, chloride of lime 18,000 lbs., also 2 cwt. of soap. Use of steam, 6 nominal horse-power. Consume 600 tons of coal. Make 150 tons of ashes which are used for repairing roads. The excrements of workpeople are removed by men employed by the Corporation. I suggest that depositing tanks should be generally used to filter the liquid refuse.
Isaac Wood, Manager. Delaine, &c. Printers.	Spring Vale Printing Co., Tanners' Lane, Pendleton.	The number of hands vary from time to time. Rateable value of works, 160*l.* Obtain supply of water from springs and from the Corporation Waterworks. The waste liquid flows unfiltered through sewers into *river*. Use chloride of lime and sulphuric acid. Use steam, 10 nominal horse-power. Consume 280 tons of coal. The excrements of workpeople removed by men employed by Corporation.
James L. Barrett, Bleacher and Finisher.	Pendleton, near Manchester.	My works are situated on the *Irwell*. Employ 70 hands. Rateable value of works 751*l.* The bed of the river has silted up to a considerable extent owing to the large quantity of solid matter thrown into the river from towns, manufactories, and works, situate higher up the river. My works are affected by floods. The condition of the river has during the past five years altered but little; it is greatly polluted by works, but the chief nuisance arises from the sewage of the large towns above us. During the dry summer of 1868 the stench from the river was dreadful. I obtain supply of water jointly from the river and from the Manchester waterworks. If the river were clear and colourless it would be of money value to me of 50*l.* per annum. I use as bleaching materials: lime, soda-ash, chlorine gas fixed in water, oil of vitriol and spirits of salts. The waste liquor is in a spent state as it flows from the works, and the effect on the water in the river is of a purifying tendency, and helps to precipitate other impurities. Use steam 50 nominal horse-power. Consume 2,000 tons of coal, the ashes from which are all carted away to repair footpaths and roads. The excrements of the workpeople have till recently gone into the river, but in consequence of notice from "River Inspector" (appointed by the Corporation of Salford), I have built privies and cesspools which will in future be emptied by men

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James L. Barrett, Bleacher and Finisher—*cont.*	Pendleton, near Manchester.	employed by the Corporation. I would suggest as the best means of avoiding pollution in future, that town sewage should be purified before being allowed to be discharged into rivers and streams, and that a strict supervision be exercised over the entire watershed to prevent cinders or any solid refuse or matter whatever being thrown into the rivers and streams. The supervision in our district is very strict, and anyone caught or known to throw any solids into the stream is summoned and fined; let this rule be generally carried out under "River Inspectors," and the silting up of the bed and pollution of the rivers and streams would be in a great measure prevented.
Roberts, Sons, & Diggle, Dyers and Spinners.	Ford Lane Dye Works, Pendleton, near Manchester.	Our works are situated near the *Irwell*. Employ 60 hands. Works not affected by floods. Obtain supply of water from the Lancashire and Yorkshire canal. The waste liquid flows unfiltered into sewer, and thence into river. We use dye-woods and burn the spent dye-stuffs. Use the ordinary bleaching materials. Use steam, 50 nominal horse-power. Consume 4,000 tons of coal, the ashes from which are carted away. The excrements of workpeople removed by men employed by the corporation. No suggestions to offer.
John Leeming & Co., Dyers and Finishers.	Hopefield Mills, Broughton.	Our works are situate on the *Irwell*. Employ 427 hands. Rateable value of works 1,060*l*. The bed of the river has silted up, caused by ashes and other solid refuse thrown into the river, and deposit brought down by floods. Our works are affected by floods, and in 1866 the flood caused damage to our property to the extent of 20,000*l*. Eight years ago the river opposite our mills was considerably clearer than at present. It is polluted by works and by mines above. We obtain our supply of water jointly from river, Corporation water-works, and rain, and consume annually 9,000,000 gallons. Produce liquid refuse from washing 2,000,000, and dyeing 1,500,000 gallons, which flows unfiltered into sewers, and thence into river. We use as dye-wares indigo, cudbear, madders, cochineal, dye-woods, 260,000 lbs. annually. The spent dye-stuffs are burnt. Use soap 250,000 lbs. The soapsuds are treated for the recovery of grease. Use steam, 100 nominal horse-power. Consume about 2,300 tons of coal. Make about 360 tons of ashes, which are carted away for repairing roads. The excrements of workpeople are conveyed by sewers into river. No suggestions to offer.
Robertson & Stansby, Paper Manufacturers.	Broughton Bridge, Salford.	Our mill is situate on the *Irwell*. Employ 50 hands. The bed of the river has silted up, caused by town sewage, washing in of the banks, and from refuse thrown into the river. Our mill is partially affected by floods. We have only occupied the mill three years, consequently do not find any great difference in the condition of the river. We derive our supply of water from thence, and if the river were clear and colourless we should be able to make a much better class of paper. We use, annually, rags, ropes, &c. 1,000 tons. The waste liquid produced flows unfiltered into the river. We make brown paper. Cannot state the quantity of rag dust produced, but it is either burnt or used as manure. Use steam power. Consume about 3,500 tons of coal, the ashes from which are carted away from the mill. The excrements of our workpeople are conveyed into river. As the best means of avoiding pollution in future we suggest that intercepting tanks should be constructed to prevent sewage and other refuse going into the rivers and streams until settled and purified. Also as the weirs are a great impediment and prevent the free scour of the river, they should be altered or re-constructed.
Joshua Scholfield & Sons, Dyers and Finishers of heavy cotton goods.	Cornbrook, Hulme, Manchester.	Our works are situate on the Bridgwater Canal, but are drained into the *Cornbrook*. Employ 200 hands. Rateable value of the works 610*l*. The stream is shallow, about three yards wide, and 40 years ago fish were able to live in it, but it is now exceedingly filthy, black coloured, and is the common sewer for some miles of a large and continuously increasing district. We obtain our supply of water from the canal for steam power, and from a well and bore-hole for dyeing. Consume yearly 45,000,000 gallons. If the stream were clear and colourless it would be of money value to us of 500*l*. a year. We produce liquid refuse from washing 13,000,000 gallons, very little polluted, bleaching 13,000,000, and dyeing 13,000,000 gallons. This waste liquid flows unfiltered into the *Cornbrook*, and from thence into the *Irwell*. We use yearly as dye-wares, chiefly woods, 200,000 lbs. The spent dye-woods are sold to brickmakers. Use as bleaching materials soda ash, bleaching powder, vitriol, and spirits of salt 84,240 lbs. Use steam, 97 nominal horse-power. Consume 4,000 tons of coal. Make 200 tons of ashes, which are used for repairing roads. The excrements of workpeople

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Joshua Scholfield & Sons, Dyers and Finishers of heavy cotton goods—*cont.*	Cornbrook, Hulme, Manchester.	are removed by men employed by the corporation. We suggest as the best means of avoiding pollution in future: 1st, prevent ashes being thrown into the rivers and streams. 2ndly, discourage the water-closet system, but as much as possible adopt the dry earth privy (outside houses). We do not know of any cheap and effectual method of filtering dye-waters.
Walker, Norris, & Son, Smallware Manufacturers.	Albert Mill, Lower King Street, Manchester.	Our works are situate in the Irwell. Employ 80 hands. Rateable value of the works, 300*l*. The bed of the river has silted up caused by cinders brought down by floods from works; above our works are affected by floods; occasionally the boiler fires are put out. The great flood of 1866 caused us damage to the extent of 50*l*. The condition of the river is blacker and more polluted than it was 14 or 15 years ago, it is polluted to a very large extent by works and mines above ours. We obtain supply of water for boiler use and condensing from the river, and consume for that purpose, yearly, 1,000,000 gallons; for dyeing and bleaching we obtain the supply from wells and the corporation water works, and consume 400,000 gallons. If the river were clear and colourless it would be of the money value to us of 50*l*. per annum. Produce liquid refuse from washing 100,000 gallons, bleaching 100,000 gallons, and dyeing 200,000 gallons. This waste liquid flows unfiltered direct into the river. We use as dyewares, woods and analine colours; the spent dyewoods are burnt, the liquids flow into the river. We use as bleaching materials, chloride of lime 10,000 lbs., and vitriol 4,000 lbs., also 700 lbs. of soap; the soapsuds are not treated for the recovery of grease. Use steam, 18 nominal horse-power. Consume 400 tons of coal, make 100 tons of ashes, which are conveyed away by boat. Excrements of workpeople are conveyed into river.
George Wright & Sons, General Dyers and Cleaners.	Bedford Street, Chorlton-on-Medlock.	We employ 60 hands. Rateable value of works 60*l*. Obtain supply of water jointly from wells, and the water-works company. Consume yearly 1,500,000 gallons. If the river, from which we might derive our supply, were clear and colourless, it would be worth 200*l*. a year to us. We produce liquid refuse from washing and bleaching 750,000, and dyeing 750,000 gallons, this flows into sewers and thence into river. We burn all spent dye stuffs, use 500 gallons of bleaching liquor, also 10 tons of soap, but do not treat the soapsuds for the recovery of grease. Use steam, 16 nominal horse-power. Consume 300 tons of coal, make 78 tons of ashes, which are carted away by men employed by the corporation. Excrements of workpeople are conveyed by sewers into the river. We suggest that an extensive and proper system of sewerage should be carried out to prevent all forms of pollution from entering rivers and streams, and that conservancy of river basins should be established.
Thomas Hoyle & Sons (Limited), Calico Printers.	Mayfield, Manchester.	Our works are situated on the *Medlock*, which flows into the *Irwell*. Employ 500 hands. Rateable value of works, 2,568*l*. The bed of the river had silted up considerably near our works, but it has been recently deepened by men employed by the corporation; we attribute the silting up to the refuse thrown in from towns and works above, and brought down by floods. Our works are affected by floods. The river is polluted to a very great extent. We obtain supply of water jointly from wells and corporation waterworks; consume yearly upwards of 80,000,000 gallons. If river from which we might derive our supply of water were clear and colourless it would be of the money value to us of 1,000*l*. a year; the waste liquid we produce flows unfiltered into the river. We have depositing tanks for spent dye-stuffs. We use annually as dye-wares, garancine 972,384 lbs., madder 103,824 lbs., and dye-woods 477,792 lbs. The spent dye-stuff is collected; the spent madder made into garancine; the others burnt or disposed of. We use as bleaching materials, bleaching powder and liquor 42,336 lbs., lime 41,328, oil of vitriol 105,280, resin 560, soda-ash 57,568, spirits of salts 2,016 lbs., and 98,336 lbs. of arseniate of soda, also, 26,880 lbs. of soap; do not treat the soap-suds for the recovery of grease. Use steam, 150 nominal horse-power. Consume 8,500 tons of coal, the ashes from which are carted away for road making. Excrements of workpeople are conveyed by sewers into the river. We have no suggestions to offer.
Taylor & Boyd, Calico Printers.	Clayton Bridge, Newton Heath, near Manchester.	Our works are situate on the *Medlock*, a tributray of the *Irwell*. Employ 110 hands. Rateable value of works 450*l*. We do not perceive any difference in the condition of the stream; it is polluted by town sewage and works above. Obtain supply of water from the *Medlock*. The waste liquid flows unfiltered into the river. Use yearly as dye-wares, madders 418,910 lbs. We have a depositing tank, and

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Taylor & Boyd, Calico Printers—*cont.*	Clayton Bridge, Newton Heath, near Manchester.	the spent madder is sold. Use as bleaching materials, spirits of salts, 104,384 lbs., bleaching powder 21,171 lbs.; also, 117,540 lbs. of soap, the soap-suds are not treated for the recovery of grease. Use steam, 60 nomnal horse-power; water, 16 horse-power. Consume 3,240 tons of coal, the ashes from which are sold to fill up gravel pits, none put into river. Excrements of workpeople used as manure. No suggestions to offer.
C. J. Schofield, Manufacturing Chemist.	Clayton, near Manchester.	I employ 50 hands. Rateable value of works 270*l.* I obtain supply of water from the canal. Use and produce annually common salt 2,000 tons, pyrites 1,500, limestone 1,700, lime 300, oxide of manganese 250, alkali or black ash an unknown quantity, soda-ash 1,000, caustic soda 250, oil of vitriol 400, and bleaching liquor 600 tons. Condense for use 3,000 tons of acid, 32° Twad. Do not know the volume of acid condensed and run to waste. I have three condensing towers 40 feet high 6 feet square, and one 40 feet high 8 feet square. The liquid refuse produced flows unfiltered from sewers into *Black* brook and thence into the *Medlock*. Use steam power, consume from (three pumping engines) 6,000 to 7,000 tons of coal, the ashes from which, and also the excrements of workpeople are carted away. No suggestions to offer.
Henry Crabtree, Dresser and Dyer of Velvet and Velveteen Cords.	Lime Kiln Lane Dye Works, Ardwick, Manchester.	My works are situate on the *Medlock*, which flows into the *Irwell*. Employ 350 hands. Rateable value of works 95*l.* The bed of the river has silted up very much, caused by refuse thrown into it. My works are affected by floods. Fish were able to live in the river 30 years ago; but since then, it has gradually become fearfully polluted by refuse from works and sewage of towns and districts above. I obtain supply of water jointly from river, wells, springs, and corporation waterworks. The whole of the waste liquid produced flows unfiltered into sewers and thence into the river. I use, as dyewares, peachwood, logwood, fustic, sumach; the spent dye-stuffs from which are carted away by brickmakers and farmers. Use as bleaching materials, soda-ash, bleaching powder, 7 tons of each yearly, also very little soap. Use steam, 100 nominal horse-power. Consume 5,950 tons of coal, the ashes from which are carted away for road making. Excrements of workpeople are conveyed by sewers into river. No suggestions to offer.
Wood & Wright, Calico Printers.	Bank Bridge, Clayton Vale, and Medlock Vale near Manchester.	Our works are situate on the *Medlock*, a tributary of the *Irwell*. Employ 650 hands. Rateable value of works 1,284*l.* The bed of the river has silted up, caused by refuse from towns and collieries thrown into the river above. In this condition the river rises more rapidly after a heavy rainfall, and our works are affected thereby. It is polluted to a considerable extent by towns and numerous works. The water is permanently injured for dyeing purposes by the volume of water pumped from coal-mines; this is most perceptible in time of drought. We obtain supply of water from river, canal, springs, and land drainage. We consume a very considerable volume of water, but have no means of gauging it. If the river were clear and colourless it would be a considerable saving of expense to us in providing and working settling lodges and filters. The whole of the liquid refuse produced at our works flows unfiltered into the river. We use yearly as dyewares, madders of various kinds from 150 to 200 tons, indigo 10 to 15 tons, logwood 40 to 45 tons, peachwood, bark, and sumach 25 to 30 tons, cochineal, persian berries, and catechue from 1 to 2 tons each. The spent dye stuffs are mostly spread over and dug into waste land. Use as bleaching materials, lime 12 to 14 tons, soda-ash 48 to 50 tons, spirits of salts 1,000 carboys of 120 lbs. each, vitrol 1,000 carboys of 160 lbs. each, also 36 to 40 tons of soap. The soap-suds are not at present treated for the recovery of grease, but experiments are being made to utilize them. Use both steam and water power. Consume from 9,000 to 10,000 tons of coal, the ashes from which are stored and used to repair our roads and footpaths. The excrements of workpeople are used as manure on our farm. We are of opinion that pollution is due to the great amount of solid matter thrown into the rivers; this should be prohibited and prevented.
R. Rumney, Manufacturing Chemist.	Ardwick Chemical Works, near Manchester.	My works are situate on the *Gorton* brook, a tributary of the *Irwell*. Employ 50 hands. The bed of the stream has not silted up. The works are not affected by floods. The stream has always been (within my knowledge) very much polluted by refuse from dye and other works, but it is now more so than formerly. I obtain supply of water from Manchester Corporation Waterworks. Consume yearly

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
R. Rumney, Manufacturing Chemist—*cont.*	Ardwick Chemical Works, near Manchester.	2,000,000 gallons. Use crop wood for the manufacture of pyroligneous acid. Use steam, 30 nominal horse-power. Consume 1,500 tons of coal, the ashes from which are carted away. Have no suggestions to offer.
John Johnson & Son, Dyers and Finishers.	Horrocks Lane, Manchester.	Our works are situated on the *Irk*, a tributary of the *Irwell*. Employ 53 hands. Rateable value of works 200*l.* The bed of the river has silted up, caused by rubbish thrown into it. Our works are affected by floods. The condition of the river every year becomes worse. It is much polluted by works above. We obtain supply of water from the corporation waterworks. If the river, from which we might derive our supply, were clear and colourless, it would be worth to us in money value 45*l.* a year. The whole of the waste liquid produced at our works is discharged unfiltered into sewers, and thence into the river. We use, as dye-wares, logwood and fustic, and we burn the spent dye-stuffs under steam boilers. Use steam, 46 nominal horse-power. Consume 1,200 tons of coal, the ashes from which are carted away. Excrements of workpeople are conveyed into river. No suggestions to offer.
J. & J. Rooke & Co., Manufacturing Chemists.	Horrocks Lane, Red Bank, Manchester.	Our works are situate on the *Irk*, which flows into the *Irwell*. Employ 12 men. Rateable value of works 167*l.* The bed of the river has silted up, owing to cinders and insoluble refuse thrown into it. Our works are year by year affected by floods, which gradually increase in height. Fifty years ago, when our works were built, they were not within flood line; now, however, three or four times a year we are much inconvenienced and put to great expense by reason of floods. The river is greatly polluted by works situated above ours. The Manchester Corporation gasworks pollutes it most. We obtain supply of water from the corporation waterworks. Consume yearly about 100,000 gallons. We produce unknown quantities of pyroligneous acid, red liquor, iron liquor, and articles for calico printers and dyers; also waste liquid, 2,000 to 3,000 gallons, which flows unfiltered into sewers, and thence into river. Consume 200 to 300 tons of coal, the ashes from which are carted away for repairing streets. Excrements of workpeople go into river. We suggest that the very offensive refuse from gasworks should be kept out of rivers and streams; that weirs, bridges, and all impediments to the free flow of the water be modified so as to leave the course open as it was some years ago, instead of being curtailed as at present, causing floods that increase in height.
John Andrew & Co., Dyers, Bleachers, and Printers.	Green Mount Works, Harpurhey, Manchester.	Our works are situate on the *Moss brook*, which flows into the *Irk*, and thence into the *Irwell*. Employ 600 hands. Rateable value of works 750*l.* The bed of the *brook* has not silted up. Our works are not affected by floods. The river is more polluted by refuse from dye-works than formerly. It is so much so that the water is unfit for the purposes of trade. We obtain supply of water from wells; consume annually 120,000,000 gallons. Arrangements for water supply being made, and considering the expense of alterations, the money value to us if the river from which we might derive our supply were rendered clear and colourless would be comparatively trifling. We produce liquid refuse from washing 69,000,000, bleaching 5,000,000, printing 5,000,000, dyeing 40,000,000, and soap-suds 1,000,000 gallons yearly. This flows unfiltered into the *brook*. We use yearly, dye-woods 150 tons, chemicals 100 tons; and as bleaching materials, soda-ash 20 tons, muriate of lime liquor 150 tons, and vitriol 10 tons. Use 25 tons of soap, but do not treat the suds for the recovery of grease. Use steam, 80 nominal horse-power; boiler 200 horse-power. Consume 8,000 tons of coal. Make 500 tons of ashes, which are carted away to fill up hollow places. Excrements of workpeople conveyed into *brook*. No suggestions to offer.
John Lancaster, Junior, Bleacher, Dyer, and Finisher.	Harpurhey Dyeworks, Manchester.	My works are situate on the *Irk*, a tributary of the *Irwell*. Employ 95 hands. Rateable value of works 392*l.* 13*s.* 4*d.* I have not observed any alteration in the bed of the river opposite to the works. In heavy floods the works are affected thereby. The river is polluted to such an extent as to make the water useless. Obtain supply of water jointly from private reservoirs and the Manchester waterworks. If the river from which I might derive supply were rendered clear and colourless it would be of the money value to me of 125*l.* yearly. The waste liquid produced at the works flows unfiltered direct into the river. We use dyewoods, and the spent woods are sold to brickmakers. Use as bleaching materials, carbonate of soda, chloride of lime, spirits of salts. Use steam, 110 nominal horse-power. Consume about 4,000

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John Lancaster, Junior, Bleacher, Dyer, and Finisher —*cont.*	Harpurhey Dyeworks, Manchester.	tons of coal. Make about 500 tons of ashes a year; these are carted away for the repairing of roads. Excrements of workpeople mixed with stable manure and used on land.
Cowlishaw, Nicol, and Company, Silk Damask Manufacturers.	Blackley, near Manchester.	Our works are situate on the *Irk*, a tributary of the *Irwell*. Employ 423 hands. Rateable value of works 712*l*. The bed of the river has silted up with mud and filth, two or three feet deep, caused by the refuse thrown in, the loose and imperfect condition of the banks, and the height of the weirs. Our works are affected by floods, the water backs up into the shaft races under our mill floors. The river is a dirty black stream, extensively polluted by printing, dye, and other works. We obtain supply of water for condensing purposes from the river, and for dyeing and other trade purposes from our own reservoirs. Consume yearly 4,400,000 gallons, exclusive of that used for condensing purposes. Produce liquid refuse from washing 3,152,000, and from dyeing and soap-suds 1,248,000 gallons; this flows unfiltered through sewers into river. Use as dyewares, woods and liquids. The spent dye-stuffs are burnt under our boilers. Use about 2½ tons of soap. The suds are not treated for the recovery of grease. Use steam, 30 nominal horse-power. Consume 1,140 tons of coal, the ashes from which are used for repairing roads. The excrements of workpeople are conveyed by sewers into river. No suggestions to offer.
Thomas B. Wood, Cotton Spinner.	Tonge, Middleton, near Manchester.	My mill is situate on the *Irk*, a tributary of the *Irwell*. Employ 80 to 90 hands. Rateable value of mill 240*l*. The bed of the river has, during the past 10 years, considerably silted up, in some places more than 12 inches, and this at the distance of about 500 yards below the weir (the distance from weir to weir being about 2,100 yards). This silting is mostly caused by throwing in heavy rubbish and refuse of all kinds, and by the periodical flushing into the river of the deposit in a large mill-dam adjoining. My works are affected by floods. The river is fearfully polluted by dye and other works above. Use steam, 40 horse-power. Consume 900 tons of coal, the ashes from which are carted away by farmers for repairing roads. Excrements of workpeople drop into river.
S. Cheetham & Company, Garancine Makers.	Middleton, Lancashire.	Our works are situate on the *Irk*, a tributary of the *Irwell*. Employ 50 to 60 hands. Rateable value of the works 322*l*. 13*s*. 4*d*. The bed of the stream has not silted up near our works, but the works are affected by floods caused principally by the weirs. The river is a dirty black stream, polluted chiefly by dyeworks above us. It is also polluted by water from coal mines. Obtain supply of water from wells. Consume yearly 40,000,000 gallons. Produce from 30,000,000 to 40,000,000 gallons of liquid refuse, which flows into depositing tanks and thence into river, only slightly discoloured. Use 4,500,000 lbs. madder yearly. Use steam, 56 nominal horse-power. Consume 2,000 tons of coal, the ashes from which are sold to farmers for repairing roads. Excrements of workpeople are used as manure.
Dickinson & Company, Silk and Cotton Dyers and Printers.	Spring Vale Works, Middleton, Lancashire.	Our works are situated on the *Irk*, a tributary of the *Irwell*. Employ 350 hands. Rateable value of works 498*l*. 2*s*. The bed of the river has silted up fully nine inches, caused by sand, gravel, and other refuse from works, also from the washing in of the banks. Our works and farm lands are invariably flooded. The river is polluted to a fearful extent by all kinds of manufacturing refuse and by mines. We impound and store the rainfall in reservoirs situate in Chadderton, about a mile from the works. Consume yearly 80,000,000 to 100,000,000 gallons of water. If the river were clear and colourless so that we could use the water, it would be a money value to us of 100*l*. per annum. We produce, yearly, liquid refuse from washing 72,000,000, bleaching 3,000,000, printing 2,000,000, dyeing 2,500,000, and soapsuds 500,000 gallons. This is all discharged unfiltered into river. We use annually as dye-wares, logwood, fustic, ebony, peachwood, about 200 tons. The spent dye-stuffs are burnt. As bleaching materials we use chloride of lime and oil of vitriol 70,000 lbs. per annum, also 80 tons of soap. The strongest portion of the soapsuds are treated for the recovery of grease. We use steam, about 70 nominal horse-power. Consume 4,000 tons of coal. Make probably about 700 tons of ashes, which so far have been used for repairing roads and filling up hollows. The excrements of workpeople are mixed with soil and used as manure on our farm. We have no suggestions to offer.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John & Henry Bleakley, Bleachers and Dyers.	Prestwich, near Manchester.	Our works are situated on a *brook* without a name, a tributary of the *Irwell*. Employ 140 hands. Rateable value of works 460*l*. The bed of the *brook* has not silted up. The works are not affected by floods. The *brook* is polluted by town sewage. I obtain supply of water from the stream. The waste liquid produced flows unfiltered into the stream. I use as dye-wares, logwood and fustic. Spent, the dye-stuffs are given to brickmakers who cart them away. Use as bleaching materials, soda-ash, chloride of lime, and sulphuric acid. Use steam, 100 nominal horse-power; the ashes from the coal used are carted away. The excrements of workpeople are used as manure on farm. No suggestions to offer.
John Buckley, Bleacher.	Prestwich near Clough, Manchester.	My works are situated close to the *Irwell*. Employ 70 hands. Rateable value of the works 240*l*. The bed of the river has not silted up near the works. The works are not affected by floods. The river is polluted to a considerable extent by sewage from towns and refuse from works above. Obtain supply of water from a *brook* and springs in the neighbourhood. Consume yearly, when in full work, 31,000,000 gallons; 20 years ago I could use the river water without filtering, but have been obliged to make two filters since, which cost 50*l*. a year to keep in repair. Nearly the whole of the 31,000,000 gallons of water consumed is more or less polluted. It flows unfiltered into a large mill lake half a mile long to be used by a printworks. I use as bleaching materials, soda-ash, bleaching liquor, and vitriol, also 15,000 lbs. of soap. The suds are not treated for the recovery of grease. Use steam, 30 nominal horse-power. Consume about 2,000 tons of coal, the ashes from which are sifted, and the fine part is mixed with the excrements of the workpeople, and used as manure; the coarser part is used for repairing roads.
J. & C. Brennand, Bleachers, Printers, and Dyers.	London Vale Printing Co., Prestwich, near Manchester.	Our works are situated on the *Irwell*. Employ 140 hands. Rateable value of works 430*l*. The bed of the stream near our works has not, to our observation, for 17 years silted up. Our works are not affected by floods. The river is very much polluted, and is totally unfit for use for printing purposes. We obtain supply of water from land drainage. Consume yearly 150,000,000 gallons; and produce waste liquid from washing 130,000,000, bleaching 5,000,000, printing 5,000,000, dyeing 5,000,000, and soapsuds 5,000,000. The whole of this waste liquid (except dye liquor, which is filtered,) flows into sewers, and thence into river. We use, as dye wares, madders 600,000 lbs. yearly. Convert the spent madder into garancine, which we use again, and then discharge into river. Use as bleaching materials annually: soda-ash 24 tons, lime 30 tons, hydrochloric acid 100 tons, resin 5 tons, chlorine liquor 30 tons, and soap 50,000 lbs. per annum. Do not treat the suds for the recovery of grease. Use steam, 100 nominal horse-power. Consume 6,000 tons of coal. Make 450 tons of ashes per annum, which are used for repairing roads. Excrements of workpeople used on land for agricultural purposes. Have no suggestions to offer.
Jno. and Thos. B. Crompton, Papermakers.	Farnworth Paper Mills, Bolton-le-Moors.	Our works are situated on the *Croal*, a tributary of the *Irwell*. Employ 149 hands. Rateable value of works, 1,350*l*. We recollect this river since 1835, and the bed has very little altered. In droughty weather it silts up. Floods afterwards scour and remove the silt. There is a weir just above, and one half a mile below our mills, so that all the silt passes from us to a lower part of the river. The river is polluted by almost every kind of manufacture above us; but the most injurious pollution is the sewage from the town of Bolton, all of which is turned into the river, and the stench in summer time and dry weather is most sickening and unhealthy. The house adjoining the mills, rated at 70*l*., has not been habitable from the above nuisance for more than 10 years. The river is not injuriously polluted by mines. We obtain supply of water jointly from river, from *Darley brook*, and from the coal pits of Knowles and Sons. Consume yearly 122,000,000 gallons. Colourless water is not so important to us as water free from sewage and organic matter in solution. This river (Croal) is saturated with organic matter in solution. Colouring matter can be removed by filtration easily. Our loss is in decomposing the sewage, and we know of no perfect way of doing this, but have to content ourselves with the nearest approach to it. We use yearly: rags 26,195 cwts., esparto and straw 5,111, soda-ash and caustic soda 1,703, bleaching liquor 1,398, alum 2,737, lime 2,927, brown oil of vitriol 2,527, salt 1,628, manganese 814, and soap 2 cwts. The whole of the waste liquid produced flows unfiltered direct into river. We only filter the water we take out of the river to make it fit for our own use.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Jno. & Thos. B. Crompton, Paper-makers—*cont.*	Farnworth Paper Mills, Bolton-le-Moors.	We produce: white paper 1,239,956 lbs.; other papers, that is, cartridge, drabs, coloured paper, and brown 998,522 lbs.; total 2,238,478 lbs. per annum. The rag dust is taken away by the farmers as produced. We use steam power, 203 nominal horse-power. Water 75 horse-power. Consume 8,405 tons of coal. Make about 1,000 tons of ashes, which we use as required for repairing roads, and put the remainder into river. The excrements of workpeople are put into river. We suggest that as the chief pollution is sewage this should be kept out of rivers and streams; the millowners would then watch one another, and so prevent undue pollution.
William Walker & Sons Tanners.	Rose Hill and Bark Street, Bolton-le-Moors.	Our tanyards are situated on the *Croal* and *Jenny Beck*, tributaries of the *Irwell*. Employ 120 hands. Rateable value of tanyards 520*l*. They are not affected by floods. Paving the bed of the river through the town has (especially the *Croal*) improved the condition of the streams. They are both polluted by works above. We obtain supply of water jointly from corporation waterworks and from wells. Consume yearly 1,600,000 gallons. Use yearly: lime 100 tons, bark 1,000, valonia 120, sumach 5, gambir 150, divi divi 40, tallow 60, oil 80, and resin 5 tons, also 624 buckets of pigeons' dung. Obtain yearly 800 packs, of 240 lbs. each, of hair in "depilation," and 100 tons of "fleshings," the former is dried and sold to plasterers, and the latter is sent while fresh to the size and grease manufacturers. We have 320 tanpits, average 6 ft. by 5 ft. by 5 ft. Produce 1,000,000 gallons of liquid waste, which flows into a settling tank, and thence into river. Consume 6,000 tons of coal, and make about 40 tons of bark ash yearly, which is sold for manure. The excrements of workpeople are removed from privies by men employed by the corporation. We have no suggestions to offer.
T. G. Horridge, Bleacher.	Great Lever and Tonge-with-Haulgh.	Our works are situated on the *Croal*, which flows into the *Irwell*. Employ 120 hands. Rateable value of the works 609*l*. The bed of the river has not silted up near our works. The works are not affected by floods. 60 years ago the river was a trout stream, and the water (except in flood) was clear and colourless, now it is polluted from many sources, the chief of which is the refuse and sewage from the town of Bolton; the stench from the river in dry weather is horrible. We obtain supply of water from a gathering ground above the works, of 500 acres, collected in an impounding reservoir. Use the river water for power only. Consume yearly about 112,000,000 gallons. Produce liquid refuse annually 54,000,000, which flows unfiltered into river. Use as bleaching materials: soda-ash 10 tons, chloride of lime 13, and oil of vitriol 10 tons yearly, also 4 cwt. of soap. Use steam, 100 nominal horse-power, water 16 horse-power. Consume 3,650 tons of coal, the ashes from which are used for making roads. Excrements of workpeople go into river. No suggestions to offer.
John Emmet & Co., Paper-makers.	Springfield Works, Haulgh, Bolton-le-Moors.	Our mills are situated on the *Croal*, a tributary of the *Irwell*. Employ 120 hands. Rateable value of mill 625*l*. The bed of the river had silted up caused by throwing in of cinders, dirt, and refuse, but this does not now (since the bed has been paved and an invert formed) affect the river. The mill is not affected by flood. Before reaching our mill the river flows through the town of Bolton and is the sole receptacle of its sewage and other refuse; being in point of fact an open sewer. The condition of the river has been for many years increasingly foul and unhealthy, but since the year 1863, when the bed of the river northward of our mill was paved on the invert system, the bed has been cleaner and less offensive. All the sewage and other refuse being conveyed directly into our mill goit and reservoirs, there giving off noxious gases and rendering the water at times quite unfit for the purposes of trade. In addition to the pollution by sewage the river is largely polluted by refuse from works and mines situated above our mill. We obtain supply of water chiefly from the *Croal* by means of a weir and goit, a small proportion from springs on our own land, and occasionally small quantities by purchase from the Earl of Bradford. Consume yearly 150,000,000 gallons. We have had to discontinue the use of the water as power on account of the dreadful stench created by the stirring up of the sewage in passing over the wheel, but if the river from which we might derive our supply be rendered clear and colourless the gain to us would be considerable. We use yearly flax and cotton, waste ropes 17,000 cwts., rags 626, esparto 317, soda-ash 295, bleaching solution 5,740, alum 1,410, lime 2,687, antichlor 11, vitriol 108, and

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John Emmett & Co., Paper-makers—*cont.*	Springfield Works, Haulgh, Bolton-le-Moors.	soap 5 cwt. The large quantity of bleaching agents are necessary to counteract the effect of the sewage water. We make about 50,000,000 gallons of liquid waste more or less polluted, this flows unfiltered direct into the river. We produce yearly white and coloured printing paper 50 tons, and wrapping and packing papers 550 tons. The rag dust and waste produced is mixed with spent lime and soda-ash and is carted away for agricultural purposes. Use steam now exclusively, 135 nominal horse-power. Consume 6,000 tons of coal, make about 1,200 tons of ashes which are carted on to spare land of our own below the works. Excrements of workpeople conveyed into river. We suggest that sewage and other offensive matters be prevented from flowing into rivers and streams, and that a system of inspection of river basins be adopted that will fairly deal with vested rights, and at the same time prevent rivers and streams being made (as in the case of the *Croal*) common sewers, and we submit that the circumstances of the Springfield paper-works are different from any others in the neighbourhood, and are probably somewhat exceptional. By reason of the position of the Weir and Goit supplying us with water, and the increased population of the town of Bolton coupled with the very great sanitary improvements effected within the last 20 years by the local authorities, our goit and reservoirs have become gradually the settling and holding tanks of the town-sewage, to the great inconvenience and loss of ourselves and predecessors. This has for some time been the source of constant negociation and threats of litigation with the Bolton corporation, and at the time of the death of our predecessor, Mr. E. P. Holden in November 1867, we understand legal proceedings were on the point of being commenced against the corporation. We have delayed so far instituting any such in the hope that the investigation by the Rivers Pollution Commission might lead to an alteration of the law, and also by the fact that the nuisances at our works and which so seriously affect us, gave rise to an aplication by residents near to the locality, to the Home Secretary for an inquiry into the state of the works, goit and reservoirs, and for some order to be made on the corporation compelling them to exercise their power as the Local Board of Health. In consequence of this memorial Arnold Taylor, Esq., one of the inspectors of the Local Government Act Office, held an inquiry at Bolton in the month of August 1868, which appears to us to bear so directly on the question that we take the liberty of annexing hereto extracts from the *report of Arnold Taylor, Esq., to the Right Hon. the Home Secretary, dated the 17th December* 1868. Conclusions. "1st. That the river *Croal* is practically the main sewer of Bolton "and that its further use for such purpose is a nuisance and an evil to "the inhabitants of the borough at large, and an undoubted injury to "the Springfield Works and the three other mills and works lower "down the river, which are shown on the accompanying plan. 2nd. "That the town council of Bolton, which is the responsible local and "sewer authority for the remedy of this evil, has had in its possession "since February 4th, 1867, a plan, report, and estimate, drawn up by "Mr. Baylis, the borough engineer, under the instructions of the town "council, by which it appears that the sewage of Bolton can be "entirely abstracted from the river within the borough boundary for "an estimated cost of about 14,000*l*. 3rd. That the natural flow "of water in the river *Croal* is so foul and polluted by its use for "manufacturing and trade purposes, that even the abstraction of the "sewage will not restore the river water to a state of purity, though it "will be thereby rendered comparatively wholesome and innocuous. "4th. That the Bolton sewage, even when abstracted from the river in "its passage through the borough, must, as a temporary expedient, be "sent back into the *Croal* at a point outside the borough boundary. "But it may fairly be concluded, that in the time which the construc-"tion of a main intercepting sewer must occupy, further legislation for "the disposal of town sewage will have made it compulsory instead of "permissive on all sewer authorities to unite and combine for the pur-"poses of main outfall and sewage distribution works. Whenever "this is done, the town council of Bolton will be enabled to join the "sewer authorities round about in some comprehensive scheme for "utilizing town sewage instead of pouring it into and poisoning the "water course of the district. "The recommendations I desire to submit for your consideration "are:— "1st. That the town council of Bolton be required under the com-

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John Emmett & Co., Paper-makers — *cont.*	Springfield Works, Haulgh, Bolton-le-Moors.	"pulsory powers conferred upon you by the Sanitary and Sewage "Acts, within a period of two months from the date of your order, to "carry out the scheme proposed by Mr. Baylis, their borough engineer, "or some other equally considered plan, for the construction of a main "intercepting sewer by which all the town sewage may be kept out of "the river *Croal*, seeing that this important work can be done at a "cost of about 14,000*l.*, which sum, if borrowed by the town council "under the provisions of the Local Government Act, can be repaid "with interest in 30 years for the charge of 1*d.* in the pound on the "rateable value of the borough." We believe (January 20, 1869) that no order has yet been issued by the Home Secretary based on this report, and that the town council of Bolton are extremely unwilling to carry it out in the effective manner there proposed. We must also state that in any such works care will have to be taken not to abstract from the river any important proportion of the flow of surface and rain water into it, which is absolutely necessary for the carrying on of our works.
William Haslam, Alkali Manufacturer.	Burnden, near Bolton-le-Moors.	I employ 70 hands. Rateable value of works 660*l.* Obtain supply of water from springs on my own land. Consume yearly, 500,000 gallons. Use and produce common salt: 1,200 tons, sulphur 1,300, pyrites 550, lime 700, oxide of manganese 190, alkali or black ash 30, and nitrate of soda 140 tons; condense for use 630,000 gallons of acid, 130 to 180 degrees Twad. Do not know the volume of acid condensed and run to waste. I have three towers for condensing sulphuric acid; heights, 29 ft., 19 ft. 9 in., and 18 ft.; widths, 10 ft., 9 ft., and 5 ft. 2 in.; four towers for condensing muriatic acid 63 ft. high, 6 ft. by 3 ft. 6 in. Produce at the works 120,000 gallons of liquid refuse, which flows into depositing tank, and thence into sewers. Use steam, horse-power. Consume 5,600 tons of coal, the ashes from which are carted away to fill up hollows where required. Excrements of workpeople are removed by men employed by corporation. No suggestions to offer.
Slater & Company, Bleachers and Finishers.	Little Bolton Bleach Works, Bolton-le-Moors.	Our works are situate on the *Eagley brook*, which flows into the *Irwell*. Employ 120 hands. Rateable value of works 1,012*l.* The bed of the brook has within the last 20 years silted up at least 3 feet caused by cinders and rubbish thrown into it. My works not affected by floods, as the buildings have been gradually raised at nearly all points. The bed of the brook on Sundays in summer is perfectly dry: this was not the case formerly; the brook had then a gravelly bed, it is now principally cinders, and sluices and wall stones, that were then visible, are now buried in the silt. The brook is much polluted by works above. Obtain supply of water jointly from stream, wells, and waterworks. The volume consumed varies. The waste liquid produced flows unfiltered into the brook. Use yearly as bleaching materials: lime about 93,200 lbs., soda-ash about 157,250, liquid chemical about 698,880, and vitriol about 166,400 lbs. Use steam 150 nominal horse-power. Consume 5,620 tons of coal, make about 400 tons of ashes, some of which are thrown into the stream, and the remainder are deposited in heaps. The excrements of workpeople are removed in part by men employed by the corporation of Bolton, and the other part used as manure on our own land. No suggestions to offer.
Henry Ashworth & Sons, Cotton Spinners and Weavers.	Turton and Little Bolton, Lancashire.	Our works are situate on the *Eagley brook*, which flows into the *Irwell*. Employ 754 hands. Rateable value of works 738*l.* 10*s.* The bed of the brook has not silted up near our works. It is greatly polluted by refuse from dye, bleach, and paper works. Fish cannot live in it. We obtain water from the stream and use for power and condensing purposes only for steam boilers. We should prefer clean water free from lime or acids. The liquid refuse we produce is of small volume; this flows unfiltered into the *brook*. We use steam and water, 150 horse-power. Consume 2,000 tons of coals, the ashes from which are cast into the *brook*, and the remainder used in repairing roads. The excrements of workpeople are carted away as manure. We suggest that those who use lime and strong acids should be compelled to keep their refuse out of the rivers and streams, and that proper conservancy of rivers be established.
James Chadwick & Brothers, Manufacturers, Bleachers, and Dyers.	Eagely Mills, near Bolton-le-Moors.	Our works are situate on the *Eagley*, which flows into the *Irwell*. Employ 820 hands. Rateable value of the works 973*l.* The bed of the stream has silted up owing to the erection of weirs. The works are affected by floods. The river is much more polluted by refuse than

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James Chadwick & Brothers, Manufacturers, Bleachers, and Dyers—*cont.*	Eagley Mills, near Bolton-le-Moors.	formerly, and in summer time it stinks, and is consequently unhealthy. We obtain supply of water jointly from Belmont reservoir, from streams, and from wells. If the river were clear and colourless, from which we might derive our supply, it would be of money value to us of 1,000*l.* per annum. We produce liquid refuse from washing 20,000,000, bleaching 20,000,000, dyeing 2,000,000, and soapsuds 20,000 gallons yearly, the whole of which flows unfiltered into river. We use yearly as dye-wares, logwood 83,000, fustic 33,600, sumach 12,000, barwood 17,000, peachwood 9,000, aniline dyes 100, copperas 30,000, acetate 3,360, safflower 1,000, alum 7,000, and acids 2,000 lbs. Use, as bleaching materials, bleaching powder 74,000, soda-ash 60,000, soda-crystals 9,408, oil of vitriol 39,424, flour 20,000, farina 6,000, and blue 100 lbs. Also soap 12 tons, but do not treat the suds for the recovery of grease. Use steam, 100 nominal horse-power. Water, 40 horse-power. Consume 4,430 tons of coal. Make 312 tons of ashes, which are used for repairing roads and levelling land. The excrements of workpeople are used, part on land and part thrown into river. No suggestions to offer.
Charles Turner & Company, Paper Manufacturers.	Spring Side Paper Works, Sharples, near Bolton.	Our mill is situate on the *Eagley*, which flows into the *Irwell*. Employ 60 hands. Rateable value of works 420*l.* The bed of the stream has not silted up near our mill. The stream is not polluted by printworks above, as at the present time they are not at work. We obtain supply of water from river for power only, and from springs for trade purposes. Use annually, rags, &c. 12,840 cwts., esparto 1,200, alum 480, lime 1,500, vitriol 250, salt 500, and manganese 250 cwts. The waste liquid produced flows unfiltered through sewers into river. We produce yearly 468 tons of merchant papers. The rag dust or waste used as manure. Use steam, 80 nominal horse-power. Water 25 horse-power. Consume 3,000 tons of coal, the ashes from which are used on land to level up hollows. Excrements of workpeople used as manure.
Robert Walker, Calico Printer.	Quarlton Vale, near Bolton.	My works are situated on a tributary of *Bradshaw brook*, which flows into the *Irwell*. Employ 200 hands. Rateable value of works 398*l.* The bed of the stream has not silted up. Works are not affected by floods. The stream is not polluted by works above mine. Obtain supply of water from stream and from springs. Consume yearly 150,000,000 gallons. The waste liquid produced flows unfiltered (except that from dyeing) direct into the river. Use as dye wares, madder, or preparations of it; as much as possible of waste caught and re-made. Use yearly as bleaching materials, lime, soda-ash, chemical and muriatic acid about 40 tons; also soap 8 tons, the suds not treated for the recovery of grease. Use steam, 80 nominal horse-power. Consume 3,500 tons of coal; make about 800 tons of ashes, which are carted away for repairs to roads. Excrements of workpeople are mixed with earth and used as manure for grass land. No suggestions to offer.
Edward C. Deakin, Bleacher and Dyer.	Egerton, near Bolton-le-Moors.	My works are situated on the *Longworth brook*, a tributary of the *Irwell*. Employ 51 hands. Rateable value of works 198*l.* The stream is polluted by works above. Obtain supply of water from the brook and springs. The waste liquid produced flows unfiltered into the brook. The spent dye stuffs are burnt. Use steam, 12 horse-power. Consume 400 tons of coal, the ashes from which are carted on to the roads. Excrement of workpeople are thrown into brook.
Thomas Wrigley & Sons, Paper Manufacturers.	Bridge Hall Mills, near Bury, Lancashire.	Our mills are situate on the river *Roach*, a tributary of the *Irwell*. Employ 700 hands. The bed of the river above the weir opposite our works has silted up very much. The mills are not affected by floods. Within our knowledge the river was a pure stream, well stocked with trout and other fish; now it is impossible for fish to live in it. The river is polluted by works, but this form of pollution is comparatively corrected by depositions. The pollution we most suffer from is sewage, which during dry weather is most offensive to the smell, although the water is comparatively clear. We obtain the principal portion of our supply of water from the river, but we have a small supply of impounded water independent of the river. We consume in washing and bleaching about 1,000 gallons per minute. We have to filter the water before using it, the cost of which is many hundred pounds a year, and, however much the river were improved, we should still require filters, but they would last much longer than at present. We use per week 175 tons of rags and esparto, 16 tons of soda-ash, 15 tons of bleaching powder, 6 tons of alum, 10 tons of lime, and very small quantities of antichlor, vitriol, sulphate of alumina, pearl-ash, salt, manganese, and

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Thomas Wrigley & Sons, Paper Manufacturers—*cont.*	Bridge Hall Mills, near Bury, Lancashire.	soap. The whole of the liquid refuse produced flows unfiltered into the river, except that portion of the waste lye we evaporate to recover the soda. We manufacture newspaper and general printing paper. The rag dust and waste produced is used as manure. Use both steam and water, from 400 to 500 horse-power. Consume from 300 to 350 tons of coal weekly. We have great difficulty in getting rid of the ashes; they are cast into the river during floods. Excrements of workpeople are used as manure. Clear and pure water in the river is to us a matter of great importance, and to a certain extent much good may be done in this direction; but any attempt to exclude manufacturing refuse from the rivers would, in our opinion, fail altogether. It would if enforced close a great number of manufacturing establishments, our own among the number. The quantity of water necessary to cleansing of filthy rags could not be impounded or filtered. The waste from chemicals, such as soda, alum, bleaching powder, tends greatly to correct the impurities that are in solution, and in a sanitary view are absolutely beneficial; they assist the deposit of matters in suspension also, and so long as the sewage of towns is allowed to go into rivers without more correctives the stream in hot and dry weather would become pestilential. The only suggestions that we can offer is that sewage should be impounded, and discharged into rivers and sewers during a flood or at the end of a week if the impounding space is insufficient to wait for a flood; that dyes and colouring matters should be impounded in a similar manner. As to cinders, if allowed to be thrown into the rivers and streams at all, should only be done at a time of high flood.
E. Buckley & Company, Bleachers, Dyers, and Finishers.	Hampson Mills, near Bury, Lancashire.	Our works are situate on the *Roach*, a tributary of the *Irwell*. Employ 300 hands. Rateable value of works 1,300*l*. The bed has silted up. The works are affected in heavy floods. The river is polluted by refuse from dye, bleach, paper, woollen and other mills, and by town sewage of Bury. Obtain supply of water jointly from river and wells. The consumption is very great, but cannot give the volume. If the river were rendered clear and colourless it would be of considerable money value to us. The whole of the waste liquid produced flows unfiltered into river. Use as dye-wares, logwood and fustic. The spent stuffs are carted away. Use as bleaching materials soda-ash, chloride of lime, sulphuric and muriatic acid. Use steam, 257 nominal horse-power; water, 60 horse-power. Consume 10,000 tons of coal, the ashes from which are carted away and used for building purposes, and to fill up hollows. Excrements of workpeople used as manure. No suggestions to offer.
Edward Ashworth & Co., Woollen Manufacturers.	Cowpe, Waterfoot, near Manchester.	Our works are situated on a tributary of the *Irwell*. Employ 140 hands. Rateable value, 540*l*. The bed of the river has not silted up. Works not affected by floods. The stream is not polluted by works above. Obtain supply of water from stream. Consume 14,000,000 gallons yearly. Produce liquid refuse: from washing 2,500,000, printing 4,000, dyeing 1,500,000, and soapsuds 500,000 gallons yearly. The whole of this waste liquid flows unfiltered into brook. We use as dye-wares lac dye, cochineal, dyewoods, oxalic acid, and cudbear, 58,600 lbs. annually. Part of the spent dye-stuffs are cast into river; the remainder is used as manure. Use 24,000 lbs. of soap. The suds are not treated for the recovery of grease. Use steam, 65 nominal horse-power. Consume 1,500 tons of coal. Make 100 tons of ashes, which are used for repairing roads. The excrement of workpeople are collected in tanks and used as manure.
Taylor & Ormerod, Woollen Printers.	Waterfoot, nr. Manchester.	Our works are situate on the *Cowpe brook*. Employ 90 hands, Rateable value of works 111*l*. The bed of the stream has not silted up. Works not affected by floods. The stream is polluted by refuse from dye and print works above. Obtain supply of water jointly from the *Cowpe brook* and a well. The waste liquid flows unfiltered direct into the river *Irwell*. Use as dye-wares: annatto, fustic chips, oxalic and other acids, pipe-clay, archill, indigo, and cochineal, 304,800 lbs. yearly. The spent dye-stuffs are cast into the *Irwell*. Use steam, 10 nominal horse-power. Consume 780 tons of coal, the ashes from which are thrown into the *Irwell*. Excrements of workpeople used as manure on our farm. No suggestions to offer.
Stott & Smith, Fulling Millers.	Cams Mill, Helmshore, near Manchester.	Our works are situated on the *Swinnel brook*, which flows into the *Irwell*. Employ 28 hands. Rateable value of the works 253*l*. 2*s*. 6*d*. The bed of the stream has partially silted up, caused by refuse being put into it. Works not affected by floods. The stream is polluted by

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Stott & Smith, Fulling Millers—*cont.*	Cams Mill, Helmshore, near Manchester.	refuse from dye, print, bleach, and gas works above. Obtain supply of water from river and springs. The waste liquor produced flows into the tail goit, and thence into reservoir at the Helmshore works. We use indigo, about 95 lbs. per annum. The dyes are sold to a dyer, and taken off the premises. Use as bleaching materials: soda crystals 34,944 lbs., brimstone 26,880 lbs.; cannot give the volume of liquid. Use 18,720 lbs. of curd soap. The suds are treated for the recovery of grease. Use steam, 12 nominal horse-power. Consume coal, 305 tons, the ashes from which are used to repair roads, paths, and tenter grounds. Excrements of workpeople are mixed with soil and put on land. No suggestions to offer.
S. B. Ingham & Brothers, Paper Manufacturers.	Shuttleworth Paper Mills, near Bury, Lancashire.	Our mill is situate on the *Shuttleworth brook*, which flows into the *Irwell* half a mile distant. Employ 38 hands. The bed of the brook has not silted up. The works are not affected by floods. The brook is polluted by works above. Obtain supply of water from the brook. Cannot give the quantity used, but abstract at times, the entire volume of the brook. Use annually: rags 500 tons, soda-ash 10, bleaching powder 20, alum 50, and lime 50 tons, also vitriol 30 carboys. The whole of the waste liquid produced flows unfiltered into the brook. We manufacture 450 tons of brown papers annually. The rag dust is used for manure. Use steam, 50 nominal horse-power. Consume 2,000 tons of coal, the ashes from which are used for repairing roads. Excrements of workpeople are partly cast into brook and part used as manure. We suggest that ashes and all solid refuse be kept out of rivers and streams.
Olive, Brothers, & Partington, Paper Manufacturers.	Woolfold, near Bury, Lancashire.	Our mill is situate on the *Woodhill brook*, a tributary of the *Irwell*. Employ 150 hands. Rateable value 1,093*l*. The bed of the brook has not silted up. The works are not affected by floods. The brook is very much polluted by print, bleach, dye, and other works above. There is not much difference in the condition of it during the past five years. Obtain supply of water for condensing only from brook; for paper making, from wells. Consume 87,600,000 gallons yearly. If we had not formed settling reservoirs, a clear stream would have been worth to us 180*l*. a year. We use yearly: rags 10,000 cwts., esparto 18,000, soda-ash 3,100, bleaching powder 2,950, alum 1,440, lime 4,000, antichlor 150, and soap 1 cwt. Produce liquid refuse about 40,000,000, which flows unfiltered into the brook. Make white and coloured printing cartridge papers 26,400 cwts. yearly, about half coloured and the other half not coloured. Produce 800 cwts. of rag dust, which we use as manure. Use steam, 150 nominal horse-power. Consume 5,000 tons of coal. Make about 230 tons of ashes, which we cart on to our own land. The excrements of workpeople are mixed with rag dust and used as manure. We suggest that there should be a division wall down the centre of each river or stream, and one half of the river course should be retained for polluted water and the other half for clean, so that clean water might be abstracted from the pure side and foul water turned into the polluted side.
Joseph Porritt & Sons, Woollen Manufacturers.	Sunnybank Mill, Helmshore.	Our mill is situated on the *Alden brook*. Employ 11 hands. Rateable value of mill 310*l*. The bed of the brook has silted up, caused by the refuse thrown in from a stone quarry above our works. Mill not affected by floods. We derive supply of water from the brook. Consume yearly 1,560,000 gallons. Produce 6,000 gallons of liquid waste from soapsuds. The liquid waste from washing and scouring flows through sawdust filters into settling ponds, and from thence the top water flows into stream. The deposit is taken out once a year, at Midsummer. We use four tons of soap. The suds are not treated for the recovery of grease. We also use steam, 15 nominal horse-power. Consume 240 tons of coal. Make about 30 tons of ashes, which are used in making of mortar and for repairing roads. Excrements of workpeople used as manure to land. Whenever there is a fresh in the stream known as river *Ogden* hundreds of gallons of gas tar are wilfully poured into it and flow down into the *Irwell*. The tributary known as *Alden brook* up to within a very recent period was polluted with gas tar. By threatening legal proceedings against the offenders (the occupiers of the mills above us) the nuisance has been abated.
Porritt, Brothers, & Austin, Woollen, Cotton, and Linen Manufacturer.	Stubbins' Vale, near Ramsbottom.	Our mill is situated on the *Irwell*. Employ 320 hands. Rateable value of mill 748*l*. The bed of the river has silted up, caused by weirs forming dams to keep up head of water for other works. Our works are slightly affected by heavy floods. The river is polluted by works above. Obtain supply of water from *Buckden brook*, and in drought

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Porritt, Brothers, & Austin, Woollen, Cotton, and Linen Manufacturers—*cont.*	Stubbins' Vale near Ramsbottom.	from a well. The whole of the waste liquid produced flows partially filtered into the *Irwell*. Do not dye at present, but intend doing so as soon as our arrangements are complete. Use sulphur in bleaching which is burnt. Use 12 tons of soap, the suds are not treated for the recovery of grease. Also use steam, 70 nominal horse-power. Consume 2,000 tons of coal, the ashes from which are used to repair roads. The excrements of workpeople are used as manure.
Thomas Oram and Sons, Woollen Manufacturers.	Simpson Clough Heap, near Rochdale.	Our works are situated on the *Bamford brook*, tributary of the *Irwell*. Employ 140 hands. Rateable value of works 306*l.* 17*s.* The bed has not, within our knowledge, silted up. Works not affected by floods. The stream is polluted by works above, principally by soap-suds. Obtain supply of water from stream for power, and from springs for finishing purposes. The whole of the waste liquid flows into settling tanks and thence into river. Use as bleaching materials, soda, urine, pig dung, also 8 to 10 tons of soap yearly, the suds are treated for the recovery of grease. Use steam and water, 28 nominal horse-power. Consume 1,000 to 1,200 tons of coal, the ashes from which are used to repair roads. Excrements of workpeople are cast into stream. No suggestions to offer.
Edward Mucklow, Garancine, Dye Extract Manufacturer, and Dyewood Mills.	Elton Fold Works and Leemans Hill Mills, Bury, Lancashire.	My works are situated on the junction of *Elton* and *Bolholt brooks*, tributaries of the *Irwell*. Rateable value of works 1,250*l.* The beds of the brooks have silted up considerably, and lodges and parts of the brooks not arched over have frequently to be cleaned out. The silt is caused chiefly by the spent dye-woods from dye and print works and cinders thrown in from the various works. This is every way detrimental to rivers and streams, and ought to be prevented by legislative enactments. Works are affected by floods; they were once washed away by the bursting of a large reservoir above. *Elton* and *Bolholt brooks* are polluted. They were formerly much purer, but now, owing to the refuse from bleach and dye-works poured in, they are known by the name of the *Blackwater brooks*. We obtain supply of water from the *brooks* for condensing purposes only; and from a coal-pit and land springs for domestic and trade purposes. Have also had large supply of water from the Bury and Radcliffe W. Works Company. Consume yearly about 5,000,000 gallons. If the river were rendered clear and colourless, from which I might derive supply of water, it would be worth in money value to me of from 150*l.* to 200*l.* per annum. Produce liquid refuse from garancine washing 1,200,000 gallons. This waste liquid flows through flannel filters, and thence into the *brook*. We do not use dye-stuffs but for extracting purposes, and all spent woods are burnt under furnaces. Use steam, 180 to 200 nominal horse-power. Consume about 6,000 tons of coal, the ashes from which are carted away to different places. Excrements of workpeople mixed with sifted ashes and used as manure. I would respectfully suggest that legislative measures be enacted to prevent pollution of rivers by ashes, dye-woods, and other solid and liquid refuse; and that the river basins be placed under proper inspection, public prosecutors appointed, and on conviction penalties strictly enforced.
James R. Crompton, Paper Manufacturer.	Eton Paper Mills, Bury.	My mill is situated on the *Irwell*. Employ 118 hands. Rateable value 884*l.* The mill is not affected by floods. I note little difference in the condition of the river at this point during my 10 years' experience of it. It is very much polluted. I obtain supply of water from the river, springs, and gathering grounds. Consume probably, 800,000 gallons per day; if the river, from which I might derive supply were rendered clear and colourless, it would be of money value to me of from 400*l.* to 500*l.* per year. I use annually: rags 2,000 tons, soda-ash 30, bleaching liquor 100, alum 50, lime 120, vitriol 150, salt 80, and manganese 50 tons. Produce, yearly, 500 tons of tissue, 150 tons of cartridge, 150 tons of various, and 200 tons of wrapper paper. Make 50 tons of rag dust, which is carted away by farmers for manure. Use steam, 200 nominal horse-power. Consume 9,000 tons of coal, and make 780 tons of ashes, yearly, which are taken away by boat to repair towing path of canal. Excrements of workpeople are cast into river.
Matthew Peel, Tanner.	School Brow, Bury, Lancashire.	My tanyard is situated on a small brook which flows into the *Irwell*. Employ 16 hands. Rateable value of the tanyard 136*l.* Not affected by floods, the brook being so much polluted by sewage is very offensive. The Bury Improvement Commissioners have caused it to be arched over. Obtain supply of water from wells. Use annually: lime 26 tons, bark 300 tons, valonia 40 tons, and unknown quantity of

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Matthew Peel, Tanner—*cont.*	School Brow, Bury, Lancashire.	pigeons' dung; the hair and fatty matters obtained in "depilation" and "fleshing" sold to plasterers and size boilers. I have 200 tanpits, 6 ft. by 4 ft. by 5 ft. Do not dye. The waste liquid produced flows unfiltered into brook. Use steam, 6 horse-power. Consume 150 tons of coal, the ashes from which are used to repair roads. No suggestions to offer.
Richard Bealey & Co., Bleachers, and Manufacturing Chemists.	Radcliffe Close, Radcliffe.	Our works are situated on the *Irwell*. Employ 330 hands. Rateable value of the works 2,222*l.* 8*s.* The bed of the river is 3 ft. 6 in. lower than it was in 1808. (*See Mr. Bealey's evidence before a Committee of the House of Commons on the Mersey and Irwell Protection Bill*, 1862.) Works not affected by floods. The river is very much polluted. Obtain supply of water jointly from river and wells. It is almost impossible to ascertain the volume consumed. Produce liquid waste from bleaching 366,000 gallons, annually. Cannot state quantity from washing and soap-suds. The whole flows unfiltered by open watercourses into river. Do not use dye-stuffs. Use as bleaching materials, carbonate of soda, chloride of lime, and sulphuric acid, approximately, 2,020,545 lbs. liquid, 484,000 lbs. solid. The soap-suds not treated for the recovery of grease. Use steam and water, 330 horse-power, the water supply as power is irregular. Consume 16,600 tons of coal, the ashes from which are carted to the railway and used as ballast. The excrements of workpeople are partly used as manure, and partly cast into river. No suggestions to offer.
Mugliston, Whittaker & Company, Bleachers and Finishers.	Mount Zion, Radcliffe.	Our works are situated on the *Irwell*. Employ 240 hands. Rateable value of works 1,000*l.* The bed of the river has silted up, caused by refuse thrown in from alkali, dye and paper works. Works are affected by floods. *The river is polluted to a very considerable extent, which is quite avoidable.* Obtain supply of water from the river only. Consume annually 120,000,000 gallons. If the river were clear and colourless it would be of money value to us of from 400*l.* to 500*l.* a year. Produce liquid waste 120,000,000 gallons annually, which flows unfiltered into the river. Use, as bleaching material, chlorine liquor. Use steam, 40 nominal horse-power. Consume 5,000 tons of coal, the ashes from which are put upon roads and waste land. The excrements of workpeople are used as manure. We suggest that manufacturers and traders should be compelled to keep all solid refuse out of rivers and streams.
Horridge & Cornall, Calico Printers.	Mount Zion, Radcliffe.	Our works are situated on the *Irwell*. Employ 80 hands. Rateable value 310*l.* The river has not silted up near our works. Works not affected by floods. The river is polluted by works and towns above to a very great extent. Obtain supply of water principally from river and part from land drainage. Do not know the volume of water consumed or of the waste liquid produced, which latter flows into settling tanks and thence into river. Use 15,400 lbs. of indigo annually, and as bleaching materials, lime three tons, and soda-ash three tons. Use steam, 30 nominal horse-power. Consume 960 tons of coal, the ashes from which are used in repairing roads. Excrements of workpeople are used on land. We are of opinion that the chemical works above us does the most damage to the river.
T. R. Bridson & Sons, Bleachers of Cotton Cloths.	Bolton-le-Moors.	Our works are situated on the *Croal*, which flows into the *Irwell*. Employ 214 hands. Rateable value 1,303*l.* The stream is greatly polluted by reason mainly of the impurities from works, mines, and sewage thrown into it; it is used as a common sewer. Our works are occasionally flooded. Thirty years ago the stream was clear and pellucid, containing trout and other fish. We obtain supply of water jointly from river and wells. Consume 100,000,000 gallons annually. If the river, from whence we might derive our supply, were rendered clear and colourless it would be of money value to us of not less than 500*l.* a year. Produce liquid refuse from bleaching 144,000 gallons annually; this flows unfiltered direct into river. Use as bleaching materials, annually, chloride of lime, soda-ash, sulphuric acid, and lime 143,448 lbs. liquid, 294,547 lbs. solid. Use steam, 211 nominal horse-power. Consume 7,030 tons of coal. Make 1,300 tons of ashes, which are used in filling up inequalities of land. The excrements of workpeople are conveyed by sewers into river. No suggestions to offer.
T. R. Bridson and Sons, Bleachers of Cotton Cloth.	Little Lever, near Bolton-le-Moors.	Our works are situate on the *Irwell*. Employ 210 hands. Rateable value of works 960*l.* The river is very much polluted by works, mines, and town sewage, its condition has entirely changed; it is thirty years

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
T. R. Bridson and Sons, Bleachers of Cotton Cloth — *cont.*	Little Lever, near Bolton-le-Moors.	since the water was fit for our business purposes without filtering. We obtain supply of water from a gathering ground of 400 acres, collected into impounding reservoirs, and consume 104,000,000 gallons annually, if the river from which we might derive our supply were clear and colourless it would be of money value to us of at least 800*l.* a year. Produce liquid waste from bleaching, 156,000 gallons a year, which flows unfiltered into river. Use as bleaching materials, annually, chloride of lime, soda-ash, sulphuric acid, muriatic acid, and lime, 139,000 lbs. liquid, and 321,000 lbs. solid, also an inappreciable quantity of soap. Use as steam, 130 nominal horse-power; and water, 86 horse-power. Consume 6,180 tons of coal. Make 1,150 tons of ashes, part used to make mortar, but the chief portion used to repair roads. Excrements of workpeople collected in tanks and used as manure. We are of opinion that a vast proportion of the polluting substances and the whole of the solid excreta might be kept out of rivers and streams.
William Broadbent and Sons, Paper Manufacturers.	Cream Paper Works, Little Lever, near Bolton-le-Moors.	Our mill is situate on the *Irwell*. Employ 80 hands. Rateable value of mill 610*l.* 15*s.* Mill is affected by floods. The river is so much polluted that at times it is impossible to be worse. Obtain our supply of water from it. The whole of the waste liquid produced flows unfiltered into river. Produce brown, grocers, and other papers about 1,100 tons annually. The rag dust is used as manure. Use steam, 200 nominal horse-power. Consume 5,150 tons of coal, the ashes from which are used in road making. Excrements of workpeople used as manure. No suggestions to offer.
James Butterworth & Son, Flannel Manufacturers.	Greenboth Mill, near Rochdale.	Our works are situate on the *Norden brook*, a tributary of the *Irwell*. Employ 370 hands. Rateable value of the works 1,165*l.* The bed has not silted up. Works not affected by floods; no perceptible alteration in the condition of the stream since the works were erected. Obtain supply of water partly from waterworks and from a private reservoir. We cannot estimate the volume of water consumed, but the Heywood Waterworks Company are obliged by their Act to send down the stream a certain quantity of water for our use. Independent of this we have a clear spring of water. There are no manufactories or mills above us, for we are at the head of the stream, just below the waterworks reservoirs. We produce annually: liquid refuse from washing 7,051,200 gallons, and from soap-suds 1,762,800 gallons. The whole of this waste liquid flows into tanks, and from thence into *brook*. We only dye on our own premises when there is a large demand. Have not done any dyeing for the last three years. Use annually 22,232 lbs. of soap. The suds are treated for the recovery of grease. Use steam, 40 nominal horse-power; water, 25 horse-power. Consume 1,800 tons of coal. Make 250 tons of ashes, which are used partly in repairing roads and the remainder carted to a spoil bank at some distance from the stream. The excrements of workpeople are mixed with ashes and used for agricultural purposes. We suggest that depositing tanks should be formed at all mills, manufactories, and works; and manufacturers and millowners, by availing themselves of the means of utilizing their waste products, would thereby prevent the pollution of rivers and streams.
James Hill, Tanner	Canal Bank, Blue Pits, near Rochdale.	My tanyard is situate on a *brook* which flows into the *Roch*, a tributary of the *Irwell*. Employ 21 men. Rateable value of tanyard 71*l.* I obtain supply of water jointly from land drainage and collected rainfall. Do not know the volume consumed. Use yearly: lime 6 tons, bark 20 tons, valonia 20 tons, and gambir 20 tons. I obtain in depilation 20 packs of hair, but the greater portion of it is short, and is mixed with lime and soil and used for manure on my land. The other portion is dried and sold to plasterers. Obtain in "fleshing" 10 tons of fatty matter, which is sold, carted away, and converted into grease and a size for woollen manufacturers. I have the following tanpits: 8 lecks 9 ft. by 9 ft. by 5 ft., 24 bloomers 4 ft. 6 in. by 3 ft. 9 in. by 5 ft., and 16 layers 6 ft. by 6 ft. by 5 ft. Do not dye. The waste liquid is of small volume, and flows into sewers and thence into river. The spent bark and dirt from tanpits is burnt. Use steam, 4 horse-power. Consume 52 tons of coal. The ashes are used to repair roads. Excrements of workpeople is mixed with spent lime, short hair, and soil, and used on my land, which is about a mile from the works. No suggestions to offer.
Paverley and Blakey, Tanners.	Crawford Street, Rochdale.	Our tanyard is situated on the Lancashire and Yorkshire canal. Employ four hands. Obtain supply of water from canal. Consume 500,000 gallons annually. Use lime 3 tons, bark 40 tons, valonia 12 tons, gambir 5 tons, and pigeons' dung 1 ton. Obtain in "depilation"

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Peverley and Blakey, Tanners — *cont.*	Crawford Street, Rochdale.	6 tons of hair, sold to plasterers, and 8 tons of "fleshings," sold to size makers. Have 40 tanpits, 6 ft. by 4 ft. by 5 ft.; and 12 pits, 8 ft. by 7 ft. by 5 ft. Produce 330,000 gallons of liquid refuse, which flows down an open ditch about 1½ miles thence into the *Roch*. Use steam, 6 horse-power. Consume 60 tons of coal. Make about 10 tons of ashes, carted to railway and used for ballast. Excrements of workpeople carted away by farmers.
W. M. Dunkill and James Holroyd, Woollen Dyers and Fulling Millers.	Spotland, near Rochdale.	Our works are situated on the *Spodden*, a tributary of the *Irwell*. Employ from 20 to 35 hands. Rateable value 112*l.* The bed of the river silts up, and in floods the silt is washed away. Works not affected by floods. Condition of the stream has little changed since we have known it. It is not polluted to an appreciable extent. Trout and other fish live in it. Obtain supply of water jointly from the stream, springs, and surface. The whole of the waste liquid produced flows unfiltered into the *Spodden*. Use as dyewares, cochineal and dyewoods. The spent woods are burnt. Use steam and water, 20 horse-power. Consume 200 tons of coal annually, the ashes from which are taken by road surveyors for repairing the highways. Excrements of workpeople removed by men employed by corporation. No suggestions to offer.
Charles Holroyd, Flannel Manufacturer.	Spotland Mill, Spotland, Rochdale.	My works are situated on the *Spodden*, a tributary of the *Irwell*. Employ 48 hands. Rateable value 60*l.* The bed of the stream has silted up considerably during the last 10 years, caused by ashes thrown in from the coal pits above. Works are affected by floods. Obtain supply of water from the river. Do not know the volume used, or of liquid refuse produced. The latter flows unfiltered into the river. Use steam, 10 nominal horse-power, and water, 10 horse-power. Consume 365 tons of coal annually. Make 70 tons of ashes, which are used to repair roads. Excrements of workpeople used on land. No suggestions to offer.
John Chadwick, Flannel Manufacturer.	Lee Mill, Shawclough, Rochdale.	My works are situated near the *Spodden*, a tributary of the *Irwell*. Employ 90 hands. Rateable value of works 240*l.* Consume 3,000 gallons of water daily. The waste liquid flows unfiltered through sewers into the river. Use yearly, as bleaching materials, 15,000 gallons of urine and 280,000 lbs. of soda. Use steam, 12 nominal horse-power. Consume 1,000 tons of coal. Make 50 tons of ashes, which are used on land. Excrements of workpeople carted away by farmers.
Robert Schofield, Flannel Manufacturer.	Well-i'-th'-Lane Mills, Rochdale.	My mill is situated on a stream which flows into the *Sudden brook* and thence into the *Roch*, a tributary of the *Irwell*. Employ 230 hands. Rateable value of mill 460*l.* The bed of the *Sudden brook* has silted up. There is a great deal of filth from works above and also sewage now cast into it. 15 years ago it was comparatively a pure stream. Mill not affected by floods. The stream upon which my mill is situated is polluted only by water used for condensing purposes. Water is pumped from mines but does not pollute it. Obtain supply of water by diverting the stream at *Buerrill brook*; cannot tell the volume used for washing yarn and wool, but it is considerable. The liquid waste flows direct into sewers, which drains several mills and thence into *brook*, which is made very impure. *I have no depositing tanks at my mill but ought to have them, and so ought all woollen manufacturers.* Use soda-ash in washing wool. Use steam, 42 nominal horse-power. Consume 450 tons of coal annually, the ashes from which are carted away as ballast for railway. Excrements of workpeople are partly sent into *brook* and part used as manure. All refuse from woollen mills might be filtered at a very little cost, and the waste products thereby recovered would be valuable.
J. Radcliffe & Co., Woollen Spinners and Weavers.	Green Mill, Lower Place, Rochdale.	Our mill is situated on the *Buerrill brook*, a tributary of the *Irwell*. Employ 190 hands. Rateable value 500*l.* The bed of the *brook* has silted up, owing to the rubbish and refuse thrown into it. Mill not affected by floods. The stream is not so deep but the channel is much broader than formerly; it is not polluted by works above. Obtain supply of water from impounding reservoirs; no means of ascertaining the volume used or of the waste liquid produced; this latter flows unfiltered into sewers and thence into *brook*. Use 10,000 lbs. of soap annually. Suds not treated for the recovery of grease. Use steam, 40 nominal horse-power. Consume 1,000 tons of coal yearly, the ashes from which are carted away. The excrements of workpeople are cast into the *brook*. No suggestions to offer.
Edward Schunck, F.R.S., Bleacher and Dyer of Cotton Yarns.	Wicken Hall Works, Butterworth, near Rochdale.	My works are situated on a tributary of the *Roch*, a tributary of the *Irwell*. Employ 106 hands. Rateable value of works 229*l.* 10*s.* The bed of the *brook* has not silted up. Works not affected by floods. The *brook* is not polluted by works above. Obtain supply of water jointly

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Edward Schunck, F.R.S., Bleacher and Dyer of Cotton Yarns—*cont.*	Wicken Hall Works, Butterworth, near Rochdale.	from springs and from *brook*. Consume 140,000 gallons pure water per day. The waste liquid produced flows unfiltered into sewers, and thence into *brook*. Use as dyewares, annually, logwood, indigo, peachwood, fustic, shumac, copperas, in all 8 tons. The spent dyestuffs are put in the ground and covered up. Use as bleaching materials, annually, soda-ash and bleaching powder 57½ tons, vitriol 22 tons, also soap 7 tons, but do not treat the suds for the recovery of grease. Use steam, 20 nominal horse-power. Consume 1,300 tons of coal, the ashes from which are used in repairing roads and filling up hollows about new buildings. Excrements of workpeople put on land as manure. In replying to the question "Have you any suggestions to offer as to the best means of avoiding pollution in future?" I shall leave out of consideration everything relating to sewage and the products from chemical works, as being outside the sphere of my experience, and confine myself to the pollution caused in streams by the processes of cotton bleaching, dyeing, and printing, with which I am more familiar. It is well known that nothing is added to cotton fibre previous to or during the process of spinning into yarn, but that on the contrary mechanical impurities, such as fragments of seed vessels, are to a great extent removed. During the process of yarn bleaching, however, about 5 per cent. by weight of matter inherent in the fibre is removed from the cotton. This matter is for the most part dissolved by the soda lye with which the yarn is in the first place treated. The product of this treatment is a dark brown liquid, which is of course allowed to flow into the nearest stream. The substances removed by this treatment are principally pectine, organic colouring matters, and fatty acids. These when allowed to pass into streams produce no evil effects beyond the brown coloration which they impart to the water, because they are bodies which are incapable of undergoing putrefactive decay. Their alkaline solutions, when allowed to stand exposed to the air, are after some time found covered with mould, but never become foul or stinking. The only substance removed from cotton by treatment with alkali which is liable to putrefaction is a minute and almost inappreciable trace of albuminous matter. The substances above named cannot be removed from the water by filtration or subsidence. They may certainly be precipitated by the addition of an excess of any acid, and the liquid thus rendered clear and apparently pure, but the process would be costly and of doubtful utility. During the succeeding stages of the bleaching process the yarn is treated with chloride of lime, then with sulphuric acid, several times in succession. These materials after effecting the purpose for which they are intended, are passed in a state of solution into the streams, which are however not, strictly speaking, polluted by them. Indeed, in cases where sewage is allowed to flow into the same stream they are positively beneficial on account of their deodorising and antiseptic properties. All that I have said regarding the bleaching of cotton yarn applies also to the bleaching of calicoes, with this addition that the alkaline liquid resulting from the treatment of piece goods with soda and lime contains a quantity of nitrogenous matter derived from the flour dressing which is always used in preparing the yarn before weaving. The gluten of this flour constitutes no doubt a pollution, as it may enter into a state of putrefactive decay in warm weather. The first process in the printing of calicoes consists in applying various mordants, which are solutions of various bases, such as alumina, oxide of iron, and oxide of tin in acids, suitably thickened with flour, starch, or gum, to the fabric. Ultimately the bases remain fixed on the fabric, the acids pass into the air, the thickening materials are washed away, and so far as they are nitrogenous, produce pollution of the streams. The next process, that of dunging, is more objectionable than any other carried on in printworks, so far as regards its effect on the water of the river or stream into which the drainage takes place, as the smell is offensive, though not so much so as that arising from the pigs' dung and urine used in woollen scouring. There would be no practical difficulty in keeping the liquid from the dunging vessels separate from the great bulk of the water used in printworks, such as that employed for washing the pieces; still the probable effect of throwing difficulties in the way of the printer disposing of the waste liquor from the dung becks would be the more extensive use of substitutes for cow dung, such as phosphate, arseniate, or silicate of soda, and a greater stimulus given to the invention of still more efficient substitutes. The liquid resulting from the operations of dyeing produces a more extensive pollution of streams, as far as appearance is concerned, than anything issuing from dye or print works. This liquid is muddy, highly coloured, and sometimes (when glue or other

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Edward Schunck, F.R.S., Bleacher and Dyer of Cotton Yarns—*cont.*	Wicken Hall Works, Butterworth, near Rochdale.	animal matters are employed to assist in dyeing) offensive. It generally contains colouring matters combined with bases, the compounds being held in suspension by the starch, gum, mucilage, &c. derived from the dye-stuffs. Ink diluted with water would bear a very close resemblance to waste dye liquor, as regards appearance and composition. Though offensive to the sight, I am of opinion that these liquids contain nothing prejudicial, as far as regards the public health, except in those cases where glue or albumen are used in dyeing, because most dye-stuffs contain very little nitrogenous matter, and putrefactive decay would in any case be arrested for a long time by the high temperature employed in dyeing and the various inorganic acids, salts, which are added during the process. If, however, it should be insisted on that only clear liquids be allowed to flow from dyeworks into streams, then the best way of effecting this would be to collect the muddy liquid from the dye vats in suitable vessels, add a slight excess of sulphuric or muriatic acid, allow the precipitated colouring and other matters to settle, and let the clear supernatant liquid run away. Filtration would be out of the question, as involving too much expense. The utility of such a process, except as regards mere appearance and the benefit derived from the antiseptic properties of the acid added, seems to me, however, very doubtful, as the liquid, though it might be clear and transparent, would be rendered useless for dyeing purposes by others lower down the stream, and would be injurious to fish. Lastly, there are the coloured liquids resulting from the treatment of dyed goods with soap, and containing in addition to soap various colouring matters. These liquids should, like those from the dye vats, be collected in separate vessels and cleared by means of caustic lime. The precipitated calcareous soap being allowed to settle, the supernatant clear liquid might be drawn off, while the soap might either be thrown away or used for the preparation of fatty acid, provided it is found possible to separate the latter from the colouring matters mixed with the soap. Generally speaking, I may state it as my conviction that even if bleachers and dyers were compelled to apply processes of purification to their water before emission, no real good would result as regards the streams, for if after purification any water should be found useful for manufacturing purposes, such as dyeing or washing, the manufacturer would probably use it himself, and what he would allow to pass away would be a concentrated solution of salts utterly useless to others and poisonous to fish. I doubt too the policy and justice of throwing the burden of purifying our streams on the towns and on one class of manufacturers only. The whole county or division of the county ought to pay the cost of any scheme for the purpose, and I think the only practical scheme would be to allow the rivers to perform their natural function of carrying away the surface water, and to take the impure water from towns and manufactories in one or several separate channels to the sea. This would still allow us to use the water as it passed along for purposes of irrigation, if thought desirable, but the possibility of being able, if we wish to get rid of it entirely, is, I conceive, a sine quâ non. There might certainly be some objection raised to the mixing together of sewage water with the drainage from manufactories as unfitting the mixture for application to the land. I believe, however, that there is nothing contained in the liquids from bleach and dye works which can be injurious to vegetation, but that on the contrary there are various matters in it, such as potash, soda, ammonia, and lime salts, which might prove beneficial. All solid matters, such as cinders, woody particles from dye works, should not on any account be allowed to be thrown into streams.
W. E. and R. Guest, (Stansfield Printing Co.), Calico Printers.	Littleborough, near Rochdale.	Our works are situated on the *Roch*, which flows into the *Irwell*. The bed of the stream opposite our works has not silted up. Not affected by floods. The river is not polluted by works above, ours being the first on the stream. Obtain supply of water from springs collected in reservoirs. Consume yearly 60,000,000 gallons, exclusive of water used in bleaching which cannot be estimated. The whole of the waste liquid produced flows unfiltered into river. Use dyewoods and madders. The spent dyestuffs are washed into stream. Use as bleaching materials, annually, muriatic acid, soda-ash, lime, chloride of lime, and resin, liquid 38 tons, solid 22½ tons, also from 5 to 6 tons of soap. The suds are not treated for the recovery of grease. Use steam, 140 nominal horse-power. Consume 3,500 tons of coal, the ashes from which are put in heaps. Excrements of workpeople are used as manure on land. No suggestions to offer.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
A. & W. Law, Fulling Millers and Flannel Manufacturers.	Lydgate Mill, Littleborough, nr. Rochdale.	Our mill is situated on a tributary of the *Roch*, a tributary of the *Irwell*. Employ 20 hands. The bed of the stream has not silted up. Mill not affected by floods. The condition of the stream has not, within our knowledge, changed. It is polluted by works above, and the water is unfit for finishing purposes of our trade. We obtain supply of water for power from the stream, but for trade purposes from gathering ground on the moors, the water being conveyed from thence in pipes. Cannot give the volume used, nor that of waste liquid produced, which latter flows into depositing tanks, and thence, unfiltered, into stream. We use 2,500 lbs. of cake blue, 5,000 lbs. of soda-ash, and 8,960 lbs. of soap yearly. The soap-suds are treated for the recovery of grease. Use steam and water, 8 horse-power. Consume annually about 416 tons of coal, the ashes from which are put in heaps. The excrements of workpeople are used on land for manure. No suggestions to offer.
Whyatt, Oppenheim, & Lindley, Calico Printers.	Bowker Bank Print Works, Crumpsall, Manchester.	Our works are situated on the *Irk*, a tributary of the *Irwell*. Employ 106 hands. Rateable value of works 434*l*. 15*s*. The bed of the river has silted up from washing of the banks and refuse thrown in. Works are affected by floods. River is polluted by works above. Condition has not greatly changed during the last 20 years. Obtain supply of water from the entire drainage area of Heaton Park. Cannot give the volume used, or of the waste liquid produced. The latter flows unfiltered into the river. Use as dyewares, madder and garancine. Spent madder we make into garancine. Use 20 tons of soap annually. Do not treat the suds for the recovery of grease. Use steam, 40 nominal horse-power. Consume 2,700 tons of coal, the ashes from which are taken away by builders for repairing roads. The excrements of workpeople are used as manure on land.
John Berrie, Dyer and Scourer and Manufacturer of Woollen Flocks.	Monsall Works, Newton Heath, near Manchester.	My works are situated on the *Rochdale canal*. Employ 90 hands. Rateable value of works 160*l*. Works not affected by floods. Obtain supply of water from canal. Consume about 8,000,000 gallons yearly. Produce liquid refuse from bleaching 4,000,000, and from dyeing 4,000,000. This waste liquid flows into sewers and thence unfiltered into river. I use dyewoods, alum, bichrome, vitriol, aquafortis, ammonia, and other acids. Spent dyewoods are burnt. Use bleaching powder in small quantities, about one ton yearly; also about 12 tons of soap; the suds are not treated for the recovery of grease. Consume 1,200 tons of coal annually, the ashes from which are carted away for road making. The excrements of workpeople are carried by sewers into river. No suggestions to offer.
Harrop, Taylor, & Pearson, Silk Throwsters.	Newton Silk Mills, Newton Heath, near Manchester.	Our mill is situated on the *Rochdale canal*. Employ 350 hands. Rateable value of mill 261*l*. Obtain supply of water from canal, which we use chiefly for condensing, and return it again to canal. The waste liquid flows into tanks and thence by sewers into river. Use 33,600 lbs. of soap annually. Do not treat the suds for the recovery of grease. Use steam, 30 nominal horse-power. Consume 800 tons of coal, the ashes from which are used for repairs to roads. Excrements of workpeople are used for agricultural purposes. No suggestions to offer.
Samuel Yarwood, Tanner.	Miles Platting, Manchester.	My tanyard is situated on the *Rochdale canal*. I employ 50 hands. Rateable value of tanyard 130*l*. Obtain supply of water from the Manchester corporation waterworks. Use annually, lime 20 tons, bark 120 tons, valonia 50 tons, sumach 1 ton, gambir 20 tons, alum 15 tons, and salt 8 tons. Obtain annually in "depilation" 200 pack of hair, which is sold to plasterers. The "fleshings" are sold (as obtained) in a wet state to size makers. I have 80 tanpits, 8 ft. by 4 ft. by 5 ft. Do not dye. The waste liquid produced flows direct into sewers, thence into a small *brook*, and so on to the river. Use steam power. Consume 200 tons of coal annually, the ashes from which are used in repairing the road (about a quarter of a mile long) to my tanyard. The excrements of workpeople are removed by my men, and carted away by a farmer for agricultural purposes. No suggestions to offer.
Thomas Vickers & Sons, Manufacturing Chemists.	Newton Heath, Manchester.	Our works are situated on the *Rochdale canal*, from whence we obtain supply of water. Employ 80 hands. Rateable value of works 459*l*. We use and produce, annually, pyrites 1,440 tons, lime 40 tons, soap 500 tons, tallow and grease 100 tons, boiled bones 1,500 tons, and artificial manure 4,000 tons. Also produce 300 gallons of spent soap lye daily, which flows direct into sewers. Use steam, 30 nominal horse-power. Consume 2,500 tons of coal, the ashes from which are carted away to fill up old clay pits. Excrements of workpeople are carted away.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
		Watershed of the Bollin, Tributary of the Mersey.
John Hankinson, Tanner.	Wilmslow -	I employ three hands. Rateable value of tanyard 20*l*. Obtain supply of water from land drainage. Use yearly, lime 5 tons, bark 50 tons, valonia 10 tons, and fowls' dung 6 cwt. Obtain 30 packs of hair in "depilation," sold to plasterers, and 6 tons of "fleshings," sold to size boilers. Have 50 tanpits, 6 ft. by 4 ft. by 4 ft. 6 in. Waste refuse produced flows down an open ditch into river. Use steam, 10 horse-power. Consume 50 tons of coal; make 8 to 10 tons of ashes, which are used on roads. Excrements are used as manure.
John Smith, Silk Printer.	Langley, within Sutton, Macclesfield.	My works are situated on the *Bollin*. Employ 130 to 150 hands. Rateable value 272*l*. 10*s*. The bed of the river has not silted up. Works not affected by floods. The river is not polluted by works above. Obtain supply of water from *brook* flowing through works. Never measured the volume used or of the waste liquid produced, which latter flows unfiltered direct into stream. Use as dyewares, chiefly analine dyes, gums and mordants with small quantity of indigo and madders. Also use 12 tons of soap annually, the suds are not treated for the recovery of grease. Use steam power. Consume yearly 320 tons of coal, the ashes from which are laid in heaps and used as required in repairing roads. Excrements of workpeople are collected in an open tank mixed with soil and other refuse, and used on land for agricultural purposes.
J. and F. Jackson, Silk Throwsters and Weavers.	Cross Street, Macclesfield.	Our mill is situated on the *Bollin*. Employ 175 hands. Rateable value 162*l*. The bed of the river has silted up. Mill not affected by floods. The river is polluted by dye, print, and other works, and by a stone quarry. Obtain supply of water from a stream which flows into the *Bollin*. Do not know the volume used or of the waste liquid produced, which latter flows unfiltered into the *river*. Use steam, 15 horse-power. Consume yearly 300 tons of coal, the ashes from which are taken away to repair roads. Excrements of workpeople are used on land. No suggestions to offer.
John J. Rolden, Cotton Spinner.	The Globe Cotton Spinning Company (Limited).	Our works are situated on the *Bollin*. Employ 491 hands. Rateable value 2,551*l*. Works not affected by floods. Have only known the river four years, the bed during that time has not silted up, and the condition of the water has not changed. The river is greatly polluted by dyes and acids and town sewage turned into it. Obtain supply of water for condensing only from the *Bollin*, and after so using return it again to river. It would save great wear and tear of engines and boilers if the river were rendered clear and colourless, and it would be of money value to us, but we are not prepared to give an amount. Use steam, 240 nominal horse-power. Consume now 5,500 tons of coal yearly, but shall eventually use 7,500 to 8,000 tons. Make three cart-loads of ashes every week, which are given away to farmers or any one who will cart them away. The excrements of workpeople are collected in a pit, mixed with the refuse from cotton, and sold to farmers as manure. The Corporation of Macclesfield turn down the river as compensation from their impounding reservoirs, three cubic feet of water per second. The whole of this volume is abstracted and diverted from the river to a mill by Mr. George Parker, and used there as power; a storeage sufficient for a day's supply is there impounded; on this account, in dry weather we are often compelled to stop work; this too causes a long stretch of river course to be nearly dry, and the sewage and dye-waste which flows in renders that portion of the river very offensive. We suggest that town sewage, refuse from dye, print, and other works should be kept out of rivers and streams.
F. E. Gaddam & Co., Silk Manufacturers.	Macclesfield -	Our mill is situated on the *Bollin*. Employ 145 hands. Rateable value of mill 268*l*. Mill not affected by floods. The river is polluted, and has been so for many years past. Obtain supply of water from river. Do not know volume used, or of the waste liquid produce, this latter flows unfiltered into river. Use steam, 34 nominal horse-power. Consume 800 tons of coal yearly. Make three to four tons of ashes weekly, which are carted away to repair roads. Excrements of workpeople used as manure. No suggestions to offer.
Josiah Smale & Sons, Silk Manufacturers.	Macclesfield	Our works are situated on the *Bollin*. Employ 200 hands. Rateable value 170*l*. The bed of the river has not, within our knowledge, silted up. The river is polluted by works and sewage. The condition of the water has not changed since our possession of the mill. We obtain

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Josiah Smale & Sons, Silk Manufacturers—*cont.*	Macclesfield -	supply of water from the river. Cannot say the volume used or waste liquid produced, the latter flows into sewers, and thence into river. Use 2,400 lbs. of soap annually. Use steam, 15 horse-power. Consume 230 tons of coal yearly, the ashes from which are used to repair roads. Excrements of workpeople are conveyed into river. No suggestions to offer.
		Watershed of the Weaver, Tributary of the Mersey.
Dutton and Lamb, Tanners.	Northwich -	Our tanyard is situated on the *Weaver*. Employ 50 hands. Rateable value 52*l.* 5*s.* The bed of the river has not silted up. Tanyard not affected by floods. Obtain supply of water jointly from river, wells, and rainfall. Do not know the volume consumed. Use yearly, lime 40 tons, bark 40 tons, valonia 50, gambir 20, dogs' dung 250 buckets, fowls' dung 250 buckets, human excrement 500 buckets, and bran 200 bags. Obtain 20 tons of fatty matter in "fleshings;" sold to size boilers. Have three tanpits 10 ft. by 6 ft. by 5 ft. Use as dyewares 6 tons of logwood, the spent wood is burnt. The whole of the liquid refuse flows unfiltered into river. Use steam, 12 horse-power. Consume 200 tons of coal; the ashes made are used on roads. The excrements are used as before stated. No suggestions to offer.
Thomas Nixon, Tanner.	Welch Row Head Nantwich.	Tanyard situated on the *Acton brook*, which flows into the *Weaver*. Employ 16 men. Rateable value of tanyard 43*l.* The bed of the *brook* has silted up. Tanyard not affected by floods. The *brook* is not polluted by works above, and the condition of the water is not much changed. Obtain supply of water from *brook*. Do not know the volume used. Use yearly, lime 30 tons, bark 200 tons, and valonia 10 tons, also pigeons' and fowls' dung 10 bushels. Obtain in "fleshing" 7 to 8 tons of fatty matter, sold to size boilers. Have 101 tanpits of various sizes, some 9 ft. square, others 7 ft. by 5 ft., and 6 ft. by 4 ft. Do not dye. The waste liquid produced flows unfiltered through sewers into the *brook*. Use steam, 6 horse-power. Consume 100 tons of ashes, the ashes from which are carted away to repair roads. Excrements of workpeople used as manure. No suggestions to offer.
Barker, Brothers, Tanners.	Mill Stone Lane, Nantwich.	Our tanyard is situated about half a mile from the *Weaver*. Employ 20 hands. Rateable value of tanyard 70*l.* 2*s.* Obtain water from reservoir, supplied by land drainage. Do not know the quantity used. Use annually, 36 to 40 tons of lime, 500 to 600 tons of bark, 40 tons of valonia (we stick to the old system of tanning, which has not and cannot be improved), and being sole leather tanners, require to use only a few bushels annually of pigeons', fowls', and dogs' dung, or human excrement. The hair and fatty matty obtained in "depilation" and "fleshing," sold to plasterers and size makers. Have 161 tanpits of sizes varying from 16 ft. by 10 ft., to 6 ft. by 4 ft., all 5 ft. deep. Do not dye. The waste liquid produced flows through sewers into river *Weaver*. Use steam, 8 horse-power. Consume 91 tons of coal annually. Ashes used in repairing roads. Spent lime and bark is mixed with excrements of workpeople and used for agricultural purposes. No suggestions to offer.
Ockleston, Brothers, Tanners.	Lostock Gralam, Knutsford, Cheshire.	Our tanyard is situated on the *Peover Eye brook*, which flows into the *Weaver*. Employ 7 hands. Rateable value of tanyard 147*l.* 10*s.* The bed of the *brook* has not silted up. Tanyard not affected by floods. We see no change in the condition of the *brook*. It is not polluted by works above or by mines. Obtain supply of water from well. Consume 156,000 gallons yearly. Use yearly, 16 to 18 tons of lime, 120 to 140 tons of bark, 50 to 60 tons of valonia, and 156 measures of pigeons' dung. Hair obtained in "depilation," sold to plasterers. Obtain 20 to 25 cwt. per month of fatty matter in "fleshing," sold to size makers. Have 87 tanpits varying in sizes from 5 ft. to 7 ft. long, and 3 ft. 6 in. to 6 ft. 6 in. wide. Do not dye. The waste liquid flows into a settling tank, and from thence into *brook*. Use steam, 6 horse-power. Consume yearly 100 to 120 tons of coal, the ashes from which are used on roads. Excrements of workpeople mixed with spent bark and used as manure. No suggestions to offer.
		RIBBLE BASIN.
		Watershed of the Ribble Proper.
Richard Dixon, Tanner.	Frenchwood Tannery, Preston.	My tanyard is situate on the *Swill brook*, which flows into the *Ribble*, about 300 yards below the tanyard. Employ 26 hands. Rateable value 95*l.* 10*s.* The condition of the brook has improved, but it

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Richard Dixon, Tanner—*cont.*	Frenchwood Tannery, Preston.	is polluted by town sewage. Obtain supply of water jointly from waterworks and from springs. Consume, yearly, 1,368,000 gallons. Use yearly, lime 45 tons, bark 250 tons, valonia 250 tons, gambir 58 tons, and pigeons' and fowls' dung, 268 bushels. Obtain in "depilation," 14 tons of hair, and about 52 tons of "fleshings," which are sold and removed from works. Have 216 tanpits, 6 ft. 8 in. by 5 ft. by 5ft., nine limepits, six waterpits, and three hair dung pits. Do not dye. All the liquid refuse produced flows through a trough over the brook into tanks, which are emptied by the tenants of the adjoining land, and used as manure. Use steam, 8 horse-power. Consume 195 tons of coal; make about 25 tons of ashes, which are used in repairing roads. The excrements of workpeople are used by tenant of adjoining land as manure. No suggestions to offer.
William Calvert & Sons, Cotton Spinners and Manufacturers.	Walton - le - Dale, near Preston.	Our works are situated on the *Ribble*. Employ 1,300 hands. Rateable value of works 1,706*l.* The bed of the river opposite our works has not silted up. Works are affected by floods. The river is more polluted than it was a few years ago. Obtain supply of water for condensing purposes from the river. Use steam, 210 nominal horse-power. Consume upwards of 9,000 tons of coal yearly, the ashes from which are used to repair roads. The excrements of workpeople removed from works and used as manure on gardens and land.
Isherwood, Brown, and Thompson, Cotton Manufacturers.	Clitheroe -	Our works are situated on the *Stockwell brook*, which flows into the *Ribble*. Employ 160 hands. Rateable value of works 106*l.* 18*s.* 10*d.* Works not affected by floods. Obtain supply of water jointly from brook and waterworks. Consume 1,000,000 gallons yearly. Use steam, 17 horse-power. Consume 700 tons of coal, ashes from which are sold or given away, and used for building purposes. Excrements of workpeople used as manure. No suggestions to offer.
A. W. and K. Dewhurst, Cotton Spinners and Manufacturers.	Salford Mills, Clitheroe.	Our mill is situated on the *Shaw brook*, which flows into the *Ribble*. Employ 800 hands. Rateable value of mill 879*l.* The bed of the *brook* has partially silted up. Mill is affected by floods. The condition of the *brook* has scarcely altered for the last 20 years. It is polluted by several cotton mills above. Obtain supply of water from the brook. Use steam, 150 nominal horse-power. Consume, yearly, between 5,000 and 6,000 tons of coal, the ashes from which are carted away by Railway Company. Excrements of workpeople are collected in tanks.
James Bleakley, Paper Manufacturer.	Primrose, Clitheroe.	My mill is situated on *Clitheroe* and *Pendleton brooks*, which flow into the *Ribble* about a mile below mill. Employ 60 hands. The beds of the *brooks* have not silted up. Mill not affected by floods. The brooks are polluted by paper mills, cotton mills, tanyards, slaughter-houses, breweries, and town sewage. Obtain supply of water from the *brooks*, and as by far the greater portion is used for power, it would not be of great advantage if the stream from which I derive supply were rendered clear and colourless. Consume in paper-making 100,000,000 gallons. Use yearly, clean paper shavings 5,160 cwts., cotton waste 8,754, rags 4,104, esparto 7,000, soda-ash 1,800, bleaching powder 1,000, alum 884, lime 1,000, antichlor 70, and vitriol 101 cwts. Produce 10,000,000 gallons of liquid refuse from boiling and washing discharges, which flows unfiltered direct into the *brook*. Produce 500 tons of paper (news and printing) per year; make 150 to 200 tons of rag-dust or waste, which is sold to farmers. Use steam, 30 nominal horse-power, and water, 40 horse-power. Consume 1,500 tons of coal. Make 65 tons of ashes which are used for ballast, road mending, and for building puposes. Excrements of workpeople used on land.
John Mitchell & Sons, Paper Manufacturers.	Clitheroe -	Our mill is situated on the *Worston* and *Pendleton brooks*, tributaries of the *Ribble*. Employ 110 hands. Rateable value of mill 360*l.* 9*s.* 9*d.* The bed of *Worston brook* has silted up, caused by refuse and the town sewage of Clitheroe thrown into it. Mill is not affected by floods. The streams are polluted by sewage, refuse from tanyards, gasworks, and mills, and during the drought of 1868 the sewage caused a great nuisance. Obtain supply of water for manufacturing (washing and bleaching) purposes from the *brooks*, and use it for power also. Use yearly, rags 16,000 cwts., esparto 15,700, soda-ash 3,000, bleaching powder 2,000, alum 1,000, lime 5,000, vitriol 498, manganese 200, and wood-pulp and paper-cuttings 5,000 cwts.; the whole of the liquid refuse flows unfiltered direct into a settling reservoir and thence into the *brooks*. Produce 670 tons of news and printing paper yearly. The rag-dust made is sold to farmers. Use

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John Mitchell & Sons, Paper Manufacturers—*cont.*	Clitheroe -	steam, 60 nominal horse-power; water, 30 horse-power. Consume 3,120 tons of coal, the ashes from which are used partly on roads, and the remainder mixed with the excrements of workpeople and used on land. No suggestions to make. We feel, however, entitled to allude to the visit to these works of the late Mr. Ffennel, Her Majesty's Inspector of Fisheries; he approved of all our arrangements for preventing pollution.
		Watershed of the Calder, Tributary of the Ribble.
Haworth & Woolnough, Power-loom Calico Manufacturers.	Brookside, Oswaldtwistle, near Accrington.	Our works are situated on a small *stream* which flows into the *Calder*. Employ 250 hands. Rateable value of works 234*l*. 15*s*. The bed of the stream has not (within our knowledge) silted up. Works not affected by floods. The small stream flowing past our works is fed largely from the coal-pits, it is clean and bright (slightly impregnated with iron), and flowing over a rocky bed, the condition has not altered probably within the memory of man, the only works above ours, which could pollute the stream, is a calico print works, but this has not been in use for some years. Obtain supply of water from springs and sometimes direct from a coal-pit, used principally for condensing steam; consume probably 60,000,000 gallons yearly. We do not produce any waste liquid. Use steam, 60 nominal horse-power. Consume 1,200 tons of coal, the ashes from which are used entirely for road making and building purposes. Excrements of workpeople used as manure. No suggestions to offer.
Robert Watson and Company, Cotton Spinners and Manufacturers.	Oswaldtwistle, near Accrington.	Our works are situated on a *brook* which flows into the *Calder*. Employ 750 hands. Rateable value of works 959*l*. 10*s*. The bed of stream has silted up, caused by sand and stones washed down. Obtain supply of water from stream, which is not polluted, and is clear enough for our trade purposes. Use steam, 100 nominal horse-power. Consume yearly 3,600 tons of coal; the ashes are carted away. Excrements of workpeople flow into tanks and then pumped on to farm land.
W. Haghton, Manager to the Oswaldtwistle Cotton Spinning Company (Limited).	Roe Greave, Oswaldtwistle, near Accrington.	Our works are situated on the *Roe Greave brook*, which flows into the *Calder*. Employ 181 hands. Rateable value 190*l*. The bed of *brook* has not silted up. Works are not affected by floods. Very little alteration in the condition of the brook. It is not polluted by works above. Obtain supply of water from the *brook*. Use 5,200 lbs. of soap yearly, the suds are not treated for the recovery of grease. The waste liquid produced flows direct into the brook unfiltered. Use steam, 40 nominal horse-power. Consume 850 tons of coal, the ashes from which are used for repairing roads. Excrements of workpeople are used as manure. No suggestions to offer.
Steiner, Gatty, & Co., Garancine Manufacturers, Calico Printers, and Turkey Red Dyers.	Church and Accrington.	Our works are situated on the *River Hyndburn* which flows into the *Calder*. The bed of the river has not silted up; our works are not affected by floods. In dry weather the water in the river is very dirty and has a most unpleasant smell, it was formerly not so bad as now. The entire volume in dry weather is used over and over again for manufacturing purposes. We obtain supply of water jointly from river, wells, and land springs. Consume about 10,000,000 gallons a year and produce that volume of liquid refuse, part of which is filtered before it flows into river. Use steam, 60 nominal horse-power; water, 20 horse-power. Consume 3,000 tons of coal. Make 150 tons of ashes which are thrown into river. The excrements of workpeople are partly cast into river and the remainder used on land. We know of no remedy for pollution so long as manufacturers and others absorb all the clean water and return it again dirty to the rivers and streams.
John Wilkinson & Co., Calico Printers and Dyers.	Oakenshaw, near Accrington.	Our works are situated on the river *Hyndburn*, which flows into the *Calder*. Employ 150 hands. Rateable value of works 430*l*. The bed of the river has silted up caused by tipping of earth from excavations for building into it. On this account the sewers from the works have had to be turned so as to discharge the sewage lower down the river than formerly. The condition of the river is always dirty and stinking, except for a day or two after a flood. It is polluted nearly as much as possible. Obtain supply of water jointly from river and springs. Consume 60,000,000 gallons annually. If the river were rendered clear and colourless it would be of money value to us of 150*l*. a year. Produce liquid waste from washing 5,000,000, bleaching 10,000,000, printing 2,000,000, and dyeing 3,000,000. The whole of this flows unfiltered into sewers, and thence into river. Use as dyewares yearly, 150,000 lbs. decoction of

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John Wilkinson & Co., Calico Printers and Dyers—*cont.*	Oakenshaw, near Accrington.	woods, and 50,000 lbs. cochineal, Persian berries, analine colours, gambir. The spent dyestuffs are sold. Use as bleaching materials yearly, 24,000 lbs. soda-ash, 24,000 lbs. lime, 6,000 lbs. bleaching powder, 200 lbs. resin, and 105,800 lbs. muriatic acid, also one ton of soap. Use steam, 100 nominal horse-power. Consume 3,000 tons of coal. Make 500 tons of ashes which are used for repairing roads. The excrements of workpeople used for agricultural purposes. No suggestions to offer.
John Smith, Turkey Red Dyers and Printers.	Baxenden Turkey Red Dyeing Company, near Accrington.	Our works are situated on a *brook* which flows into the *Calder*. Employ 200 hands. Rateable value of works 611*l*. 5*s*. The bed has not silted up. Works are not affected by floods. The condition of the *brook* now is quite as good as it has ever been. It is polluted above only by washing from the highway. Obtain supply of water from impounding reservoirs. Consume 500,000,000 gallons annually, produce liquid refuse from washing 490,765,000 gallons, bleaching 160,000, printing 75,000, dyeing 3,000,000, and soap-suds 6,000,000 gallons; the whole of this waste liquid flows unfiltered into sewers and thence into the *brook*. Use garancine, 336,000 lbs. Spent dyestuffs are filtered and put on to the land. Use as bleaching materials, yearly, caustic soda 100,000 gallons, and hydrochloric acid 15,000 lbs., also soap 137,680 lbs. Do not treat the suds for the recovery of grease. Use steam, 60 nominal horse-power. Consume 4,500 tons of coal. Make 450 tons of ashes, which latter are used to repair roads. We have earth closets, and the excrements of workpeople are put on land.
Joseph Green, Cotton Spinner.	Jackhouse, Oswaldtwistle, near Accrington.	My mill is situated on the *Jackhouse brook*, which flows into the *Calder*. Employ 30 hands. Rateable value of mill 80*l*. The bed of the brook has not silted up, and its condition is very little changed. It is not polluted by works above. Obtain supply of water from the *brook*. Use steam, 16 horse-power; water, 8 horse-power. Consume 120 tons of coal. Ashes put on roads. Excrements of workpeople go into a tank, and are carted as manure from thence on to land.
F. and W. Grafton, & Co., Calico Printers.	Broad Oak Printworks, Accrington.	Our works are situated on the *Warmden brook*, a tributary of the *Calder*. Employ 1,000 hands. Rateable value 2,100*l*. The bed of the brook has not silted up. Works not affected by floods. A part of the works is built over the *brook*, and the water it has not altered in condition or appearance for the last 50 years; it is not polluted by works above. Obtain supply of water from impounding reservoirs. Consume 400,000,000 gallons annually. Produce liquid refuse from washing 300,000,000, bleaching 2,000,000, printing 1,000,000, dyeing 10,000,000, and soap-suds 9,000,000 annually. All refuse liquors containing solid refuse are run into large settling tanks to drain off the liquor. The waste water from madder dyeing is filtered. The principal dyestuffs used is ground madder, 2,000,000 lbs. yearly. After being once used it is collected into tanks for converting into garancine. We use yearly as bleaching materials soda-ash, bleaching powder, and oil of vitriol; solid about 300,000 lbs., liquid 700,000 lbs.; also soap 336,000 lbs. Preparations for collecting the grease from soap liquors in construction. Use steam, 180 nominal horse-power. Consume 15,000 tons of coal. Make 1,000 tons of ashes, these are carted for road making and paving. None thrown into stream. Excrements of workpeople collected in boxes with dry ashes and used for land. No suggestions to offer.
Thomas Taylor, Tanner.	Lane Bridge, Haberyham Eaves, Burnley.	My tanyard is situated on the *Calder*. Employ 10 hands. Rateable value of tanyard 38*l*. 10*s*. The bed of the river has silted up. Obtain supply of water from the river after having been used by several mills and works above; it is sufficiently clear for my purpose. Use yearly, lime 4 tons, bark 100 tons, valonia 10 tons, sumach 1 ton, gambir 3½ tons, alum 10 tons, salt 7 tons, and fowls' dung 156 bushels. Obtain 40 packs of hair in "depilation," sold to plasterers. The "fleshings" sold to glue makers. Have 67 tanpits of sizes varying from 6 ft. 6 in. square and 5 ft. deep, to 5 ft. 2 in. square and 4 ft. 6 in. deep. Do not dye. Produce liquid refuse about 31,000 gallons yearly, which flows into a depositing tank and thence into river. Use steam, 4 horse-power. Consume 105 tons of coal. Ashes from which as well as excrements of workpeople are carted away.
Pillingfield Mill Co. (Limited), Cotton Spinners.	Burnley -	Our works are situated on the *Calder*. Employ 300 hands. Rateable value 470*l*. The bed of the river has silted up, caused by rubbish of all kinds thrown into it. Our works are affected by floods. Thirty

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Pillingfield Mill Co. (Limited), Cotton Spinners—*cont.*	Burnley -	years ago it was a clear stream; now it is a very dirty and foul one, and fish have not been seen in it for years. In summer the water is often so hot that we are compelled to stop work. Obtain supply of water from river. If the river were clear and colourless it would be of money value to us of from 30*l.* to 40*l.* a year. Use steam, 130 nominal horse-power. Consume 11,000 tons of coal, the ashes from which are carted away. The excrements of workpeople flow into a sewer and thence into river.
John Kay & Son, Cotton Spinners.	Burnley Wood, Burnley.	Our works are situated on the *Calder*. Employ 566 hands. Rateable value of works 682*l.* Bed of river has silted up. Works not affected by floods. Obtain supply of water from river for condensing purpose only. Use steam, 120 nominal horse-power. Consume 22,400 loads of coal. Make about 3 tons of ashes per week, which are used for road making. Excrements of workpeople taken away by farmers.
John Baines & Son, Cotton Spinners and Manufacturers.	Burnley -	Our works are situated on the *Brun*, which flows into the *Calder*. Employ 370 hands. Rateable value of mill 688*l.* The river course has been improved opposite our works, and walls built on both banks. Obtain supply of water from river. Consume for generating steam and condensing purposes, about 70,000,000 to 80,000,000 gallons yearly, which is again returned to river. If the river were clear and colourless it would be of money value to us of from 100*l.* to 125*l.* a year. Use steam, 112 nominal horse-power. Consume 2,600 tons of coal yearly, make about 200 tons of ashes, which are carted away to repair roads. Part of excrements of workpeople are cast into river and part carted away for agricultural purposes. Since the passing of the Burnley Improvement Act, 1854, authorizing waterclosets to dwelling houses, the river has been much more polluted by sewage; the drains all discharge their contents into the river, and in summer time the condition of the stream is most objectionable.
Tunstill, Brothers, Cotton Spinners and Manufacturers.	St. James' Street, and New Town, Burnley.	Our works are situated on the *Brun*, which flows into the *Calder*. Employ 300 hands. Rateable value 443*l.* 10*s.* The bed of the river has silted up, caused by ashes and other refuse thrown into it, so much so that the Corporation two or three years ago found it necessary to lower the bed. Our works are affected by floods. The river is polluted by town sewage. Obtain supply of water jointly from river and from a well. Use steam, 100 nominal horse-power. Consume 2,700 tons of coal yearly, the ashes from which are carted away and used for building purposes. Excrements of workpeople are cast into river. We suggest as the best means of preventing pollution in future, to fine all who pollute rivers and streams.
Hay, Ogle & Co., Cotton Spinners and Manufacturers.	Parsonage Street, Burnley.	Our works are situated on the *Brun*, which flows into the *Calder*. Employ 450 hands. The corporation of Burnley impounds the water of the gathering ground, and do not always send down the stream the amount of compensation water required by their Act. The stream is polluted by town sewage above our works. Obtain supply of water from the river. Consume about 63,000,000 gallons yearly. Use steam, 100 nominal horse-power. Consume 2,400 tons of coal, the ashes from which are carted away to repair roads. Excrements of workpeople carted away for agricultural purposes. No suggestions to offer.
Baldwin & Broxup, Cotton Spinners and Manufacturers.	Hammerston Street Mills, Burnley.	Our mills are situated on the *Calder*. Employ 104 hands. Rateable value 204*l.* The bed of the river has silted up, caused by throwing in of solid refuse from various works above, and the floods washing sand and gravel down. Our works are affected by floods. The river was formerly clear, the channel deeper, and fish were able to live in it; but now it is very offensive and the water thick and muddy, and unfit even for condensing purposes. The river is polluted by works above, but about a mile above our works it is quite clear. We obtain supply of water from the river. If the river were clear and colourless it would be a great saving to us in the consumption of coal, but we are unable to fix a money value. We use steam, 30 nominal horse-power. Consume 8,000 loads of coal annually, the ashes from which are carted away regularly to a public depository at the outskirts of the town. The excrements of our workpeople are carted away by the farmers in the neighbourhood to be used as manure. We suggest that solid refuse should be prohibited from being cast into the river, and that town sewage should be kept out of rivers and streams.

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Critchley, Armstrong & Co., Worsted, Cotton, and Silk Power-loom Manufacturers.	Trawden, near Colne.	Our works are situated on the *Calder*. Employ from 350 to 400 hands. Rateable value of works 451*l.* The bed of the river has not silted up. Our works are near the source. The river is not polluted by works above. Obtain supply of water jointly from springs, wells, and a brook. Do not know the volume used. The supply is abundant and unlimited. Use steam, 50 nominal horse-power; water, 12 horse-power. Consume 1,000 to 1,200 tons of coal yearly, the ashes from which are used to repair highways. Have privies and waterclosets for workpeople. No suggestions to offer.

Watershed of the Darwen, Tributary of the Ribble.

Thomas Clarkson & Co., Chintz Furniture Printers.	Bannister Hall Printworks, Higher Walton, near Preston.	Our works are situate on the *Darwen*. Employ 120 hands. Rateable value of works 400*l.* 5*s.* The bed of the river has silted up, caused by the sewage and refuse from the towns of Blackburn and Darwen, and from works above us on the river and tributaries. The deposit of filth gradually increases, but is partially from time to time carried away by floods. Works not affected by floods. Obtain supply of water from the river, but cannot state volume consumed. If the river were clear and colourless it would undoubtedly be of considerable money value to us, but we cannot state the amount. The whole of the waste liquid produced flows direct into the river unfiltered. Have depositing tanks for dye refuse but not for soap-suds and bleaching liquor. Use as dyewares, principally madder; the spent stuffs made into garancine. Use as bleaching materials, vitriol, soda-ash, resin soap. The soap-suds not treated for the recovery of grease. Use water as power. Consume 800 tons of coal annually, the ashes from which are used in repairing roads. The excrements of workpeople are mixed with soil and used on farm.
John Cooper, Cotton Spinner.	Samlesbury Mills, near Preston.	My works are situated on the *Darwen*. Employ 150 hands. Rateable value of mill 250*l.* and 300*l.* The weirs on the river hold back the solid matter to some extent; this is generally washed down in heavy floods. My mills are affected in heavy floods; the water wheels are backwatered, but I do not attribute this to the silting up of the bed of the river. There is less water flowing down the river than 30 years ago, and a great deal more filth. It is polluted by the sewage of Blackburn and Darwen, and by refuse from paper and other mills, and in warm weather is very offensive. Obtain supply of water for power only, from the river. Use steam, 20 horse-power; and water, 20 horse-power. Consume 1,000 tons of coal, the ashes from which are used to repair roads. Excrements of workpeople used on land. I suggest as the best means of avoiding pollution in future, that town sewage and refuse from paper and other works, should be kept out of rivers and streams.
Henry Ward & Sons, Cotton Spinners and Manufacturers.	Swallow Street Mills, Blackburn.	Our works are situated on the *Blakewater*, which flows into the *Darwen*. Employ 800 hands. Rateable value of works 1,469*l.* The bed of the river has silted up. Our works are affected by floods. The river is polluted by printworks and mines. Obtain supply of water from the river for generating and condensing steam only, and after it is so used, it is returned again to the river. Use steam, 120 nominal horse-power. Consume 4,000 tons of coal and make 500 tons of ashes, which are carted away to repair roads. Excrements of workpeople are conveyed into sewers, and thence into river. No suggestions to offer.
James Astley & Co., Cotton Manufacturers.	Cobwall, Blackburn.	Our works are situated on the *Blakewater*, a tributary of the *Darwen*. Employ 600 hands. The river is polluted by refuse from works and from mines. Obtain supply of water from river. Consume 462,000 gallons daily. Use steam, 40 nominal horse-power. Consume 1,800 to 1,900 tons of coal, ashes from which carted away for road making. Excrements of workpeople removed from privies and used as manure. No suggestions to offer.
Liveseys and Roggett, Cotton Manufacturers.	Whalley Bank Mills, Blackburn.	Our mill is situated on the *Blakewater*, a tributary of the *Darwen*. Employ 400 hands. The bed of the river has silted up near our mill; we attribute the cause to our own weir on the river. The river is polluted, but as we only use the water for generating and condensing steam, it serves our purpose. Use steam, 130 nominal horse-power. Consume 3,500 tons of coal, the ashes from which are carted to fill up clay pits and hollow places. Excrements of workpeople are removed by farmers.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
Robert Hopwood & Son, Cotton Spinners and Manufacturers.	Nova Scotia Mills, Blackburn.	Our works are situated on the *Leeds* and *Liverpool canal.* Employ 1,300 to 1,400 hands. Rateable value of mill 1,721*l.* Obtain supply of water from canal, used only for steam and condensing purposes, and then returned again to canal. Consume 7,000 tons of coal. Make 1,000 tons of ashes, which are carted to a spoil bank. Excrements of workpeople are carted away by farmers. We suggest as the means of avoiding pollution, that impounding reservoirs should be formed in valleys above towns, and in dry weather that a sufficient volume of water should be allowed to flow down for the purpose of flushing the courses of rivers and streams.
George Whiteley & Co., Cotton Spinners and Manufacturers.	Albion Works, near Blackburn.	Our works are situated on the *Leeds* and *Liverpool canal.* Employ 400 hands. Rateable value of mill 776*l.* 10*s.* Obtain supply of water from canal, which is returned again after having been used for condensing purposes. Use steam, 90 nominal horse-power. Consume 2,600 tons of coal, the ashes from which are used to fill up hollows in our own land. The excrements of workpeople carted on to our own land and used as manure. No suggestions to offer.
Pilkington Brothers & Co., Cotton Spinners and Manufacturers.	Park Place Mills, Blackburn.	Our mill is situated on the *Leeds* and *Liverpool canal.* Employ 940 hands. Rateable value of mill 2,149*l.* Obtain water from canal, which use for condensing purposes only, and return to canal again. Use steam, 340 nominal horse-power. Consume 6,300 tons of coal, the ashes from which, and also the excrements of workpeople, are carted away. No suggestions to offer.
John Baynes, Cotton Spinner and Weaver.	Cicely Bridge Mill, Blackburn.	My mill is situated on the *Leeds* and *Liverpool canal.* Employ 840 hands. Rateable value of mill 1,100*l.* Obtain supply of water from the canal, and use it only for condensing purposes. Use steam, 150 nominal horse-power. Consume 3,600 tons of coal. Make 150 tons of ashes, which are spread over waste land for building upon. Excrements of workpeople collected in tanks and sold in a liquid state to farmers.
John Baynes, Cotton Spinner and Weaver.	KnuzdenBrook Mill, near Blackburn.	My mill is situated on the *Knuzden brook.* Employ 550 hands. Rateable value of mill 600*l.* The bed of the brook has not silted up. This is a country district, and the water is perfectly clear and only occasionally polluted by water from coal mines. For the past thirty years have not observed any change in the condition of the brook. Obtain supply of water from gathering ground, collect it in reservoirs of an area of 3 acres, which cost in constructing 6,000*l.* Use steam, 100 nominal horse-power. Consume 2,600 tons of coal, the ashes from which are spread over waste land. The excrements of workpeople are mixed with soil and used as manure. No suggestions to offer.
John Fish, Cotton Spinner and Manufacturer.	Waterfall Mill, Livesey, Blackburn.	My mill is situated on the *Darwen.* Employ 800 hands. Rateable value of mill 1,384*l.* The bed of the river has silted up, caused by ashes and other rubbish thrown in from manufactories on the stream. Works not affected by floods, but the reservoirs and goit by which water is conveyed to waterwheel silt up from time to time. Forty-five years ago the river was clear, and fish lived in it; now it is very filthy, polluted principally by paper and paper staining works, and to some extent by coal mines. Obtain supply of water from river. If the water were clear and colourless it would be of money value to us of from 20*l.* to 30*l.* per annum. Use steam, 170 nominal horse-power; water, 30 horse-power. Consume 2,250 tons of coal, the ashes from which are used for road making and filling up hollows about new buildings. Excrements of workpeople used as manure.
C. & J. G. Potter & Co., Paper Manufacturers.	Hollins Paper Mill, Lower Darwen.	Our mill is situated on the *Darwen* and *Earnsdale.* Employ 250 hands. Rateable value of mill 798*l.* 5*s.* The bed of the streams have silted up 2 ft. 6 in. within the last thirty-five years, caused by ashes and other refuse thrown in from mills and manufactories above. Mill is affected by floods. The rivers are polluted to such an extent that we cannot use the water except for the commonest purposes in manufacturing the lowest class of papers. Obtain supply of water principally from the *Earnsdale,* a portion from springs, and the remainder from the *Darwen.* Consume about 375,000,000 gallons annually. If the rivers were rendered clear and colourless it would be of money value to us of 500*l.* a year. Use yearly, rags 68,758 cwts., esparto 27,071, soda-ash 4,662, bleaching powder 3,806, alum 5,766, lime 11,682, antichlor 22, vitriol 271, and manganese 34 cwts. Produce yearly, 250,000,000 gallons of liquid refuse, 40,000,000 gallons of which we evaporate to recover the

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
C. & J. G. Potter & Co., Paper Manufacturers—*cont.*	Hollins Paper Mill, Lower Darwen.	chemicals it contains; the remaining portion of the liquid refuse flows unfiltered into river. Produce yearly, news and printing paper 531,300 lbs., white elephant 3,169,714 lbs., and coloured elephant 1,440,686 lbs. Make about 576 tons of rag-dust, a small portion of which is used as manure; about one-third is carted away, and the remainder is deposited in hollow places in banks of streams formed by floods. Use steam, 333 nominal horse-power. Consume about 10,811 tons of coal. Make about 1,020 tons of ashes, half of which are carted away, and the other half deposited in hollow places in river banks. Excrements of workpeople used as manure for land.
James Dimmock & Co., Paper Manufacturers.	Over Darwen-	Our works are situated on the *Darwen.* Employ 114 hands. Rateable value of works, 642*l.* 15*s.* The bed of the river has not, to our knowledge, silted up. Our works are not affected by floods. The river near our works is now arched over; it has been polluted for many years by print and other works, but not by mines. We obtain our supply of water from the river and from springs, but do not know the volume we consume; the liquid refuse flows unfiltered into the river. We produce 27 tons of news and printing paper weekly. Make 150 to 200 tons of rag-dust annually, which is thrown into the river. We use steam, 170 nominal horse-power. Consume 7,000 to 8,000 tons of coal yearly, the ashes from which are thrown into the river. Excrements of workpeople are conveyed from privies and waterclosets into river.
Heron, Baron, & Edleston, Bleachers of Calico.	Railway Road, Over Darwen.	Our works are situated on the *Darwen.* Employ 15 hands. Rateable value of works 63*l.* The river opposite the works has been arched over and built upon. Works not affected by floods. The river is polluted by works above. We do not use it for bleaching purposes, but obtain supply of water from wells and springs. Consume about 24,000,000 gallons yearly, the whole of which is polluted more or less, and flows unfiltered direct into the river. Use yearly, as bleaching materials; soda-ash, spirit of salts, bleaching liquor, lime, and resin, 309,000 lbs. Use steam, 8 nominal horse-power. Consume 800 tons of coal; the ashes are used for road making. Excrements of workpeople are conveyed by sewers into river.
Thomas & Joseph Eccles, Power-loom Cloth Manufacturers.	Foundry Street, Over Darwen.	Our works are situated on the *Darwen.* Employ 200 people. Rateable value of works 141*l.*, old valuation. The bed of the river has silted up two feet within the last six years, caused by refuse and ashes from paper and other works cast in. Works are affected by floods. The river is so much polluted that we cannot use the water for our boilers. Obtain supply of water for condensing purposes from river, and for other purposes from a stream flowing through our works. If the river were clear it would be of money value to us of 40*l.* a year. Use steam, 35 nominal horse-power. Consume 700 tons of coal, ashes from which are partly put into river and partly used to repair roads. Excrements of workpeople carted away by farmers.
John Taylor, Paper Manufacturer.	Collins Mill, Over Darwen.	My mill is situated on the *Darwen.* Employ 20 hands. Rateable value of mill 88*l.* The bed of the river has silted up, caused by refuse from works thrown into it, and gravel and stones washed down. Mill not affected by floods. The river is seriously polluted. Obtain supply of water jointly from waterworks and from well. Use yearly, rags 160 tons, soda-ash 3 tons, alum 20 tons, lime 30 tons, and bleaching powder 1 ton. The whole of the liquid refuse produced flows unfiltered into river. Produce brown paper. Make one ton of rag-dust yearly. This, with the excrements of workpeople, taken away by farmers as manure. Use steam, 26 nominal horse-power. Consume 1,400 tons of coal, the ashes from which are used to repair roads. No suggestions to offer.
Pickup & Halliwell, Cotton Manufacturers.	George Street Mill, Over Darwen.	Our works are situated on the *Darwen.* Employ 300 hands. Rateable value of works 271*l.* 15*s.* The bed of the river has silted up about 18 inches during the last 10 years. Works affected in heavy floods. The river is polluted to a very great extent. Obtain supply of water from the river. We only use it for condensing purposes, and return it to the river again. Use steam, 45 nominal horse-power. Consume 1,250 tons of coal, the ashes from which are part put into river and remainder taken by Local Board of Health. Excrements of workpeople flow into tanks, and then are carted on to land as manure. No suggestions to offer.

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Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
John Walmsley, Cotton Spinner and Manufacturer.	Holme Mill, OverDarwen.	My mill is situated on the *Darwen*. Employ 240 hands. Rateable value of mill 342*l*. Works not affected by floods. Twelve years ago the river was clear; now it is very much polluted by refuse from paper and other mills. Obtain supply of water from river. Use steam, 70 nominal horse-power. Consume 500 tons of coal, ashes from which are cast into river. Excrements of workpeople are removed by men employed by the Local Board of Health.
Thomas Gillibrand, Cotton Manufacturer.	Hollin Grove Mill, Over Darwen.	My mill is situated on the *Darwen*. Employ 400 hands. Rateable value of mill 394*l*. 10*s*. The bed of the river has silted up two feet, caused by a weir below. Works not affected by floods. The river is polluted to a very great extent. Obtain supply of water from the *Darwen* and *Earnsdale*. It would be of great advantage to me if the river were clear and colourless, but I cannot state the money value. Use steam, 70 nominal horse-power. Consume yearly 1,820 tons of coal. Make about 360 tons of ashes which are used for filling up and repairing roads. Excrements of workpeople removed by farmers.
Edward Gregson & Son, Cotton Manufacturers.	Towsfield Mill, Over Darwen.	Our works are situated on the *Darwen*. Employ 264 hands. Rateable value of works 163*l*. 10*s*. The river is polluted by the refuse from paper mills above, and the water is very injurious to boilers. Obtain supply of water from river. Use steam, 40 nominal horse-power. Consume 880 tons of coal, the ashes from which are carted away. The excrements of workpeople used for agricultural purposes.
Eccles, Shorrock, Brothers, & Company, Cotton Spinners and Manufacturers.	Over Darwen	Our mills are situated on the *Darwen*. The bed of the river has silted up owing to the throwing in of ashes and refuse from paper and other mills. Have had part of the mills stopped a day during floods from this cause, but all the manufacturers along the river have agreed with us to abstain from putting ashes in again. The stream has for forty or fifty years been polluted by paper and print works. Some of our mills are situated above the polluted part of the river; most, however, are on the part affected, but pure water is not essential for purposes of cotton manufacture; of course pure water is better than foul for engines and boilers. Obtain supply of water from the *Darwen* and its tributary streams. Our water is clean after we have used it for condensing purposes. If the river were clear it would perhaps be of money value to us of from 50 to 100*l*. a year. We use steam, 500 nominal horse-power. Consume 15,000 tons of coal yearly, the ashes used to be put into the river, but now they are put on to roads. Excrements of workpeople used for agricultural purposes. We suggest that all print, bleach, and paper works should use depositing tanks, and for the conservancy of rivers and streams would place the watersheds under the jurisdiction of Local Boards of Health, giving them powers to prevent pollution.
P. L. & J. Gregson, Calico Manufacturers.	Carr's Mill, Over Darwen.	Our mill is situated on the *Darwen*. Employ 260 hands. Rateable value of mill 212*l*. 15*s*. The bed of the river has silted up 9 inches, caused by ashes and refuse thrown in from mills. Our mill is not affected by floods. The river is covered over through the town, and we are not affected by the pollution of it. Obtain supply of water jointly from river, wells, and waterworks. Use steam, 60 nominal horse-power. Consume 250 tons of coal yearly; the ashes are used to repair roads. Excrements of workpeople sold to farmers. We suggest, as best means of avoiding pollution in future, to keep out of rivers and streams ashes and refuse of all kinds now thrown in from mills and factories.
William Thomas Ashton, Cotton Manufacturer.	Over Darwen	My mill is situated on the *Darwen*. Employ 350 hands. Rateable value of works 800*l*. The bed of the river has silted up, caused by tipping in of ashes. My works not affected by floods. The river is polluted by ashes and refuse from print and other works, but not to a great extent above, as my works are situated not far from the source of the river. I can remember it a good trout stream, now it is impossible for any fish to live in it. Obtain supply of water from river. Consume 45,000,000 gallons yearly. If the river were clear and colourless it would be of money value to me of 20*l*. a year. Use 104 cwts. of soap yearly, but it is all absorbed by the size, and goes away in the cloth. Use steam, 34 nominal horse-power. Consume 1,800 tons of coal, the ashes from which are used to level up waste land. Excrements of workpeople are removed from a cesspool by farmers. I suggest that ashes should be kept out of rivers and streams. The paper mills do nearly all the damage to the *Darwen*.
Henry Lightbown & Co., Cotton Manufacturers.	Duckworth Street, Over Darwen.	My mill is situated on the *Darwen*. Employ 120 hands. Rateable value of mill 134*l*. 10*s*. Obtain supply of water from small stream. Use 15 cwt. of soap; also steam, 20 nominal horse-power. Consume

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Henry Lightbown & Co., Cotton Manufacturers—*cont.*	Duckworth Street, Over Darwen.	yearly 650 tons of coal, the ashes from which are used to repair roads. Excrements of workpeople removed by farmers. No suggestions to offer.
Thomas Wardley & Brothers, Calico Bleachers and Printers.	Spring Vale Print Works, OverDarwen.	Our works are situated on the *Darwen*. Employ 120 hands. Rateable value of works 405*l*. We are at the head of the stream. The bed has not silted up. Works not affected by floods. Since the railway was constructed past our works the drainage from a tunnel adjoining appears to send down a quantity of iron, which precipitates in the bed of the river and makes it red. The river is polluted by refuse from works and mines. We obtain supply of water from river, and consume about 156,000,000 gallons annually. A great portion of this volume is used for power, and is unpolluted. The liquid refuse produced flows into tanks and settling reservoirs. It formerly used to flow direct into river. Use as dyewares yearly, madder of all sorts, peachwood, bark, sumach, about 100,000 lbs.; the spent wares flow into tanks, and are used over again. Use as bleaching materials, lime water 15,600 lbs., soda-ash 15,000 lbs., muriatic and sulphuric acid 90,000 lbs.; chloride of lime 15,000 lbs.; also soap 5 tons. The suds are not treated for the recovery of grease. Use steam, 50 nominal horse-power; water, 25 horse-power. Consume 3,000 tons of coal yearly. Make upwards of 300 tons of ashes, part used for repairing roads and footpaths, part used in levelling up waste land, and part cast into river. Excrements of workpeople are mixed with soil and carried on to land. We suggest that depositing and settling tanks should be used at all works.
Nathaniel Walsh, Cotton Spinner and Manufacturer.	Orchard Mill, Over Darwen.	My mill is situated on the *Darwen*. Employ 500 hands. Rateable value of works 908*l*. 10*s*. The bed of the river has silted up 3 or 4 feet, caused by town sewage, refuse and ashes from mills, especially paper mills. The mill is affected by floods; the water backs up the sewers and floods the mill floors. I remember the *Darwen* a perfectly clear stream, with plenty of trout and other fish in it; its present condition is abominable, thick, muddy, black, and emitting a most disgusting stench, more especially in time of drought. I obtain supply of water for condensing only from the river, and filter before using it. Consume 700,000,000 gallons yearly, this volume is used over and over again; there is very little waste. If the river were rendered clear and colourless it would be of money value to me of from 100*l*. to 150*l*. a year. Use steam, 120 nominal horse-power. Consume 5,000 tons of coal. Make 650 tons of ashes, which are used chiefly for road making and filling up hollow ground. The excrements of workpeople mixed with soil and used as manure. In order to avoid pollution in future, I suggest, *first*, that an absolute prohibition be enacted against solid and fluid refuse being cast into rivers and streams; and, *second*, that it be a penal offence for any one in any way to pollute flowing water.
J. B. Deakin, (late J. F. Kenyon & Co.,)Cotton Manufacturers.	Whitehall Mill, Over Darwen.	My mill is situated on the *Whitehall brook*, a tributary of the *Darwen*. The bed has not silted up. Mill is not affected by floods. The condition of the *brook* has not (within my knowledge) changed, except that owing to the drainage of the lands abutting on the *brook*, higher up than my mill, the *brook* is more swollen during and immediately after a heavy rainfall, it has a less volume of water in it at other periods. It is not polluted by works above. I obtain supply of water from the *brook* mainly, but occasionally use water from a bore hole as an auxiliary supply. Consume yearly, 30,000,000 gallons. I only use soap for size, none goes into *brook*. Use steam, 25 nominal horse-power. Consume 1,000 tons of coal, the ashes from which are put on roads. Excrements of workpeople are removed from privies and used as manure.
Aspden, Walmsley, & Cooper, Cotton Cloth Manufacturers.	Industry Mill, Chapels, Over Darwen.	Our mill is situated on the *Crawshaw brook*, a tributary of the *Darwen*. Employ 83 hands. Rateable value of mill 87*l*. 5*s*. The bed of the *brook* has not silted up. Works not affected by floods. The condition of the stream is the same now as when we first knew it. It is not polluted by works above. Obtain supply of water partly from stream and from waterworks. Consume 400,000 gallons yearly. Do not produce any liquid refuse. Use steam, 18 nominal horse-power. Consume 520 tons of coal. Make 150 tons of ashes, which are used for repairing roads. Excrements of workpeople are used as manure by farmers. No suggestions to offer.
Heron, Baron, and Edleston, Calico Printers.	Dob Meadows, Over Darwen.	Our works are situated on the *Earndale brook*, a tributary of the *Darwen*. Employ 80 hands. Rateable value of mill 25*l*. The bed of the *brook* has not silted up, there is little or no alteration in the

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Heron, Baron, and Edleston, Calico Printers—*cont.*	Dob Meadows, Over Darwen.	condition of the *brook*. It is not polluted by works above. Obtain supply of water from the *brook*, being the overflow or compensation from the Over Darwen Waterworks Company's reservoir. We are entitled to 300,000 gallons a day. Most of the water used at our works is more or less polluted, the liquid waste flows into depositing tanks, thence into the *brook*. Use yearly as dyewares: madder, garancine, and dye woods, 75,000 lbs., part of the spent dye stuffs sold to be reconverted; also use from 11,000 to 12,000 lbs. of soap; the suds not treated for the recovery of grease. Use steam, 54 nominal horse-power. Consume 2,300 tons of coal, ashes from which are used for road making and filling up. Excrements of workpeople are used on land.
		Watershed of the Douglas, Tributary of the Ribble.
McNaughtan and Thom, Calico Printers.	Birkacre, Chorley.	Our works are situated on the *Yarrow*, which flows into the *Douglas*. Employ 600 hands. Rateable value of works 1,077*l.* 19*s.* 6*d.* *Bagganley brook* and the *Limerick brook* join about a mile to the south-east of Chorley, and form the *Yarrow*. On the *Bagganley brook* there is Brinscall bleach, print, and dye works; Heapy bleach works (not at present in operation); Healey bleach works, and Crosse Hall dye works. On the *Limerick brook* there are no works. It is, however, polluted by mine water. On the *Yarrow* mine water, from pits at present being wrought, and also from old pits; Birkacre bleach, print, and dye works, and Chorley sewage are the sources of pollution. There are several weirs on the *Yarrow*. Sixteen years ago the water used at Birkacre dye works was from the *Clauciutts brook*, a pretty little trout stream with good water; this stream is now polluted by water from mines and rendered useless; no fish can live in it; the *Clauciutts brook* flows into the *Yarrow* below Birkacre works. Below the weir where Birkacre works takes in the supply of water, there is an issue into the *Yarrow* from an old mine of nearly 100,000 gallons of water a day, containing 8 tons of solid matter. Sixteen years ago the average hardness of the *Yarrow* above Birkacre print works was 9°, Clark's test; at the same spot the average hardness is now 18°. This increase in impurity in the water is not owing to additional pollution, for there is less pollution, owing to the stoppage of Heapey bleach works, and Crosse Hall bleach, print, and dye works; but to the reduction in the volume of water since the Liverpool corporation impounded the water in reservoirs at Rivington, and also to the bed of the river not being scoured out as it used to be in rainy weather. This evil will be aggravated when the new reservoir is finished, which we are given to understand is expected to impound all, or nearly all, the flood water. The *Yarrow* will then be merely a large ditch, instead of a river. We obtain our supply of water chiefly from the *Yarrow* and from springs. Consume 900,000,000 gallons a year. If the river were rendered pure it would certainly be worth at least 3,000*l.* a year to us. The whole of the waste liquid produced flows unfiltered direct into the river, except the dyewoods, which are intercepted in settling tanks. Arrangements are in course of being made for settling and filtering all liquid refuse. We use as dye-wares, madder and its derivatives 656 tons yearly. Spent dye-stuffs are sold. Use, as bleaching materials, soda-ash, resin, soda-crystals, muriatic acid, lime. In 1867 we used 3,675*l.* worth of soap. Arrangements are now in progress to recover the grease from soap-suds. Use steam, 462 nominal horse-power; water, 25 horse-power; used to have more water power. Consume 10,827 tons of coal, the ashes from which we use and sell. Excrements of workpeople are mixed with earth and put on land. As we are anxious that there should be legislation on the subject of the pollution of rivers and streams, and in hope that there will be, we respectfully submit the following suggestions:—First. For the first three years not much should be attempted. What would now be impossible, practically speaking, would probably be easy, if not profitable, in a few years. For instance, it might be practicable at present, and the public opinion of polluters of streams might agree to the necessity, of keeping all foul matters in cisterns, kiers and dyebecks, out of the streams until settled, also all solid matters; but if pieces or goods were to be wrinced or washed and these washings were also obliged to be settled it would stop every bleach, print, and dye works in the country. It could not be done at once, but we have little hesitation in saying that in a few years the same thing would be quite practicable, which is now impossible, and that it would and should be done. *Second.* Local authorities should have no power except to call attention to pollution. *Third.* River inspectors to be appointed; these should not only be competent but of some standing. *Fourth.* Every river basin in the

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Name of Witness or of Firm, and Trade or Manufacture carried on	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
McNaughtan & Thom, Calico Printers—*cont.*	Birkacre, Chorley.	United Kingdom should come under the operation of the Act at one and the same time. *Fifth.* That land required by the mill owners or manufacturers to carry out inspector's orders as to filtration or deposition should be subject to compulsory sale at a valuation. If land be too valuable and the manufacturer could not bear the additional burden then he should have power to surrender his lease. *Sixth.* If every reasonable means of lessening the pollution have been taken, and all requirements of the Act fulfilled by those manufacturers already established on a stream, and if the inspector cannot show any practical mode of further improvement, then the manufacturer shall not be liable to an action at law unless costs on both sides be guaranteed, and paid by the prosecutors in event of their suit being unsuccessful. *Seventh.* Anyone proposing to erect new works on a water course should deposit a plan with the chief inspector, and also show the *modus operandi* contemplated; also to publicly state where it could be seen by those interested in the matter, and, if sanctioned by the chief inspector and not opposed by those affected by such works, then it shall be on the same footing as an old established works.
Leonard Cooke, Paper Manufacturer.	Horwich, near Bolton-le-Moors.	My mill is situated on the *Douglas* and *Pearl brook*. Employ 15 hands. Rateable value of the mill 200*l.* The river and brook are polluted by dye, bleach, and other works to a very considerable extent. Obtain supply of water as compensation from the Liverpool Waterworks 288,000 gallons daily. Use annually, rags 240 to 300 tons, soda-ash 120 cwts., bleaching powder 120 cwts., alum 240 cwts., lime 480 cwts., antichlor 16 cwts., and vitriol 12 cwts. Produce liquid refuse about 150,000 gallons per annum, which flows unfiltered into *Pearl brook*. Produce annually 200 tons of casings and fine bag papers. The rag dust is mixed with refuse lime and used or sold as manure. Use steam, 25 nominal horse-power. Consume 1,500 tons of coal, the ashes from which are either sold or given away for roads or ballast for railway. Excrements of workpeople used as manure.
Jno. & Thos. B. Crompton, Paper makers.	Standish Mills, Standish, Wigan.	Our mill is situated on the *Douglas*. Employ 53 hands. Rateable value of the mill 547*l.* 10*s.* The bed of the river has not materially silted up during the past 30 years; the past and present condition of the river are very little changed, except prior to 1856, when the Rivington reservoirs for the supply of Liverpool were completed. We had larger and more frequent floods, which scoured out the river bed more thoroughly than at present. We obtain supply of water from waterworks, *Bradley brook*, but our chief supply is direct out of the reservoir recently constructed by the Local Board of Health of Wigan, who have to turn down the *Douglas* 800,000 gallons a day compensation water to the Leeds and Liverpool Canal and the mills and works below. When our works are completed we shall use the whole of the 800,000 gallons per day. As we use the river water for power solely its purity is not of direct money value in this instance. Of course our case is exceptional and peculiar. We use yearly, 8,407 cwts. of rags, 377 cwts. of esparto and straw, 166 cwts. of soda-ash, 29 cwts. of caustic soda, 558 cwts. of alum, 1,416 cwts. of lime, 817 cwts. of B.O.V. vitriol, 620 cwts. of salt, and 224 cwts. of manganese. Do not know the volume of waste liquid produced, which flows unfiltered direct into river. We take care to utilize all our chemicals to the fullest extent. Produce yearly 399,346 lbs. of white, and 295,083 lbs. of brown paper. Works are being rebuilt and reconstructed with a view to make 50,000 lbs. per week. We use on our own farm all the rag dust made. Use steam, 129 nominal horse-power; water, 15 horse-power. Consume 3,265 tons of coal, the ashes from which are taken away and put on roads in the township. The excrements from works go into river; from workmen's cottages go to the farm. The chief injury to the river is sewage pollution, which ferments, and in some cases taints the air of the entire district in a way none but those who have unfortunately experienced it can imagine.
William Johnson, & Co., Cotton Spinners.	Bradford Place Mills, Wigan.	Our mill is situated on the *Douglas*. Employ 450 hands. The bed of the river was silted up, caused by Henhurst bridge weir, which is not provided with proper and sufficient floodgates. Our mill is stopped in heavy floods. The river is greatly polluted, year by year it becomes worse, and does considerable injury to our boilers and engines. We use steam, 130 nominal horse-power. Consume 5,000 tons of coal, the ashes from which are sold. Excrements of workpeople carted away from premises.
J. B. Weedall, & Co., Cotton Spinners.	Chapel Lane Mills, Wigan.	Our works are situated on the *Douglas*. Employ 89 hands. Rateable value of works 148*l.* The bed of the river has not silted up opposite our works, but it has immediately below them. Works are

Series A, B, C, D, Trades and Manufactures.—Ribble Basin—(River Douglas)—*continued.*

Name of Witness or of Firm, and Trade or Manufacture carried on.	Residence of Witness or Situation of Works.	Answers to Queries on Page 123.
J. B. Weedall & Co., Cotton Spinners—*cont.*	Chapel Lane Mills, Wigan.	very much affected by floods owing to the construction of arches across the river, built by adjoining owners of land below us (William Johnson and Company, cotton spinners). These arches impede the watercourse and back the water upon us; the water has often been from two to three feet above the arches. The river is polluted by gas refuse by washing of slack from the Ince Hall Coal and Cannel Company, who cause the water, after it has been so used, to be turned into the river, also by refuse from paper and other mills, and by refuse water from mines. Obtain supply of water from the *Douglas*. Use steam, 30 nominal horse-power. Consume 1,200 tons of coal, the ashes from which are sold to the Local Board of Health, Wigan. The excrements of work-people are conveyed into a tank underground, and when required emptied, and contents sold to farmers.
A. P. Widdows, Cotton Spinner.	Sandbrook Mill, Orrell, near Wigan.	My mill is situated on the *Sand brook*. Employ 50 hands. Rateable value 200*l*. The bed of the brook has silted up. Works are not affected by floods. Obtain water from brook which is not polluted by works above. Consume 144,000,000 gallons annually. Use steam, 50 nominal horse-power. Consume 500 tons of coal. Make 100 tons of ashes, which are sold to Highway Board. Excrements of work-people collected from tanks and used on land. Suggest that every form of pollution should be kept out of rivers and streams.
Joseph Rylands Cross, Cotton Spinner.	Gidlow Lane, Wigan.	My mill is situated on the *Barlow brook*. Employ 230 hands. Rateable value of works 455*l*. There has been little difference in the condition of the brook during the last 30 years. It is polluted by water pumped from collieries. I obtain supply of water from gathering ground, and use it chiefly for generating and condensing steam; the liquid refuse flows into *Barlow brook* at a low level. Use steam, 66 nominal horse-power. Consume from 3,000 to 4,000 tons of coal yearly; ashes therefrom used as ballast for railway. Excrements of workpeople flow into a tank underground, and when required pumped out for agricultural purposes. No suggestions to offer.
Rylands & Sons, Cotton Spinners and Manufacturers.	Gidlow Works, Wigan.	Our mill is situated on *Barlow brook* which flows into the *Douglas*. Employ 850 hands. Rateable value 2,000*l*. The bed of the *brook* has not silted up. Mill is not affected by floods. The *brook* is not polluted by works above. Obtain supply of water from *Barlow brook*, used for condensing purposes only. Use steam, 200 horse-power. Consume yearly 7,300 tons of coal. Make 780 tons of ashes, which are used for repairing roads. Excrements of workpeople pass into sewers and thence into *brook*. No suggestions to offer.
James Gidlow, Cotton Spinners.	New Hall Mills, Ince, near Wigan.	My mill is situated on a *brook*, tributary of the *Douglas*. Employ 300 hands. The *brook* was pure before polluted by refuse from Wigan Coal and Cannel Company's Iron Works at Kirkless, Ince, were established. Obtain supply of water from the *brook*; in dry weather from wells. If the *brook* were perfectly clear it would be worth 100*l*. a year to me. Use steam, 80 nominal horse-power. Consume 3,840 tons of coal, the ashes from which are carted away to repair roads. Excrements of workpeople carted away by farmers.
Richard & Robert Burland, Manufacturing Chemists.	Wigan -	Our works are situated on the *Douglas*. Employ 6 hands. Rateable value of works 40*l*. The bed of the river is constantly silting up. Our works are affected by floods. The river is polluted by works above. We obtain our supply of water from the river, and consume annually about 4,000,000 gallons. We use yearly 700 tons of green copperas. We manufacture grease; the refuse produced is solid and is not thrown into river. We use steam 8 nominal horse-power. Consume 1,000 tons of coal, the ashes from which are used in repairing roads. The excrements of workpeople are used for agricultural purposes.

EVIDENCE.—PART III.

TAKEN AT

MANCHESTER, SALFORD, BOLTON, BURY, ROCHDALE, OLDHAM, STOCKPORT, ASHTON-UNDER-LYNE, STALYBRIDGE, MACCLESFIELD, ST. HELEN'S, WIDNES, WARRINGTON, LIVERPOOL, BIRKENHEAD, PRESTON, CHORLEY, WIGAN, BLACKBURN, ACCRINGTON, AND BURNLEY, AND ALSO AT THE OFFICE OF THE COMMISSION, No. 2, VICTORIA STREET, WESTMINSTER, BEFORE THE COMMISSIONERS APPOINTED TO INQUIRE INTO THE BEST MEANS OF REMEDYING THE POLLUTION OF RIVERS.

The Town Hall, Manchester.

Monday, 26th April 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.
DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.
MR. S. J. SMITH, *Secretary.*

THE INQUIRY was opened at the Town Hall, Manchester, on Monday, 26th April 1869, and the Chairman, addressing the mayor, members of the corporation, and other gentlemen, said,— 26 April 1869.

It will be in the recollection of your worship that we paid you a visit some months ago, read Her Majesty's Commission, and explained the instructions we had received from the Government. We then visited all the important towns in the valleys of the Mersey and the Ribble, and inspected a great number of different works and manufactories. In that way we collected together special data, which enabled us to draw up a series of questions, these we afterwards submitted to the principal governing bodies and manufacturers; in answer thereto a mass of information was obtained which has been printed and circulated, and the object of our present visit is to lay before you the conclusions at which we have arrived, to ask if you are satisfied with the correctness of them, and whether you have any further information to bring before us. We wish particularly to ascertain opinions as to the influence of the neighbouring river upon the health of the population, and in order to eliminate that from the many other causes which affect health, we require details of the density of population, and particulars as to the character of the water supply and the volume of rainfall which actually flows off the gathering ground into impounding reservoirs or down the channel as compensation for rivers. We shall be glad also to receive information as to the effects of weirs on the river channel and any additional evidence you may have to offer.

JOSEPH HERON, Esq., (Town Clerk,) examined. *J. Heron, Esq.*

1. (*Chairman.*) If there are any observations that you wish to make, the Commissioners will be glad to hear you?—As the Commissioners know, Manchester has enjoyed rather a bad reputation, or at all events it has been attempted to charge us with being opposed to sanitary improvements, and for this simple reason, that we have in the strongest possible manner protested, both in Parliament and elsewhere, against the introduction of a general system of watercloset; and we have always coupled with that objection these observations,—until there is a total change in the system of dealing with town sewage, human excreta ought, at any rate, to be kept out of the rivers. Some years ago, to show our determination to prevent watercloset being introduced into the smaller houses (the practice having been to require the public authorities to supply water to the first watercloset without any charge, except that which they were authorized to make for the domestic supply to the house), we gave notice that we should apply to Parliament for power to charge one guinea per annum for the first watercloset. We did not care about charging for the second, because we knew that in large houses watercloset would be introduced, and that in such houses they would be, as far as possible, prevented from becoming a nuisance, except that, of course, the refuse must pass into the rivers. Our bill was unopposed. I went to Mr. Adderley, who was at that time the head of the department, and called his attention to the bill. He said, "we shall not oppose "your bill," and I said, "I did not expect that you "would," because at that time proceedings were being taken with reference to Birmingham to obtain an injunction to restrain them from turning their sewage into the river. When we went before Mr. Fitzroy, who was then Chairman of Committees, he said, "I "cannot pass this bill as it is, I must strike that "clause out." I begged that he would not do so, as it was arranged that he should make a special report to the House, and consider it as a quasi-public bill. The

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bill was then referred to a special committee over which the Hon. Mr. Cowper presided, and, instead of accomplishing our object, the Committee put in a clause making it more stringent than before, that we should certainly not charge for the first watercloset, nor for any expenses in connexion with it. That is our position, and I wish it to be clearly understood that it is not that we approve of the present system, or say that it is perfect, but we do say that there has been more mischief created by the indiscreet pressure put upon communities generally by the introduction of waterclosets without any proper arrangements being made, than can possibly be well exaggerated. We have been improving very much the character and condition of the privies and ash-pits. Whether they are to be dry-earth closets or improved privies and ash-pits, such as the Health Committee are now encouraging parties to put up, and which we can show to the Commissioners, I hardly know, but I will defy any one to perceive any smell at all in the improved privy, for the privy itself is just as free from smell as the cottage. We are trying all we can to carry out these improvements, and we feel also the necessity of removing the night-soil as frequently as possible, in order to prevent it becoming in any way objectionable. It is true, as the Commissioners have observed, in Manchester, as well as in Liverpool and in other places, that the expense we incur in removing the night-soil is by no means returned to us by anything that we obtain for it, and we often have to carry it at a very considerable loss. In no case is it found that it is paying. Liverpool turns its sewage into the river Mersey, but how long they will be able to go on doing that without complaint it is not for us to consider, but complaints are often made of the state of the shore at Waterloo which is attributable to the large amount of sewage carried into the river Mersey; fœcal matter is found lying upon the shore at Waterloo. If we are not allowed to turn the sewage into the rivers, it will be quite necessary that we should find an outfall where the sewage will flow to sea. If there was any practicable or possible means of getting rid of the sewage there would be no objection to it; or if Parliament thought fit to determine that no sewage for the future should go into the rivers, but that each district should be compelled to carry its drainage into an intercepting sewer and let it find its outfall wherever that might be, well and good, but this appears to the Corporation of Manchester to be the only plan that is possible. As has been shown by our plans, the whole of our sewage finds its way into the rivers. We have an immense number of outfalls, and if we had to divert the sewage from the rivers there must be sewers made to catch the whole of the drainage in its progress through the town, and so carry it off into the main drain which might be constructed. Then as to the trades and the navigation, which are supplied and fed by the rivers that flow through Manchester, the question is, whether it would be or not absolutely necessary to have a double system of sewers, to prevent the rivers from being gradually deprived of that which is in fact their natural source of supply. Then, again, what are to be the arrangements as to water-closets, ash-pits, and privies. It is assumed that if such a system were adopted it would be desirable or neces, sary that all privies and ash-pits should be done away with, and that a system of water-closets should be generally adopted. There would not be the same objection to the introduction of water-closets, so far as getting rid of the excreta was concerned, but there are nevertheless other considerations of importance which would make it very objectionable, or at any rate would deprive us of a very large share of that which might be supposed to be the benefit to result from the change. We get rid of the night-soil, and in fact sell it, although we obtain from it a very small return. We have to dispose of a very large amount of ashes and rubbish to the extent of 40,000 tons and odd, for which we get no return, which the Corporation must remove just the same, and we believe that the expense of removing that would be quite as large as the expense which we now incur. Then, there is a still more important question—where is the water which would be required to come from? We have already stated in our answer that our works would be totally insufficient to provide water for the water-closets if they were generally introduced throughout Manchester. In our district we only supply something like 12 gallons a head per day for domestic purposes, and as near as we can ascertain from 12 to 13 gallons a head per day for purposes of trade. At Glasgow I am informed that the consumption is as much as from 50 to 60 gallons a head per day. I believe there is no question from the experience in all places that the consumption of water per head where the watercloset system exists is enormously increased, and I have no hesitation in saying, so far as we are concerned in Manchester, that we could not meet the demand for water from our present waterworks. With regard to irrigation, which seems to be a popular and favourite notion with some people, it might be carried out whereever it would be either possible, or practicable, and if such a main sewer or drain were constructed it would go throughout the whole district just as the rivers do now; and the people who are willing to irrigate the land, and to use the sewage for that purpose could then have it, and anything that could be obtained for it might be carried to the credit of the enormous expenditure that would be incurred. Supposing we could get the land to irrigate, and as favourably situated as the Craigentinny meadows near Edinburgh, we should not be placed in the same difficulty. More sewage runs to waste than can be utilized; the farmer can only take it at certain times and seasons, and for particular crops. I believe that the objection to irrigation is so strong just now that local authorites would have a difficulty, if land was to be had, to get possession of it for any such purpose. I have made an estimate of the quantity of land that the authorities of Manchester alone must obtain in order to carry out a system of irrigation, and it amounts to 5,000 acres.

2. (*Dr. Frankland.*) Do you mean that for Manchester alone?—Yes; Salford has a population of 120,000, and they would have to get their proportion of land, but Salford and Manchester form together only a very small part of the district that would have to find land if irrigation is to be adopted. There remains yet another fact to bring under the notice of the Commissioners—the silting up of the river; this is indisputable, and is the necessary result of that which we know is going on, but more especially outside rather than within the city of Manchester. There is no doubt that a large quantity of cinders and ashes, although perhaps less now than formerly, is habitually thrown into the rivers, and ultimately we get the benefit of them all. Then, again, we have in Manchester a number of weirs which are creating considerable obstructions; when we were dealing with the question of the Medlock we tried to get rid of one or two of them, but we found that the compensation that was asked was so enormous that we were obliged to abandon all idea of accomplishing our object. Although it may be thought extraordinary to venture to utter such a sentiment, I am of opinion that the best course would be, so far as this watershed is concerned, to make up our minds that what has been must be, and that the streams must continue to be common sewers, making at the same time such provision as would be comparatively small in cost, to prevent them from being in any way unnecessarily a nuisance to the neighbourhood. The expense would be enormous to carry out any arrangement that would otherwise get rid of the sewage, and the question really is, whether the lesser evil of the two will not be to continue the system which now exists.

3. Would you apply that observation to the other rivers in the country?—No; I am dealing only with this particular district, which is a peculiar one. I do not, of course, recommend this, nor do I say that the Commission could ever come to such a conclusion, but the Commissioners will have to suggest something to Parliament, to whom their Report will be made, and all we can say is this, that whatever may be the suggestion made, after the trouble the Commissioners have taken, and after the way in which they have invited us to make our suggestions, any recommendation which they may make will be treated by the Corporation of Manchester with the greatest possible amount of consideration and with the greatest possible respect. We feel satisfied of this, that what will be recommended will be proved to be practicable, and that, in considering what is practicable, there will be some consideration given to the amount which districts to be affected by any proposed legislation will be called upon to incur to carry out any reform. I am sure I may say for Manchester that any reasonable expenditure to satisfy any recommendation that may be made, we shall be quite prepared, in common with our neighbours, to incur; but at the same time we do fear, as the expenditure will be so enormous to carry out any satisfactory works, that there is little hope of seeing them accomplished in our time.

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Mr. William Ashton examined.

Mr. W. Ashton.

4. (*Chairman.*) What are you?—I am an iron-founder and machine maker at Knot Mill, Manchester.

5. If you have any information to give we shall be glad to receive it?—I have to complain of the obstructions in the River Medlock caused by the Bridgwater trustees, who have erected a weir just at the end of my works, to supply the canal, and when through the neglect of their servants the water is allowed to overflow, a great deal of damage is done.

6. How long has the weir been erected?—I cannot tell you exactly, but about 25 years. When the canal below (*pointing to the plan*) was made, the water flowed continually into it from the river to supply the canal, and an overflow was arranged at the Giant's basin, so that the canal relieved itself. The trustees found, I presume, that the injury sustained by the constant flow here (*pointing to the plan*) was such that they erected moveable paddles on the weir near my works, and their servants used to draw them until a recent action took place, on the part of the tenants along the bank, who would not be annoyed by the nuisance.

7. Do you complain of anything that affects health, any action of the weir that neutralizes the common and ordinary flow of the river by causing a nuisance to collect?—It is well known that for about 200 yards above the weir you might almost walk on the top of the water, and at certain seasons of the year so strong is the gaseous stuff at the top of it, the stink is almost unbearable. Only this morning I took an iron bar, and I put it in where I considered the mud was low, and I could not get to the bottom of the mud, there was nothing but perfect stink and filth, I should think, for a depth of 7 feet. When a freshet comes it raises up this stuff, and causes a perfect stink all along the river. As a proof that it did cause damage and annoyance and loss at the flood in 1866, from the negligence of the servants of the trustees, I may mention that it was proved before Mr. Fereday Smith, that the man who has charge of the paddles was not at the spot at the time to draw them so as to allow the water to flow away, and when he came, he could not draw them, one paddle being out of order, and the others he dared not touch for fear of being swept away himself. You will see the place by looking at this photograph (*handing in the same*).

8. You complain, as I understand you, of the nuisance arising from the weir?—Yes, by the checking of the water, by not allowing it to have a free and natural course. With regard to the nuisance arising from the weir that is a thing which we are sure to take a note of.

9. I do not quite understand your complaint which is described by the photograph; did you say that in consequence of the existence of the weir your works had been washed down?—Yes; my object in producing the photograph was merely to show that in consequence of there being a flood I had suffered damage.

10. The flood washed down the weir?—Yes.

11. Do you attribute the damage that was done to the existence of the weir?—Yes; if that weir had not been there it would not have occurred, and if the man had been at his post it would not have occurred.

The witness withdrew.

Mr. Peter Hall examined.

Mr. P. Hall.

12. (*Chairman.*) We wish to know anything about the effect of the nuisance described by the last witness which he states is caused by the weir?—I have known the neighbourhood in which this place is situated from a boy. Originally there was no culvert, and there was no obstruction to the water; the water of the Medlock went through the canal, and emptied itself in a large culvert some few hundred yards beyond. I do not know why this culvert has been put here (*pointing to the plan*), or why the paddles have been put there (*describing*). I think it is to keep the canal clean, as it was considered by the people living on its banks unhealthy; consequently this culvert has been put there. The navigation there used to be through the archway which joins the bridge at Knot Mill (*describing*). The culvert (*describing*) is a very small one, and when there is a flood, it is not sufficiently large to carry away the water that comes down the river. Anyone can hoist the paddles, and let the water through the canal. Until the paddles that go right under the archway into the main canal are drawn, there is and must be sediment. When our workpeople opened the windows at the end of the mill only three weeks ago they complained of the smell from the river, which at that point enters this culvert, and for some 100 yards is enclosed. I do not know of there being any ventilation, and that is the reason, I suppose, why they suffer from the nuisance.

The witness withdrew.

Mr. James G. Lynde examined.

Mr. J. G. Lynde.

13. (*Dr. Frankland.*) Are you city surveyor to the Corporation of Manchester?—Yes.

14. You are of course acquainted with the sewers and the system of drainage in the city of Manchester?—Yes.

15. Can you tell us whether the following sewers fairly represent the sewerage and drainage of Manchester. The table that you have handed in, I believe, represents the drainage area?—Yes.

16. Does Miller Street drain chiefly a watercloset or a privy district?—It is entirely a privy district, but in warehouses they have water-closets instead of privies.

17. Does Market Street drain principally a water-closet district?—Yes.

18. York Street sewer, which empties itself into the Medlock, near Dawson Street, that drains a large district, does it not?—Yes; it drains nearly the whole of Hulme.

19. Is Oxford Street a water-closet district?—It

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is a mixed district, but there are principally water-closets in that district.

20. Shude Hill sewer drains into the Irwell, does it not?—Yes, and that is a water-closet district principally.

21. What is Junction Street?—That is a privy and ash-pit district.

22. What is Miller Street?—A privy and ash-pit district.

23. Do you consider that these sewers fairly represent the districts respectively of water-closets and privies with ash-pits?—I should think that taking them all together they give a very fair average of the sewers of the town.

24. Does any extraordinary quantity of water get into those sewers as compared with other sewers?—I think they are sewers that may be taken as a fair average.

25. Is there any peculiarity about Miller Street sewer that leads you to suppose that the sewage has been more diluted than usual. We saw them using it for building purposes, for slacking the lime?—It is a very large district, and when they are slacking the lime the water is running to waste, and there is perhaps a little more running down, but on the whole I think it is a fair average.

26. There is no spring or fresh water that gets into it?—No.

27. Do you consider that these sewers fairly represent the drainage of Manchester, or would you suggest any others as more fairly representing it?—No, they are a very fair average of the sewage of Manchester.

28. I believe that the ashes or some portion of them is put upon the land, and used for filling up holes?—Yes.

29. Is that at all polluted by animal refuse. I mean are the ashes mixed with animal refuse in such cases, or are they nearly pure ashes?—They are nearly pure ashes, but they take them mixed with night-soil.

30. Do they not use ashes mixed with night-soil? I think not.

(*Mr. Heron.*) It is possible that there may be a little occasionally used, although it is carefully avoided, to fill up holes as rubbish; we classify it as rubbish.

(*The Witness.*) It is not to be sold as manure.

(*Dr. Frankland.*) It is so worthless as manure as to be unsaleable.

(*Mr. Heron.*) It is not saleable. It forms a part of the 40,000 and odd tons of rubbish which we have stated are conveyed out of the town, and which are not saleable at all for the purposes of manure.

31. (*Dr. Frankland to the Witness.*) Is the land upon which it is placed subsequently built upon?—No doubt, ultimately; or the owners of the land allow the rubbish to be deposited; sometimes they charge for the privilege, sometimes they do not.

32. What should you say is the water supply per head of the population in the water-closet districts which are drained by these sewers?—We cannot separate the one from the other.

33. Do you think the water supply in the water-closet portions of the city is equal to the supply in those parts where privies exist?—I have no data to judge by, but I think it must be more in the water-closet districts.

34. (*Chairman.*) Is the water supply a constant or an intermittent one?—It is a constant supply.

(*Mr. Heron.*) Except in the case of such an extraordinary drought as we had last summer?—We then supplied the water only for 12 hours instead of 24; in most of the very small houses they have discontinued the cisterns.

35. (*Dr. Frankland to the witness.*) Was that a very severe infliction upon the consumers, being deprived of water for 12 hours?—I do not think it was; I think that when they had it from 6 o'clock in the morning to 6 o'clock in the evening, practically but little inconvenience resulted, and at other times they very willingly submitted to the interference; there was no complaint from any one.

36. The water-closets are all supplied, are they not, from cisterns, and that supply would not be stopped?—No.

37. What is the arrangement made in Manchester for checking the waste of water?—There is nothing but the constant superintendence and supervision of inspectors. Our system of connections, and the arrangements for supplying water, are very perfect, and waste is in every possible way prevented.

38. Has that system of inspection been of late years more stringent than it used to be?—Yes, I think it has.

39. I suppose that the inspection also extends to the fittings in private houses?—Yes, they are most carefully inspected before the supply of water is turned on, and they have all to be carried out in accordance with arrangements made by the Water-works Committee.

40. How many inspectors are employed in Manchester?—I cannot tell you off-hand, but I can easily obtain that information for you.

41. I should like to know whether all the street grids of the sewers are trapped or untrapped for the purposes of ventilation?—I have got a return showing the townships in which they are trapped, and in which they are untrapped; a portion are trapped, and a portion are untrapped.

42. In Cheetham we are told that the ventilation is through down spouts and in passages; does that mean that there is no ventilation through the grids in the streets?—In the Cheetham district they do trap, in Chorlton there are none trapped.

43. In Ardwick it is said that it is by down spouts; does that also mean that the grids are trapped?—Yes.

44. I believe that all the privies are not connected with the sewers in Manchester?—All the ash-pits are connected with the sewers by means of a small grid and drain.

45. Is that the case everywhere?—Yes.

46. Perhaps I need not ask you whether any of these middens are what are termed technically very wet?—They cannot be, except at times when the grid gets stopped up, but then it is cleaned out and set all right by the men.

47. You are no doubt acquainted with the manner in which these matters is carried out in small houses and cottages in Manchester; can you give the Commissioners a sketch of the mode in which the excreta are disposed of in an average cottage in Manchester. First, the solid excrements go into the privy; what is done with the slops and the remaining excrementitious matter?—In many houses they are thrown into the ash-pits, but we have prohibited that practice as far as possible. In the new system that we are now about to enforce we shall put a grid suitable to receive the slops near the scullery or privy door, so that there will not be any inducement to empty the slops into the ash-pits. We try all we can to keep the ash-pits dry, and by the new arrangement it will be impossible for them to empty their slops into the ash-pits, excepting down the privy seat, which they will find much less convenient than using the grid that will be provided in the yard for the purpose. The yards are now provided with grids which take the rain water, but they are, many of them, in inconvenient places to empty the slops down.

48. Will that be connected with the sewer?—Yes.

49. Is it not the fact that the yards are usually furnished with such grids through which the slops are to be carried away?—Yes; they are all furnished with a grid that drains off the water; it drains their own yards, but in many cases it is not in a convenient place, and it is more easy for them to throw the slops into the ash-pit than into the grid. We shall do all we can to keep the ash-pits dry.

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50. (*Mr. Morton.*) Are you acquainted with the scavenging arrangements in Manchester?—No.

(*Mr. Heron.*) We will take care, if you wish it, to have the Superintendent of the scavenging here to-morrow.

51. I see that there are 13¼ millions of gallons of water which are said to be the daily supply of water from your waterworks; what population does that supply?

(*Mr. Heron.*) You must take into account that there are 14,000,000 of gallons which go down the river as compensation to the millowners, and you may say that in round numbers there are about 15,000,000 of gallons which go to supply the whole of the inhabitants.

52. What is the number of the inhabitants?—The number of inhabitants included within the district is something like 750,000.

53. And Manchester will receive just its proportionate quantity?—Manchester proper gets a larger proportion of water than the other districts, as there is a larger quantity of water supplied in the Manchester district for trade purposes than in the other districts.

54. Are you able to state what quantity is supplied for domestic purposes, and what quantity for manufacturing purposes?—I am not able to say at the moment, but I believe that two-thirds are consumed for domestic purposes, and one-third for trade purposes.

55. The quantity of sewage cannot be more than the quantity which is supplied for domestic and for trade purpose, plus the occasional rainfall?—No.

56. It must, in fact, be less than that by the amount which is evaporated and which goes to waste?—Yes; Mr. Lynde has made an estimate as to what the probable quantity of sewage in Manchester would be, and he thought that it would probably be about 20,000,000 of gallons per day. I believe that the water is looked upon as being something like one-half of the rain-fall.

57. Does the water which is used for trade purposes find its way into the rivers through the ordinary sewers of the town?—It finds its way into the rivers either through the ordinary sewers or it goes direct into the rivers, which latter is often the case on account of the works being on the banks of the rivers.

58. Do those sewers which have been named receive a quantity of the water which has been used for trade purposes, as well as that which has been used for domestic purposes?—Yes, they take their fair proportion.

59. (*Dr. Frankland to Mr. Lynde.*) Are most of the works in Manchester situated on the banks of the streams?—I think you would find the sides of the streams pretty well occupied by works, that being a very convenient situation; but there are a large number of works which cannot be said to be upon the banks of the streams.

60. Do those works which are situated some distance from the streams frequently send steam and hot water into the sewers?—That is a question which I am unable to answer.

61. Is there any regulation against its being done?—No, but I do not know that they do it to any very great extent.

62. (*Chairman.*) They must get rid of the water, and if it is hot it must go into the sewers?—Yes.

63. (*Dr. Frankland.*) Does that practice ever occasion any nuisance from the sewers or emanations from the grids in the streets?—I do not know of any case, nor have I ever heard of any.

64. Practically, are the sewers well ventilated?—Yes, very well ventilated indeed, as far as it goes; some are ventilated through grids, but we shall get perhaps a better system of ventilation than that in course of time. I believe there is no accumulation of gases in the sewers.

65. Do you think there is any danger in consequence of steam being turned into the sewers of sewer gases being forced into the houses?—I do not think there is any chance of it. I do not know of any case of turning steam into the sewers. With regard to condensing water, where it is used, those who employ it get it from the rivers, and it goes back again for somebody else to use it afterwards. But a great many of these works are away from the rivers, and they get their water for condensing purposes from the canals.

(*Mr. Heron.*) I may observe that it is not only from the natural streams from which it is obtained, but there are many branches from the canals which are carried into the districts merely for the convenience of the works which are placed on their side; they are branches which only go a certain distance from the canals.

66. Do you think that any considerable portion of your water supply, after being used for trade purposes, goes into these canals or branches, independently of the rivers?—I have no doubt that some does and will. They take it out for the purposes of their works at the most convenient place, and there is no doubt that it would go into the river, or into the branches of the canals that were the nearest to them.

67. Would that, in your judgment, represent any considerable proportion of the total quantity of water that is used for trade purposes or not?—It would be very small indeed.

68. (*Chairman.*) Is all the water that you give for compensation purposes turned into the river and not supplied by pipes?—For compensation it all goes down the river direct from the reservoir.

69. Does the water that you supply to the different firms come through your own pipes?—Yes, and it is supplied by meter at each place.

70. (*Dr. Frankland to Mr. Lynde.*) With regard to the refuse from gasworks, is any refuse from the City Gasworks turned into the stream?—I am not aware of any.

71. (*Mr. Morton.*) Referring to the alleged impossibility of resorting to irrigation as a remedy for the evils which exist, can you state what the fall in the river is from Manchester to the junction with the Mersey?—I do not know.

72. There is a natural fall, plus the two weirs, is there not?—Yes, to the Mersey.

73. Do you know what the fall is at these two weirs?—I do not know that.

74. What is the height of Manchester above the level of the sea?—I believe it is about 100 feet above ordnance datum.

75. (*Chairman.*) Is that your lowest point?—It may be some 97 or 98 feet; but I believe that in round numbers 100 feet above ordnance datum represents the lowest part of the town.

76. (*Mr. Morton.*) How low down are the sewers below the level of the surface in Manchester on the average?—The shallowest sewer that we put in now is 10 feet below the surface of the ground, but there are some which are more than 30 feet deep; the shallowest sewer is 10 feet below the surface. In some cases we have been content with 8 feet 6 inches, in very flat land 8 feet; but as a rule it is not less than 10 feet below the level of the streams.

77–83. (*Chairman.*) The 100 feet above ordnance datum refer, does it not, to the surface of the river?—The surface of the land adjoining the river. Below Dean's Gate and in the lower parts of Hulme, the streets are 100 feet above ordnance datum.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock.

The Town Hall, Manchester.

Tuesday, 27th April 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

JOHN LEIGH, Esq., Medical Officer of Health, examined.

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84. (*Dr. Frankland.*) Are you Medical Officer of Health for the City of Manchester?—I am.

85. Have you for many years paid particular attention to the epidemics prevailing in this city?—I have.

86. Did you on the occasion of the visitation of cholera in 1849, make a detailed report of the origin and spread of the disease in Manchester?—I did.

87. Will you be good enough to state what have been the principal epidemics which have prevailed in Manchester within the last two or three years?—Within the last two or three years we have had a large amount of scarlet and typhus fever in its various forms. There has been a considerable amount of whooping cough and measles; indeed, we are never in Manchester without some of those diseases.

88. Those were epidemic attacks of disease as distinguished from sporadic attacks of disease, were they not?—I can scarcely say that they were because they always exist in the city in a very large number of cases, and it is very difficult to distinguish them as epidemic attacks from sporadic attacks or prevalent attacks.

89. Can you give any definition of epidemic disease, as distinguished from sporadic disease?—I consider diseases epidemic which somewhat suddenly arise and spread themselves with rapidity, and prevail for a time and then disappear or nearly so, such as cholera.

90. Take scarlatina, what do you imagine to be the mode of its propagation?—It is by infection entirely.

91. Through the atmosphere or by some other agent?—Yes; it may be generated from a person already suffering from the disease, and by the atmosphere.

92. What do you consider to be the origin of that disease?—I do not know the origin of scarlet fever.

93. Have you formed any opinion as to the conditions which prevail sometimes among the population that would be favourable to the development of that disease?—Yes; whenever the general health of the population becomes deteriorated, there is a readiness to take on the symptoms of scarlet fever.

94. Would those conditions, which deteriorate the general health of the population, be favourable to the development of that disease?—I have no doubt of it.

95. How do you consider that typhoid fever arises?—I consider that typhoid fever arises, not always from infection, but often spontaneously from special conditions and circumstances which seem to arise in a population; and in the course of my observations, which have extended now over a period of 35 years, I have constantly found fermenting cesspools associated with attacks of typhus. There are instances in which the disease may occur by infection.

96. Do you separate the disease which is commonly called typhoid into different varieties?—Yes; there is what is called enteric typhus, where the stomach and bowels are particularly affected. Some forms of the disease are called brain fever, where there is great excitement of the brain, and they are distinguished by medical men as typhus, typhoid, &c.

97. Is there any difference in the infectious character of them?—Yes; some more than others. I think that a certain maculated typhus is a more infectious form of it.

98. Do you think that the infection of all these forms of typhus can be conveyed through the atmosphere?—Yes; I do not know for what distance, but I think that the atmosphere existing in a room where there is an infected person may convey the poison to another, but whether they may consist of organisms, or simple association of organic particles, I do not know.

99. Do the same conditions, so far as is known, give rise to all the different forms of that disease?—I cannot distinguish them accurately.

100. What are the conditions present in Manchester which you think contribute to the rise and spread of these diseases?—The accumulation of large quantities of fœcal decomposing matter, the overcrowding of rooms, want of cleanliness, and intemperance.

101. And perhaps a deficiency of food?—I do not think we suffer very much from that.

102. I understand that you consider the accumulation of excrementitious matter among the population to be directly active in producing diseases of this kind?—Yes; I consider that the ordinary conditions of the cesspools are capable of actively promoting fever. I distinguish the cesspool from the well-constructed privy and ash-pit. I can imagine an ash-pit to be quite dry, and having the fœcal matter constantly covered with dry ashes, and the contents being frequently removed. I believe it is in that case as innocuous as a water-closet.

103. Do you consider it desirable to keep the solid excrementitious matter as dry as possible?—Yes, I think that a great deal of the evil of collections of matter of this kind arises from putrefactive fermentation, and that matters are given off, when that putrefactive fermentation is going on, which may be organisms or may contain organisms of an injurious character. I made a report a good many years ago to the Registrar-General, and I think they were the earliest experiments that were made upon the subject. I conducted the atmosphere from cesspools and from overcrowded houses through dry sulphuric acid, or not absolutely dry, and I found that there was a constant reddening of the acid from the presence of organized particles. Those experiments were followed up afterwards by experiments made by others with the permanganate of potash. I believe that mine were the earliest experiments made.

104. What were the general results of those experiments?—Wherever infection prevailed or a great number of people were crowded together, or the cesspools were in a very offensive condition, I found that the sulphuric acid was reddened by the atmosphere that was conducted through it.

105. Have you experimented in this way upon the atmosphere in a dry privy as distinguished from a wet one?—No, our experience of dry privies in Manchester has been small. At the present time we are trying to bring them into use, and I shall attempt to do so as soon as I can; dry privies are not yet constructed as they ought to be.

106. Have you had any experience of the dry earth closet system?—No, I have not.

107. In your opinion, is any part of the mortality in Manchester to be attributed to the condition of the rivers flowing through it?—I have no knowledge of the action of the rivers on the public health, except as it was exhibited during the attacks of cholera, and on those occasions, I know that many people died on the margins of the rivers, more particularly of the Irk. I remember in 1832 that there was one court, bordering on the Irk, in Long Mill Gate, that was nearly depopulated, and the whole of the courts along the margin of the stream suffered very severely.

108. Was that also the case in 1849?—To a smaller extent, as many of the courts had been pulled down. There are manufacturing establishments now erected in their place, and I have not learned that the workmen employed in those establishments have suffered materially, nor can I say, as the result of my present investigations, that there exists on the margin of those streams a larger amount of fever of a typhoid character than in other parts of the city.

109. Can you give us approximately at least, the number of deaths which occurred from cholera in 1832, 1849, 1854, and 1866?—I can obtain that information for the Commission and will put it in.

110. Do you remember whether the mortality in 1832 was greater than it was in 1849?—Yes, I think it was greater in 1832, than in any of the succeeding attacks.

111. Do you remember whether in the attacks of 1854 and 1866 there was any marked difference in the amount of the mortality?—As far as I recollect 800 persons died from cholera in Manchester in the year 1832, and I think in the last visit of 1866 only about 60 or 70 persons died; what the numbers were in 1854 I do not remember.

112. Were there within your knowledge any alterations in the conditions surrounding the population of Manchester during the last two attacks of cholera, as compared with the first two?—Yes, since the first attacks of cholera, we have had a supply of very pure water to Manchester, and the streets in which a great deal of cholera prevailed have been sewered, paved, well swept, and scavenged. I remember in 1832 when the whole of what is called Angel Meadow was unpaved, and consequently during the greater part of the year the streets were constantly in a muddy state, they were always damp and wet.

113. What was the comparative condition of the rivers in 1832 and 1849, as compared with 1854 and 1866?—It is almost impossible to answer that question, but they always seemed to be as thoroughly bad as they well could be, there has been no difference obvious to the eye, but there may have been a chemical difference.

114. Do you not think that the rivers were purer in 1832 and 1849, as compared with 1854 and 1866?—They did not look so, but I remember that my father told me that he used to fish for trout close to the Palatine Hotel.

115. You have spoken of a change in the water supply having been effected between the first two and the last two attacks of cholera; do you attribute any improvement in the public health to that circumstance?—Perhaps the town clerk can supply the date of the year when the water now supplied to the city was first brought.

(*Mr. Heron.*) I think it was about 1851.

(*The Witness.*) Since the water supply has been improved, cholera has not existed to anything like the extent that it did before.

116. (*Dr. Frankland.*) Supposing the water to be tainted by some specific poison, say of cholera, do you know any process by which it can be rendered innocuous?—No; I do not know what would destroy cholera poison, but there may be many agents that would do it.

117. Do you think that diseases of a typhoid form are ever propagated through the medium of water?—I have no knowledge of that whatever.

118. With regard to the conditions affecting disease now in operation in Manchester, and which were in operation in 1832 and 1849, the improvement in the water supply is the only one to which you can refer?—That is the great one, but the city has been much more extensively sewered and paved, and the streets are now generally in a better condition; you will find with the exception of that which is contained in the ash-pits no collections at all of decomposing matter; in Manchester at one time the streets contained a considerable amount. It is now very much the custom with people who live in back-to-back houses, where they have nowhere else to deposit the ordinary garbage of the house to throw it into the streets which are swept almost daily, and very few collections of decomposing matter will be found except that contained in the ash-pits.

119. Have you had any experience as to the use by the population of filtered as distinguished from unfiltered water?—I have not. For many years we have been supplied in Manchester with water that requires no filtering.

120. Has the density of the population increased of late years in Manchester?—At the last census the density of the population was about five and five-tenths persons to a house, and on the three last occasions when the census was taken the density of the population certainly had not increased.

121. Had you not a high death-rate here in 1865 and 1866?—Yes, and that was partly attributable to a proportion of the deaths being due to cholera, a small proportion, and a larger proportion to diarrhœa. I cannot give you the exact number now, but I can obtain the numbers for you in a very short time.

122. In 1864 the deaths were 30·6 per 1,000 per annum, and in 1865, 35·5 per 1,000?—Yes, that was during the years preceding the cholera. A cholera year is almost always a very severe diarrhœa year. I consider that ordinary diarrhœa is a totally distinct disease from cholera, and that the same circumstances which promote cholera still more promote the extension of diarrhœa.

123. To what causes do you attribute the extensive prevalence of diarrhœa in 1865 and 1866 in Manchester?—I know of nothing but the high temperature which prevailed to account for the increase of that disease.

124. Would that have affected Manchester in a way different from any other place?—Diarrhœa prevails chiefly among children; the greatest number, or something like eight-tenths, of those deaths are among children under five years of age. They seem to be affected very readily by an increase of temperature. I do not think it is owing to diet, because a very large mortality from diarrhœa occurs in children receiving simply breast milk.

125. Do you consider that the condition of the atmosphere as regards decomposing organic matter has any effect upon that disease?—I think that it is the exciting cause of a great many things which conduce to diarrhœa, and which arise from the decomposition going on in ash-pits, and produce diarrhœa; because we find that where that is absent there is, comparatively speaking, a small amount of diarrhœa; in other words, diarrhœa exists to the largest extent in the most overcrowded and dirtiest districts.

126. Would that condition of things in your opinion affect infants receiving their nourishment from the breast?—It does seem to affect them very largely, for the mortality amongst them is the largest in those bad districts, and it is the largest from diarrhœa; but in fact all the circumstances which tend to increase the mortality in the adult population still more seriously affect the infant population.

127. Do you consider that cholera was an epidemic disease in Manchester in the year 1854?—Cholera was imported into Manchester, and spread amongst a considerable number of the people. I forget the proportion at the time that the census was taken, but it was a milder epidemic here, and not so severe as it had been in preceding years.

128. In 1866 was it an epidemic visitation?—I should say so.

129. Do you consider that the particular mode of defecation practised in Manchester had any direct influence upon the health of the population?—In what sense?

130. I mean in the prevalence of the midden system, as distinguished from the water-closet system?—My experience of the water-closet system is not sufficient

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to enable me to say how far a difference might exist, but over many parts of the town we have a mixture of middens and water-closets. Where water-closets are found, there is a high-class population, all the circumstances connected with which are conducive to health. Where middens exist, you have a population crowded together, living in a very dirty condition, having inferior food, and all the circumstances surrounding them are worse than in the districts where water-closets are to be found. It is, however, very difficult to say to what extent the mortality in the one case may be due to middens or otherwise. I think that our present midden system is a very bad one; I think it is open to very great improvements, and that the health of the district will be much improved by an alteration.

131. You are, I believe, a member of the Committee of the Manchester and Salford Sanitary Association?—Yes, I am, but I am sorry to say that I have not attended except for a very short time.

132. Do you agree with this passage in their report for 1869:—"It was admitted at the meetings held to "consider this subject that no plan should be generally "adopted which does not provide for the speedy re- "moval of fœcal matter from the vicinity of dwelling- "houses. Neither the Manchester nor the Salford "method does this, and therefore the Committee "think they should not be applied generally unless a "provision were made for the removal of the contents "of the ash-pits at very short intervals?"—I think it is desirable that the contents of the ash-pits should be removed at short intervals, but what is meant by the Manchester system I cannot say. I do not quite know whether it is the existing system or the system that we have been endeavouring to get adopted lately, and which I have no doubt we shall succeed in getting carried out, and then the contents will require removal at much shorter intervals than has been the case hitherto.

133. Do you consider that there should be a frequent removal of the fœcal matters?—That, I think, would depend upon the time of year; for instance, I do not think that it would be requisite to remove them so frequently in winter time as in summer time, because then the tendency to putrefaction from the high temperature of summer is greater than in the low temperature of winter.

134. Do you agree with the medical officer of the Privy Council that it is desirable to remove excreta from the neighbourhood of a population while they are still quite fresh?—I think it is very desirable to do so.

135. Can you give any opinion as to when they cease to be quite fresh?—I cannot.

136. If they were a week old, do you think they would then cease to be fresh?—They might be fresh, I think, for a much longer period than that. If they were carted away and kept from the effects of the atmosphere and kept dry, I think they would be fresh for a longer period than that, if the temperature was not very high.

137. If they were mixed with urine do you think they would remain fresh for a week?—The mixture of urine with them would excite putrefactive decomposition at a much earlier period, I think, than if it was excluded.

138. Have you instituted a comparison between the rate of mortality in Manchester and the rate of mortality in other towns with an equally dense population?—I have read the numbers as they have been published by the Registrar-General, and I have perceived that we have a very high rate of mortality in Manchester as compared with other towns.

139. Take Birmingham for instance, have they not a dense population as compared with that of Manchester?—No; but without knowing the area covered it is impossible to say what is a dense population. I think it is very much better in looking at the densities of population to take particular cities, and to compare the dense population in a district of registration, say Ancoats, with some central district of registration in a town like Birmingham or Bristol. I do not, from the statement made, know what the density of the population in Birmingham is, and I think that the rates of mortality lose a certain portion of their value as they are published, simply because we do not get the area over which those rates extend. It is possible that a comparison made between Manchester and Bristol, or Birmingham, or some other place might be very unfair, because there might be included in the death rate of Birmingham or of Bristol, for instance, a considerable suburban district, whereas that for Manchester would include a district which is almost entirely densely covered with buildings.

140. And that would represent Manchester as having a more dense population than Birmingham?—Yes, it might be so, but I intend, with the permission of the Corporation, to visit Birmingham and Bristol and some other considerable towns during the approaching summer in order to make inquiries, to see what are the fair comparisons to be made.

141. Do you consider that in estimating the density of the population of Manchester too much of the suburbs has been taken into account?—No, too little of the suburbs of Manchester is described. The registration district of Manchester, as reported, simply contains the township of Manchester with the township of Hulme, Chorlton, and Ardwick, and it is relieved by one township, which has, after all, a considerable population, namely, Cheetham; that has a rate of mortality not exceeding 17 per 1,000, which is a very low rate, and yet that is closely verging on the town, and is fairly covered.

142. In returning ·05 acre as the quantity of land belonging as you may say to each person in Manchester, the Registrar-General would be rather giving you too great a density of population than too low a one, but that is his return?—In comparison with other towns I do not know what area he would cover, but some portions of it are more densely populated than others, such as Cheetham, Chorlton, and Ardwick.

143. The returns of the Registrar-General show that the density of population in Birmingham is five times as great as that of Manchester?—There is not a square yard in Manchester that is uncovered, and therefore I do not see how it is possible that there can be any such difference.

144. Granting, however, the correctness of the returns, there would be nothing in the density of the population that would be unfavourable to Manchester?—Certainly not, but I think there must be some misapprehension about those figures.

145. What is your opinion as to the cause of the difference in the mortality between Birmingham and Bristol on the one hand, and Manchester on the other?—I do not know what is the cause of the difference, but I am told, although I have not verified it, that in Birmingham they have no cellar dwellings. That is one distinction, and we have now in Manchester not a very large number compared with what we had a year ago; we are weekly, almost, closing them. Then I have been told that there are no closed courts in Birmingham. I do not know whether that is so, but it is very likely. Then there is another cause which is a very important one, that the women in Birmingham, as a rule, are not engaged in out-door occupations, as the women are in Manchester. Here a very large proportion of the women are engaged in out-door occupations, and they leave their offspring perhaps a week or 10 days after birth, and before they have acquired sufficient power to live. When they require the warmth of the mother and nourishment, they are left to the care of old women and children, and the consequence is, that the mortality during the first years of infancy is very high. I think that we require to have very much more minute statistics to afford fair comparisons between the different towns in the kingdom. So far as Manchester is concerned, I am endeavouring to get up those statistics.

146. Are you responsible for the medical opinions expressed in the returns which the Town Clerk has sent to the Commission?—Yes, for a portion of them.

147. I see that there has been an extensive prevalence of diseases of the lungs, and a smoky atmosphere is mentioned as a strongly exciting cause?—Yes; I think that it is an exciting cause of bronchitic affections, and perhaps a sustaining cause also.

148. Have you made any investigations into the matter of the sewers as connected with dwelling-houses, and as to whether there is any escape of gases from the sewers into the dwelling-houses?—There is a very great escape from the sewers.

149. Do you think that that has anything to do with the prevalence of disease?—Most of these things act injuriously on the health.

150. Is disease caused by the want of ventilation in the sewers?—Yes; I think the sewers ought to be ventilated at their highest points, and that would prevent, I think, an escape of gases into the houses.

151. Do you consider that a discharge of steam or hot water into the sewers has any connexion with the penetration of gases into houses?—I do not think there is sufficient injected into the sewers to raise their temperature appreciably, and therefore it could not be operative to any great extent.

152. Is not the temperature of a sewer in the winter time considerably higher than that of the external atmosphere?—As far as my observations have gone, and I have made some occasionally, they have the same average temperature; the sewer is about 62 degrees.

153. On many occasions in winter the temperature of the air is below 32 degrees?—Yes.

154. What do you think would be the effect of this difference of temperature in a sewer with a steep gradient? Would it cause the gases to rise to the highest points of the system, and force the traps of the drains at the summit of the hill?—Yes, no doubt it would have that effect.

155. Supposing you have a rise of 100 feet in a sewer, and the temperature below was 60 or 62 degrees inside, and the temperature outside was 32 degrees, can you tell us what would be the pressure at the summit of the hill?—Without knowing correctly the specific gravity of the gases, I could not tell that.

156. Would it not be something considerable?—Yes.

157. Are you not consulting chemist to the Gas Company?—Yes.

158. You know that this matter has to be taken into account in regulating the pressure of gas in hilly towns?—Yes; I do not know what the ordinary pressure is, but it is very small.

159. Is it not the fact that unless you do regulate the pressure of gas going up hill you get an inconveniently high pressure?—Certainly. I have a very strong opinion that the sewers ought to be ventilated by distinct shafts at the highest points of the sewers, and that the ventilation should be carried out in the yard or passage drains.

160. Would you adopt any precautions for the destruction of the noxious ingredients in sewer gases before you admitted them into the air?—I think it would be too troublesome to do that; at least I am not sure about its desirability. If the sewer gases were conducted to the highest points of buildings, or nearly so, they would then become so mixed with the general body of the atmosphere as to undergo sufficient diffusion to be innocuous before they were carried into the houses or into the streets. When they escape at a very low level there are not atmospheric currents to cause a rapid diffusion to take place.

161. Are the street grids in Manchester mostly untrapped?—I do not know how many are trapped or how many are untrapped.

162. Have you ever known an instance of fever arising from people living near to an untrapped opening?—Yes, I have known fever to occur in streets where the grids have been untrapped, and which I felt strongly disposed to attribute to the escape of gases from the grids.

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163. Are you of opinion that those noxious gases would be increased in quantity or noxious quality by the substitution of water-closets?—I think that must be inevitable. The noxious gases largely arise from the presence of decomposing animal and vegetable matters, or almost entirely so, and the larger the extent to which you convey these to the sewers the greater the amount of putrefactive fermentation and the production of noxious gases in the sewers.

164. Is not urine a liquid which very readily enters into putrefaction?—Yes, very readily.

165. Do you consider that the putrefaction of urine is likely to disengage noxious gases?—I think it must to some extent do so. I think that the presence of urine in privies and ash-pits is to be deprecated, because urine is more readily disposed to enter into putrefaction than fœcal matters; and when urine once takes in that action it is communicated to the fœcal matter, and it is the putrefaction of the joint compound which gives off the most offensive gases. On that account we have provided in the ash-pits and in the privies, which it is proposed to carry out, a means of conveying away the urine from the ash-pits entirely.

166. Is there any difference in the degree of rapidity with which urine enters into putrefaction when you place it in a clean vessel and when you place it in a vessel that has already contained putrid urine?—It is sure to enter more rapidly into putrefaction in a vessel which has already contained putrid urine.

167. I suppose it may be said that a sewer would be in the condition of a dirty vessel?—Yes.

168. Have you noticed that fever cases are located in particular districts of Manchester?—Yes, in a district which is called Angel Meadow, which forms a portion of St. George's district, fever always prevails to a considerable extent, and in some portions of Dean's Gate and in the small streets running out of that place; and in some of the densest portions of the Ancoats district more particularly.

169. Are the privy arrangements in those districts peculiarly defective?—Yes, very defective.

170. Is any one of those districts in the neighbourhood of the river?—No; Dean's Gate lies at a considerable altitude above the Irwell, and Ancoats is entirely removed from the Irk and the Medlock. It is the space that lies between these places and Angel Meadow, but still it is at a considerable height above both rivers. Ancoats extends to the Medlock on one side, and Angel Meadow to the Irk on the other. I cannot say that the districts immediately verging on the rivers are more subject to fever than others.

171. Do you, in fact, find any fever nests located on the banks of these rivers, or any of the smaller ones?—I do not think that I have found it so lately, not within the last twelve months, during which time I have been officer of health. Previously to that time, speaking of my experience as a medical man, I made myself acquainted with the fever districts on these rivers; but there were other very unsatisfactory conditions that might have led to it.

172. Can you directly connect the condition of these rivers with any outbreaks of fever on their banks?—I cannot.

173. Will you state generally what you consider to be the defective arrangements contributing to fever in these particular districts?—In two of them, Dean's Gate and Angel Meadow, or the St. George's district, the houses have three storeys, and each room is let out, or in a great number of instances to a separate family; and where there is a very large number of persons in each house there is a considerable amount of overcrowding. They are occupied to a large extent by the Irish population, whose habits are very filthy, and their food of an inferior quality, the food consisting chiefly of potatoes with a little fat, and an occasional herring to improve the taste; they are also intemperate. The structural arrangements of the privies are as bad as it is possible to conceive; but at the same time the people make the matter still worse by their own habits. It cannot, indeed, be said that they make a proper use of the privies or ash-pits, for the entrances to these places

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are covered with excreta; the ashes are poured out, not into the ash-pits, but into the passages approaching to them, and they are consequently in a very disgusting state.

174. Are these privies cleaned out as often as they ought to be or as they are in other districts by the scavengers?—I do not know how often they are cleaned out, but they are often in a very dirty state.

175. Are the houses generally speaking, in the districts you have referred to, old houses?—Yes.

176. Is it the case that there is not a privy for each house?—Very rarely is there one to each house, these are mostly back-to-back houses, and the privies are at some distance, there may be two or three privies at the end of a street which all the inhabitants use, and there may be six or eight houses to one privy.

177. Is the privy sufficiently separated from all the houses?—No, the adjoining houses must suffer from the smell constantly, in some instances the bedrooms are built over the privies.

178. Is that frequently the case?—Yes, very frequently; I have reported a considerable number of them lately, and which I have no doubt the Council will deal with.

179. Are the Manchester Corporation seeking to improve the privy arrangements, and also the general sanitary condition of the city?—Yes, they are doing so with great activity, and with a very earnest desire to carry out the improvements suggested by the "Labourers and Artizans Dwellings Act." I may add that the Health Committee of the corporation meet every fortnight, and that at those meetings the condition of a considerable number of these privies is reported to them, and orders are given for their improvement; the improvements are carried out under the direction of the city surveyor so that the best mode of construction shall be adopted.

180. The corporation, in fact, has now increased powers to deal with these questions?—Yes. I may mention that a much larger number of the old ash-pits would have been converted, but from a desire which the corporation have to ascertain what will be the best form to meet the special cases, because there is no one form of ash-pit that will suit all properties. In some cases the area to be dealt with is much more limited than in others, and therefore the corporation have been desirous to try a considerable number of forms, keeping to the same principles with a view to adopting that which it was the most expedient to use in particular cases. But all this requires a little time. The Committee has existed only for 12 months, and there has not been so large an amount of alteration as might be expected.

181. I understood you to say that there are privies in Manchester in dwelling-houses, or at all events that there are sleeping rooms over privies?—Yes, in a great number of instances, but they are not in the houses, they are in the passages, which are thoroughfares, but where bedrooms have been built over them originally.

182. In how many cases do you suppose that is so in Manchester?—Probably 200 or 300.

183. Do you consider that zymotic diseases generally are increasing or diminishing in Manchester, in proportion to the population?—Looking back to the last 25 years, I do not think there has been very much change, there have been occasional exaltations of the one at the cost of the other, for there appears to be a sort of replacement in zymotic diseases; for instance, I have often noticed that scarlatina in children has declined while cases of measles have increased, and that has gone on for a time, and then been replaced by fever, and fever occasionally has been replaced by small-pox, and so on, as one has declined another has made its appearance, has increased, attained a certain acme, and then declined.

184. In this respect then your sanitary improvements have been fruitless?—I do not see that at all, but you mean perhaps with regard to zymotic diseases. Our sanitary improvements consist of improving the general health of the people, so far as we can, but rather with a future tendency. I do not think that you stop disease, except in a choleraic form, by a supply of pure water; for example, you do not stop scarlet fever, which is communicated by infection, and solely by infection. If people are found in a low condition of health, no doubt they are more disposed to take infection than they would otherwise be.

185. Do you consider than an improvement in the water supply has in itself diminished zymotic diseases of any kind in Manchester?—It is difficult to say to what extent.

186. Have you not formed any opinion?—I cannot say that it has diminished diarrhœa; it was worse last year than it had been in the last 35 years; indeed, we have never had so severe an attack of diarrhœa as last year, and therefore the rise of a disease of that kind is independent of any such circumstance as water supply.

187. Has there been any alteration in the mortality caused by cholera?—Certainly there has been a diminution. I am not prepared with figures to say to what extent; special diseases have also prevailed in successive years, but it would be easy to obtain them.

188. If any improvement is to be attributed to the water supply, would it not follow that the other conditions have rather deteriorated than otherwise, if the mortality from zymotic diseases has remained stationary?—I dare say they have; the size of the city has increased, and without any considerable improvement in the ash-pit and privy system. Thus, they have got over a great number of acres, a large and dense population with constantly unfavourable circumstances surrounding them. I think that the mortality of the city is very largely dependent upon its size, as well as the density of the population.

189. Is there any refuse discharged from the gas-works in the city of Manchester into any of the rivers?—I do not think there is, unless what is carried accidentally from the surface of the soil at one of the stations. The other station is at a considerable distance from the river, and there is certainly nothing that can pass from that station to the river. I do not think, except by the merest accident, that anything can go from the other stations, because it is opposed entirely to the interests of the Gas Company that any escape should take place; for instance, the tar is diposed of and fetches a considerable price, and the gas water is also sold at a considerable price.

190. What are the purifying materials?—The purifying materials are oxide of iron, copperas, and lime.

191. Do they use a large quantity of lime for purification?—It varies very much, but I should think they do not use a very large quantity of lime, and that it is chiefly oxide of iron and copperas that is used.

192. What is afterwards done with the lime that is so used?—It is carted away by the farmers as manure mixed with the soil, and it is exposed to the air until all the sulphurets are converted into sulphates.

193. What, in your opinion, would be the effect of superseding the privy and midden system in Manchester by the water-closet or by the tank system?—I think that the effect would be to foul the river to a very enormous extent, and to increase the putrefactive action which is now going on in the river which may be comparatively harmless now, but would become a source of injury if contaminated with all the fœcal matters of Manchester.

194. Will you be good enough to state whether this is matter of opinion, or the result of any experiments which have been made, that you think the river would be in a very much worse condition?—It is matter of opinion. I have made no experiments on the subject.

195. You are well acquainted, I presume, with the country about Manchester?—Yes.

196. Are you well acquainted with the lands which are below Manchester?—Yes, I know them pretty well.

197. Is it in your opinion practicable to convey the sewage of Manchester on to those lands for the purpose of converting them to agricultural purposes?—The question is one of very considerable difficulty, of course I think that there would be considerable engineering difficulties in getting the material to the land. As to whether if it were got there, the land would be improved. I consider that land like that at Chat-Moss might be considerably improved by the sewage of Manchester, if it were previously a little solidified by marl.

198. You have spoken of the distinction between ash-pits and cesspools as regards their influence upon health. As a matter of fact, are the privies and middens of Manchester more properly described as cesspools or as ash-pits?—A considerable number of them are moderately dry, and therefore could not be called cesspools; there are some ash-pits which contain liquid matter, they are in the condition of cesspools.

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199. Is there not a larger number that are in point of fact wet?—Yes, but I should not call an ash-pit which contains a quantity of ashes a cesspool. If it contained a quantity of liquid fœcal matter, undoubtedly it would be a cesspool.

200. Are they not being converted from the one to the other, from cesspools into dry pits?—Yes. I will hand in these tables, showing the death rates.

The witness withdrew.

Mr. John Wallworth examined.

Mr. J. Wallworth.

201. (*Mr. Heron, through the Chair.*) Are you superintendent of the scavenging department in Manchester?—Yes.

202. How many privies and ash-pits are there within the city?—From 38,000 to 40,000.

203. You are speaking of privies and ash-pits?—Yes.

204. How often on the average are those privies and ash-pits emptied?—On the average they are emptied about twice a year, but some are emptied weekly, some monthly, and some only once a year, because they do not require it. In the last year 82,115 privies and ash-pits were emptied, and of those there were 56,769 which were emptied without any notice from the inhabitants.

205. That was owing to the system of inspection, was it not?—Yes.

206. Are the privies and ash-pits emptied by men employed by the Corporation and under your direction?—Yes.

207. How many inspectors are engaged, either during the day or during the night, in examining the state of the ash-pits?—There are four inspectors, whose duty it is specially to attend to the emptying, and they can have any ash-pit emptied which they see requires it without waiting for notice. We have also four inspectors with the scavengers, and that is also a portion of their duty. Scavengers are required to give notice to the inspectors when they see any ash-pits full. The police and nuisance inspectors are also instructed to report to our office any ash-pit that requires emptying.

208. Is it not the practice that as soon as any information is received through any of these officers or from the tenants of the houses themselves, that an ash-pit requires emptying, to send your men forthwith to empty that ash-pit?—Yes, that is so.

209. In what state are these ash-pits; are they dry, or otherwise generally?—Twenty-two years ago the ash-pits were in a very bad condition; many of them were very wet; there are cases where the grids are stopped up, and cases where slops are thrown down by careless people, but the ash-pits, as a rule, are very much improved, and we generally find them in a fit state to empty; they generally are dry.

210. (*Mr. Morton.*) Is the whole of the stuff that is taken out of these ash-pits used as manure?—No; in the course of last year we threw away as much as 55,000 tons as being totally unfit for manure.

211. What was done with that?—It was thrown away at spoil places to fill up.

212. Did the 55,000 tons come out of the ash-pits?—They did.

213. The wet portion of it would be available for manure, and the other part would be thrown out upon spoil places?—Yes, the place we have is at Collyhurst.

214. Where is the separation between the two portions made?—At the ash-pit.

215. Do you employ two sets of carts?—No; two men constitute a party, and they go into the passage behind a house, one man has a wheel-barrow, one is in the pit throwing the stuff out, and the other separates the rubbish and he wheels the rubbish out and puts it on one side, and he puts that which is manure on the other, the cart is then brought to take the one portion to the depôt, either for sale or otherwise, and the other portion to the spoil place.

216. You say that two men constitute a party?—Yes, and each party of two has so much work to do every night.

217. How many couples of men are engaged on that work altogether?—There are about 100 men constantly employed getting out this stuff, or about 50 couples.

218. How many pits has each party to clean out in a night?—That depends upon the quantity to be removed, but every two men are expected to remove six cart loads per night.

219. Can you state what is the average weight of the stuff which is taken out of a pit?—I can scarcely answer that question accurately, because some of the ash-pits are very large, and some of them very small, but the weight is perhaps not more than a ton taking them on the whole.

220. (*Chairman.*) What is the size of the largest ash-pit?—Some few of the old pits will hold five or six cart loads.

221. Is a cart load about a ton?—It is a ton and a half.

222. (*Mr. Morton.*) Are those the pits that are cleaned out once a year?—No; those are more frequently cleaned out once a week, sometimes all the refuse in the neighbourhood is thrown in, such as shavings, chips, cinders, unburnt coals, broken mugs and vessels, and frequently bricks.

223. In the case of rows of houses standing back to back, where there may be 20 or 30 privies on each side, and a central gangway down, when you remove the contents, do you cleanse all those privies at once, or do you carry on your operations after serving individual notices?—The information that we receive from the public leads us to go and look at these places, and we sweep the whole of them if we can, but where the passages are narrow, we cannot cleanse them all in one night, because only one wheel-barrow can be worked through the passage, but the rule is to sweep them out when we can do it.

224. Then there may be cases in which for two or three successive nights the scavenging cart will be there?—Yes.

225. (*Mr. Heron, through the Chair.*) Do you resort to any means of deodorizing at the time of emptying the privies?—Under the direction of the health officer we have adopted the plan of using carbolic acid where ash-pits have been emptied and on the passage.

226. (*Mr. Morton.*) How do you use the carbolic acid?—In the form of powder, and last year we had men specially drafted out to sprinkle it wherever the material had been laid.

227. Did you use carbolic acid and lime?—No, the health officer objected to lime.

The witness withdrew.

Mr. Thomas Greenwood examined.

Mr. T. Greenwood. 27 April 1869.

228. (*Chairman.*) Are you a member of the Manchester Corporation and also Chairman of the Medlock Improvement Committee?—Yes.

229. I believe you have forwarded to the Commission a letter on the subject of the floods?—The Committee Clerk of the Corporation forwarded to each member of the Commission a copy of the letter which I addressed to the Corporation.

230. Is there anything further you wish to add to what is contained in that letter?—I am not aware that there is anything else very special with reference to that matter that I could bring before the Commission.

231. We have then in the letter, all that you have to state on the subject of floods?—I think so.

232. (*Mr. Morton.*) Is there anything further that you would wish to state?—I am not aware that there is.

The witness withdrew.

Joseph Heron, Esq., Town Clerk, further examined.

J. Heron, Esq.

233. (*Chairman.*) Is there any further evidence which you wish to bring before the Commission?—I have ascertained by inquiry that we have eight permanent sub-inspectors, who are employed in inspecting the internal water fittings, both as to their quality and also the state of their repair, in order to prevent a waste of water. I wish also to correct one of the answers given as to the power possessed by the Corporation over the Medlock; these only extend from the Pin Mill weir at one end, at the eastern end of the town, to Birley's weir on the western side of the town; in fact, we only obtained power to interfere with the river between those two weirs, finding that it was impossible to make any arrangement except at an expense which the Corporation did not feel justified in incurring, nor would the owners have been prepared to pay their proportion of that expense if there had been any attempt to interfere with or get rid of the weirs.

234. Your power extends further, does it not, if you choose to exercise it?—No; only in that district.

235. Have you not power over the whole river?—No; only in that district. We take special power to carry out the works which are indicated by the plans which have been deposited; and the owners of the land and property on each side of the river consented to contribute a proportion of the expense, to be limited, I think, to 25,000*l.* With regard to the supply of water, it may be stated that the population supplied by or through the instrumentality of the corporation works amounts to about 700,000; take the maximum supply per day to be 15,000,000 gallons. That would make it 21½ gallons per head per day; then, deducting one-third for trading purposes, which is the estimated proportion of the total quantity which is consumed, there would be left about 14 gallons per head as the quantity consumed for domestic purposes. That is the maximum in the summer time; and it is in connexion with the subject which was referred to yesterday, viz., the water-closets, that the water question becomes of such paramount importance, because here we are able, with the population I have mentioned, to carry on, using only about 14 gallons a head per day; whereas, under another state of circumstances, we might get up to 40, or even 50 gallons a day. The consumption of water is increasing at the rate of about a million gallons a day per annum now.

The witness withdrew.

Adjourned till to-morrow, at Salford, at 11 o'clock.

The Town Hall, Salford.

Wednesday, 28th April 1869.

PRESENT:

Major-General SIR WILLIAM DENISON, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

Thomas Davies, Esq., Mayor of Salford, examined.

T. Davies, Esq.

236. (*Chairman.*) Mr. Mayor, any views that you may have as to processes or modes of cleansing sewage, or any statements of fact that you may wish to give us, we shall be glad to receive?—The Corporation of Salford have been for a long time dissatisfied with the state of things in this borough. In 1863 and 1864 they had a scheme with reference to the river. It met with very general approval. It was proposed to have a sewer to intercept the whole of the sewage from Salford and Pendleton district and take it to some point outside the borough for the purpose of utilising it. We want an intercepting sewer for another purpose. In Broughton and in the low lands there is no adequate fall for the sewers. In Salford too there is a great quantity of low-lying land nearly upon a level with the river, and we cannot get an adequate fall for the sewers. The bed of the river silts up two to three inches every year, and is now so much raised that it is nearly on a level with the outlets of the sewers, so that whilst a large flood in days gone by would not have done much mischief, an ordinary one now backs up the sewers and sewage matter, and floods the houses on the low lands. That evil is going on continually. During the very last flood I saw immense quantities of cinders coming down from the high parts of the river. Of course a good deal of that matter had sunk, but great quantities were floating and would be ultimately arrested by the weirs, and so bank up the river. Mr. Bateman in his plan for the prevention of floods estimates that some 33,000 tons of cinders and débris from manufactories and excavations from buildings are passed into the river every year; but 33,000 tons per annum is a very moderate estimate. I am of opinion that there have been not less than from 50,000 to 60,000 tons of this description of refuse poured annually into the river Irwell between the source and its junction with the Mersey. Since the Corporation have had control of the river they have prevented encroachments on it and also people putting solid matter into it within their jurisdiction. The Mersey and Irwell Navigation Company have, from

facts which we have presented to them, employed an inspector. The manufacturers higher up the stream pour in an immense quantity of refuse and half block up the river, hoping that rain may come to their relief and take off those thousands of tons of refuse. The sewage from all the towns on the river and its tributaries flows down to us, and during the drought of last summer we found that there were immense banks of mud in the bed of the river. These consisted for a certain depth of the foulest matter, throwing up emanations that were of the most noxious description. The Corporation estimate the cost in dealing with this great evil at from 50,000*l.* or 60,000*l.*, and I do not think that the inhabitants, or the corporation would hesitate, in going to a very large expense to prevent sewage going into the river, and introduce a better system of sewerage throught the borough. The great difficulty was, when we were considering the matter in 1863-4, what should we do with the sewage, and we decided to rest until the legislature made it imperative upon the towns upon the banks of the river to prevent sewage going in, and gave corporate bodies, power of going into the country and by means of conduits carrying the sewage on to the land for the purposes of irrigation. Doubtless you have examined sewage from the various outlets into the river, and will be able to tell by analysis whether it is fit to go on to the land or not. The Corporation are perfectly prepared to undertake the full share of any obligation which may be laid upon them by the legislature whenever a scheme is matured for the purpose. There is only one other matter I wish to mention. If storeage reservoirs were made to contain the floodwater, this might be reserved until times of drought, and then allowed to flow down to supply the deficiency in the volume of the river. This has been mentioned before and I think it is not unworthy of consideration.

T. Davies, Esq. 28 April 1869.

The witness withdrew.

Dr. Edmund John Syson examined.

Dr. E. J. Syson.

237. (*Chairman.*) Are you Medical Officer of Health for the Borough of Salford?—I am.

238. Have you any statement to make in addition to what you have already communicated, if so, we should be glad to hear you?—The first remark I would make relates to the number of privies. In my report I said that their number was by no means small, in fact there are too many, and I think when I explain it you will see what I mean. We find this, that unless you supply a separate privy to each house, and the privy is also in such a situation that the inhabitants in the other houses cannot use it, the privy becomes used as a receptacle for all sorts of filth. We find that by diminishing the number of privies we have increased the cleanliness. The mayor expressed some doubt as to whether the sewage from a town like this, consisting of such an extraordinary admixture of matters, can be utilized for the purposes of vegetation. I believe that one argument which is used by the opponents of irrigation is this, that although you may still keep up the supply of sewage, yet you exhaust the land of its salts and other properties. It strikes me that the mixture coming from a town like this may supply in some measure all that deficiency. We shall pour in a great quantity of soap suds, and a certain amount of lime and potash, and, I am afraid, a little arsenic also. I look very hopefully on the sewage from a town like this being utilized even with greater benefit, and greater after-effect, than the sewage from a purely agricultural district or country town.

239. We should be very glad to have anything specific from you as to whether the present state of the river produced any deleterious effect on the general health of the town?—It is uncommonly difficult to fix any specific charge upon the river. I account for that in some way in this manner, as a rule dwellings are not collected immediately on the banks of the river, and therefore it is a question whether we ought not to look on the general unhealthiness of the town in some degree as the result of the foulness of the river. We are completely enclosed here on three sides by the river. In summer time we consider, generally speaking, the stink from the river to be injurious. If a man caused a great stink in his yard his neighbour would apply to our health committee and request them to enable him to put it down, and, in the same way, I take it that a town as an equal right to say,—Here is this river causing a stink round us, we look to you to put it down. Why not give the river the credit of being a great nuisance? With regard to the branch streams, I think that a case could be made out as to their unhealthiness, for instance, in the case of the Broughton Grove paper works, there is a small stream supplying those works into which the drainage of Cheetham and of various other townships besides our own enters. I may state that a row of houses has been built against a reservoir formed to collect this water, and the year before I was appointed fever visited those houses to a very great extent; the stink arising there is so strong that nobody would have any hesitation in saying at once that it must be injurious, but I cannot speak to any other district lying so immediately near the river.

240. As to this particular row of houses, does the fever continue, or is it generally a place to which you may trace fever?—We have not had any fever there since.

241. A suggestion was made, and we went to Edinburgh for the express purpose of ascertaining whether a stink was in fact unwholesome, and we rather got evidence to the effect that it was not?—I had the other day testimony in support of that; some people were living on ground which was a constant generator of sulphuretted hydrogen, and I was told that they were peculiarly healthy. I should have been personally very much pleased if we could have brought home a direct case to the river, but this fact remains. Complaints reach us that the river is constantly pointed to as a source, at least, of very great discomfort. If we stop there we ought to try and promote the comfort of the people, and that is quite case enough. I cannot see that any insuperable difficulties lie in the way of adopting a scheme of irrigation; of course these schemes are now on their trial, and it may be afterwards known, when we have laid out a considerable sum, that less improvements have taken place than the public might have expected. As a medical officer, I am somewhat looked to, to put down the death rate, and there I feel my great difficulty. While we have these constant fever exciters, viz., imperfect ashpits and middens, in our midst, our simply going and disinfecting them from time to time does not remove the cause, or the exciting cause of the evil. If you calculated the amount of money that a perfect disinfection would cost in a town like Salford, where we have so many ashpits and drains causing smells, I think that the money would be better laid out upon some permanent works than in going round and disinfecting. Carbolic acid is used here as a disinfectant, and we have almost abandoned chlorine in cases where it is brought in contact with people suffering from fever. The use of the rivers and streams is certainly essential to the carrying on of the industry of the district, but their abuse is by no means essential. Their use consists of, 1st, power; viz., in turning water wheels, supplying steam engines, &c.; 2nd, use as water for manufacturing purposes, for dyeing, &c.; 3rd, as a river highway. In the first case it is evident pure water would answer equally as well. In the second case pure river water would be a great advantage, the water being at present unfit for use unless previously filtered. The river water when pure produces better blacks and some other shades than does the town's water or any spring water. In the third case

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it would be essential to ensure the proper return of the used water into the river. The obligation of returning pure water into the river would only entail certain mechanical re-filtering or chemical precipitation processes on the users of the river water, and this would not only be a fair charge for the use of such water, but in all probability would eventually prove a source of profit. For instance, all soap suds from works used to be turned into the river. Now these suds are all economised and the streams spared. The effect of the floods is certainly injurious to the low parts of the borough of Salford. At present about 200 houses are empty in Lower Broughton; previously to the late flood all these were occupied, and, were all fear of another flood removed, there is little doubt but that they would soon be re-inhabited. The corporation of Salford think that an easy and summary mode of punishing owners of works adjoining the river and others for fouling the stream or emptying their refuse and ashes into it would be the best means of ensuring the purity of the water. It is suggested that a general conservancy board might be formed. At present though the corporation have obtained several convictions for polluting the river, they have failed on purely technical grounds in many cases. Tips exist at several places on the river; from these tips the refuse is regularly shot into the river in flood time. I have been trying to take a house-to-house census of the borough of Salford, not yet completed, but with this result, that in the Crescent Ward we have 6,116 houses occupied and 342 empty ones, or in course of building, and 96 cellar dwellings. The population in those 6,116 houses and 96 cellar dwellings is 31,176. I believe that the Registrar-General's estimate for the same ward is a few hundreds more than half that. In the Pendleton district the census is not yet completed. I have not been able to go through the returns myself, and I cannot give them with authority.

242. That is an average of about five to a house, is it not?—Yes, rather over that.

243. Are there any houses with 10 people in them?—I will show you how we may arrive at that afterwards. In the Pendleton district I have already got the population of 4,789 houses. The people living in those houses amount to 24,798. In the Broughton district, that is our west end, there are 2,610 houses, 170 empty, and four cellars. The population in those 2,610 houses amounts to 13,457. In the Salford district I have not yet taken the census; but I took Pendleton, Broughton, and the Crescent Ward of Salford, and that leaves us the old town to deal with. Then if I take the number of houses in the old town and subtract this other return from the estimate that will give me the population in the densest part.

244. In taking an account of the houses do you consider a factory as a house?—No; these are dwelling houses every one of them. We have an idea here that we are considerably under estimated with regard to our population, and that of course will to a certain extent affect the death rate.

245. Have you in your table the number of houses in the Crescent Ward?—Yes.

246. Have you the area of that district?—I can obtain it.

247. (*Dr. Frankland.*) I see from your annual return that there is a great prevalence of zymotic diseases in Salford?—Yes, there is.

248. What are the principal diseases of that character that you suffer from?—Scarlet fever, typhus, and typhoid fever.

249. What in your opinion is the cause, or what are the causes to which those diseases can be attributed?—I think that the exciting causes, as I stated before, may be found in the bad drainage and imperfectly trapped drains, and in the middens and ashpits.

250. Have those diseases increased of late, or are they stationary?—Last year there was a considerable increase in the number of the zymotic diseases. In 1868 we had 373 deaths from bronchitis compared with 483 in 1867; 281 cases of phthisis in 1868 as compared with 333 in 1867; 367 cases of diarrhœa in 1868 compared with 286 cases of diarrhœa in 1867; 124 cases of marasmus as compared with 201 cases of marasmus in 1867; 193 cases of convulsions as compared with 236 in the previous year 1867; and 242 cases of fever as compared with 137 cases in 1867. So that we find that all other diseases have considerably diminished while fever has increased. I look upon diarrhœa as fever here, for this reason: when we analyse these returns we find that these cases of diarrhœa occur almost all in babies; in fact, we have no deaths practically from diarrhœa in adults, and to attribute this diarrhœa in babies to unripe fruit and all that sort of thing is, in my opinion, absurd. I have spoken to many medical gentlemen about this, and they all agree that diarrhœa is a kind of typhoid fever, and that the diarrhœa is symptomatic.

251. Do you attribute the increased prevalence of these forms of zymotic disease exclusively to the bad condition of the sewerage?—Last year I do, and for this reason, that this increase in the death rate all occurred in one quarter, the third quarter of the year, the hottest quarter, just when the rain came again. That at once set all our drains and all our cesspool and ashpits reeking, and it was curious to note that immediately when the rain began our death rate went up.

252. Do you consider that the neglect of the children by their mothers in Salford, in consequence of their employment in the factories, has any influence upon the spreading of these diseases?—It has this influence, that they are crowded together, and they are farmed. I consider that the neglect of mothers of their offspring has a great effect in causing an increase in what is termed diarrhœa.

253. Should you consider it possible that scarlatina could be produced simply by the neglect of a parent?—No, I think decidedly not.

254. Are there particular districts in Salford in which fever cases are specially located?—Scarlet fever last year was peculiarly strong in Pendleton, which is situated rather high.

255. Are there any districts that have been specially distinguished for fever outbreaks close to the neighbourhood of the river?—I ought to state that during the last year the low ground of Broughton the part that was flooded was an unhealthy part of Broughton, although Broughton itself was comparatively healthy. Had it not been for that low ground, Broughton would have stood out still more conspicuous for its healthiness.

256. Although part of the low ground which lies next to the river was more unhealthy than the portion of ground at about the same level that was further removed from the river, was there any difference in the unhealthiness of the place. I presume that the portion of land now referred to was flooded?—It was.

257. I want to know whether the bad influence extends indiscriminately through the districts flooded, or is it more confined to the bank of the river?—There are no houses immediately situated on the bank of the river, but this ground to which I have referred is in close proximity to the river, it is on made ground that those houses are built, and therefore the ground is very pervious to water.

258. Do you consider that the water supply of the town has anything materially to do with the prevalence of zymotic diseases?—I think that a bad water supply may encourage zymotic disease.

259. Do you consider the present water supply of Salford is a good and satisfactory one?—I have never analysed the water myself. The water which I get in my own house is good to taste though very dirty. During the prevalence or outbreak of fever several complaints were made of the supply of water to the Pendleton district. Two or three letters appeared in the paper, calling attention to the fact that this water was stinking and complaints were made about it.

260. The water supply was I believe changed in or about the year 1851?—I believe it was.

261. Have you any statistics to enable you to state whether the mortality from those causes was smaller or greater before that change took place?—I have not seen any myself I think that the Mayor who was practically the officer of health for that period might be able to say.

(*The Mayor.*) We have no statistics. I was not concerned in sanitary matters at that time, and I do not remember that we have any returns which would bear upon that question.

262. (*Dr. Frankland to the witness.*) Is there a probability that the increase of those diseases has anything to do with the change of the water supply, supposing them to have increased?—That is, in other words, can I attribute zymotic diseases to what is stated to be pure water?

263. Yes?—No.

264. Is it your opinion that the present prevalence of zymotic disease has anything to do with the present water supply?—No.

265. Do you connect any of those diseases with the process of emptying the middens which is carried on in Salford?—I have received a great number of complaints as to the discomfort which is caused by emptying the middens, but I have no evidence of the actual disease being encouraged by the emptying of them. It is a source of discomfort, no doubt.

266. Mention has been made of the emanations from chemical works: do you consider that gaseous emanations from chemical works generate zymotic disease of any kind?—No.

267. Or promote it?—No.

268. Can you tell us what is the area of land to each head of the population in Salford?—I have not calculated that.

269. What do you consider to be the best mode of removing fœcal matter from towns?—That is rather a difficult subject to answer, but I may say this, that I consider the quicker the mode the better, and I have admitted in a discussion at the Sanitary Association, that where a water closet is mechanically perfect, I look upon it that it is perfect, in theory; but I find from experience that water closets, and the drains connected with them, are laid out so badly that they themselves are apt to become a source of annoyance and discomfort.

270. Would that objection extend to tank or trough closets?—I have a strong prejudice against trough water closets.

271. On what ground do you object to them?—We had one at a school where I was, and I may say that it was a frightful place, and there is one at the workhouse now here. I have been in it and it smells; it wants emptying frequently to keep it sweet.

272. Is it regularly emptied every 24 hours?—Yes.

273. Do you consider it advisable that the excrementitious matters should be removed from the population while they are still fresh?—It would be better if they were so removed.

274. Do you know of any plan by which that could be effected, in a dry way?—I have carefully considered the various dry plans, and I have seen none that are perfect. The plan adopted in Salford is called the Salford plan (but it is rather Mr. Beach's, the property owner and agent), is a great improvement on the old privy and ashpits; but it is by no means perfect.

275. Taking the ordinary excrementitious matter, such as the solid fœces and the liquid urine, should you say that the danger chiefly arose from the solid portion?—Yes, I should say so, rather than the liquid portion.

276. Would you have no fear of the urine becoming putrid and generating noxious gases?—I do not think that urine should be left to become putrid; if you leave urine it must certainly become putrid very soon.

277. Is it the case that urine placed in an unclean vessel, or admitted into contact with something that has previously been in contact with fermenting urine, is more liable to become putrified?—It is a start given to it as it were then.

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278. Have you any such condition of things as that prevailing in the sewers themselves?—The sewers of course are dirty vessels.

279. Have you yourself considered any scheme of irrigation with regard to the sewage of Salford?—I do not know the district sufficiently well round here, but I have seen a large quantity of vacant ground unproductive, it is called Chat-moss, and I should look to that as a place to conduct it to. I also think some proposition might be made by which the farmers could tap this liquid manure, if they chose, as it passed near and put it on their land.

280. I think you have stated that it might be possible to apply the water of the river itself to the purposes of water-closets, supposing them to be properly adapted, can you explain how that would be done?—By a mere scheme of storage reservoirs higher up.

281. Would that involve a separate water supply to each house for that purpose?—You could not connect it with your drinking water, it must be kept separate. I look upon it as preferable to the other scheme of utilizing our street sweepings to disinfect the privies.

282. Have you had any experience as to the salubrity of filtered as distinguished from unfiltered water supplied to the population?—No.

283. Has the density of the population in Salford increased of late years?—It has increased. The returns which I have just given you as to the number of houses show that in one district alone in the case of 342 houses which are either empty or being built, as soon as they are finished they are inhabited. In the Broughton district there are 170 houses empty and 150 almost of them are empty in consequence of the last flood, that is one strong fact against floods.

284. (*Mr. Morton.*) With regard to the question of sewage irrigation, you have stated that possibly the sewage may ultimately exhaust the land to which it was applied?—I stated that that was the argument advanced by anti-irrigation people.

285. Is that owing to the possibility that the sewage may not contain all the ingredients that the plant requires?—Partly so, and partly because the deodorizing power of the soil might become checked, as it were.

286. Are you not aware that the fertility of the soil is maintained mainly by the excrement from cattle and sheep that the farmer keeps on his farm?—I was brought up on a farm, and we had to keep a great stock of pigs to keep up our supply of manure.

287. I mean cattle, sheep, and pigs?—Yes; but pigs feed on other produce besides that which is produced by the farm. We bought food for them, to convert this food of the pigs, as it were, into manure.

288. Man being omnivorous, his excrement is more likely to be a complete compound than the excrement of sheep or cattle or pigs; ought it not therefore to be a more perfect manure?—Yes.

289. Are you aware what becomes of the dry portion of the contents of the privies and middens?—It is thrown on any waste land that we can get until the owners of the adjacent property give us notice to go somewhere else.

290. Does building follow upon the land which has been thus covered or filled up?—Building certainly does follow on it.

291. Are the ashes perfectly dry ashes?—They cannot be perfectly dry. I believe that the scavengers take all the refuse out, and at the same time that it is being carted away of course it is being thoroughly mixed up with the other in process of emptying.

292. And the building of a house on this foul ground of course is an unwholesome proceeding?—Decidedly so.

The witness withdrew.

MR. JOHN KENWORTHY examined.

Mr. J. Kenworthy.

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293. (*Chairman.*) Are you superintendent of the scavenging?—Yes.

294. (*Mr. Morton.*) Are you aware of the number of privies and middens that are cleared out under your superintendence?—Not exactly from memory. By referring to the book I can tell.

295. It is about 11,000, I think. Do you take charge of all the three districts which constitute Salford, Pendleton, and Broughton?—No, only the Salford district.

296. I see that 26,000 tons of stuff are collected?—Yes.

297. What proportion of that goes as manure, and what proportion as dry stuff?—It all goes as manure. The rubbish is separated from it.

298. Is there not a lot of rubbish in addition to it?—Yes, from 1,000 to 2,000 tons.

299. The rubbish I presume comes from the ash-pits?—It does.

300. Is it separated from the wet stuff at the time that the ashpit is cleaned out?—Yes.

301. Is that done in the night by the scavengers?—Yes.

302. How many constitute a party?—Three. One gets the stuff out, and the others wheel it away.

303. Do they throw out the dry stuff first?—They begin at the top take the dry stuff out and the wet afterwards.

304. Are those middens drained?—Not all; there are many undrained.

305. Then very often they must be in a bad condition?—In summer the stuff is very wet indeed.

306. Are the middens then full of water?—Yes.

307. Do the men get up to their knees in it?—Some pits vary from a foot to three feet in water.

308. Are the middens water-tight?—They are.

309. How often are those middens and privies cleaned out on an average?—About from four to five times a year, in accordance with the size of the ash-pit.

310. What is the average size of an ash-pit?—The cubical contents varies from about six to thirty-six feet; the average is about twenty-two feet.

311. What is the largest sized pit that you have?—I cannot say; there are some that will hold about 11 tons.

312. What is the weight of a load, a ton and a half?—A ton and three-quarters.

313. Is this stuff carted to a yard?—Yes.

314. Have you more than one depôt?—No; the contents of the middens are carted and deposited in a boat and taken away by canal next day.

315. What do you get for it?—It varies from 1*s.* a ton, which is the average price now.

316. Is that the price at the boat or at the yard?—Yes.

317. Does the farmer pay the expense of carriage?—He does.

318. How far is it sent?—Some portion of it is sent nearly as far as Liverpool; that is the longest distance.

319. Do you know the average quantity that is put on an acre of land?—I do not.

320. Are these privies cleaned out in consequence of individual notices received from the owners or occupiers of the houses?—Not all; those that are locked up remain till we receive notice. We cleanse every fortnight from 800 to 1,000 pits without notice, and about 300 or 400 with notices.

321. Are there instances of streets with rows of houses back to back, with a privy to each, abutting upon the passage between the two rows of houses?—We have many that abut upon the passage between houses, but there are two houses to a privy.

322. What is the largest number of privies to a single passage?—They vary from four to 30 or 40.

323. Are those 30 or 40 cleaned out at once, or are they cleaned out upon individual notices?—We clean the lot in a passage altogether.

324. Are you two or three nights at one passage cleaning out privies?—Yes.

325. Are any means taken to diminish the nuisance when a large number of privies on one spot are cleaned out?—Yes, we use chloride of lime as a disinfectant.

326. Are there any complaints from the people in the locality when you are at work for two or three nights together?—In the middle of the passages there is no nuisance, but those that are at the ends suffer from and complain of it.

327. In passages with two outlets, do you work them at both ends?—Not all.

328. Are you bound to clean down the passages?—We are bound to clean all after emptying.

329. I suppose you do not slush it with water?—No.

330. How many men are employed under you in the night scavenging?—Forty.

331. How many loads is each party expected to take away in a night?—The quantity varies from 7 tons to 10 tons each pair of men. Some nights we average 100 and 120, and some not more than 80 tons. It depends upon the length and position of the place, and the difficulty of getting out.

332. Do your men suffer in health from doing this kind of work?—No.

333. Have you known of any cases of epidemic to occur?—We have men that have been working for us for the last 40 years, and they have been very seldom sick.

The witness withdrew.

MR. JOHN BOWDEN examined.

Mr. J. Bowden.

334. (*Dr. Frankland.*) Are you surveyor to the borough of Salford?—Yes, to the Salford district.

335. Can you tell us the drainage area of the sewer that empties itself at the Crescent?—I will furnish that to you.

336. Also the drainage areas of the following Sewers; Regent's Road Bridge, Prince's Bridge Road, Ordsall Lane, and Woden Street?—Yes.

337. Do you know the position of those sewers, and something of the districts that they drain?—Yes.

338. Do you know anything in connection with any of those sewers which would lead you to believe that the sewage was exceptional in quality?—No.

339. Do you think that they fairly represent the sewage of Salford, or could you suggest any others that would more fairly do so?—There are 19 in the Salford district.

340. If there is nothing peculiar in those six, would you expect to find anything different in the remaining 13?—Nothing particular.

341. Do you think the sewage from those fairly represents the average drainage from Salford into the river—Yes.

342. Do you know whether the Crescent sewer drains water closets or privies?—Chiefly privies.

343. Is that the case with the Regent's Road Bridge Sewer?—Chiefly ash-pits and privies.

344. You say that all those sewers are in what may be called the privy or midden districts, with very few watercloset?—Yes, there are very few watercloset.

345. How do you consider that the water that is supplied to Salford finds its way into the river?—By the sewers. In many cases the house drainage in the older portion of the borough is very defective.

346. Where do the slops go?—They are allowed to percolate in many cases owing to the deficient surface drainage.

347. Do they soak through into the sewer?—Yes.

348. What is the mode of construction in the drainage pipes in use in Salford?—What we use now are the glazed circular socketed pipes; we have taken up the butt joints in many instances.

349. Do they allow of the soakage of the sewage through the joints?—Most decidedly.

350. Have you given your attention to the subject of the water supply to that part of the town that uses watercloset in contradistinction to that part of the town where middens are in use?—I had great experience in Preston previously to coming to Salford, and we had there a considerable number of watercloset. In one or two instances we converted the privies into watercloset in some of the worst localities, and found them to be very beneficial.

351. What do you consider would be the increased quantity of water necessary in Salford per head, supposing watercloset to be substituted for the present privy system?—It would not be increased more than 10 per cent.

352. (*Chairman.*) That is, supposing that 20 gallons are being supplied to each individual now, you think that two gallons more would be sufficient?—Yes, quite.

353. (*Dr Frankland.*) We are told in your return that so far as is known there are no privies within dwelling-houses. It was given in evidence yesterday in Manchester that in certain cases people sleep over privies, although they can scarcely be said to be in dwelling-houses; are there any similar cases in Salford?—Yes, very many.

354. How many do you think?—From 200 to 300.

355. Is the sleeping room over the covered part of the privy or over the midden as well?—Over the whole of it. Our Corporation now have full power to remedy these evils. We are now reconstructing those privies on the dry principle, which no doubt is a very great improvement on the original plan.

356. (*Mr. Morton.*) What is the nature of the alteration?—The ashpit is now made directly under the privy, according to Mr. Beech's plan.

357. You do not remove the privy; it is still where it was; but you alter the plan of dealing with it?—Yes; we reconstruct it, and get the ashes thrown directly upon the faeces.

358. Do you know the land below Salford and Manchester along the sides of the river?—I am not particularly acquainted with it.

359. Or the land at the junction of the Irwell and Mersey?—No.

360. Do you know the difference of level between the land here and there?—No.

361. Do you know the fall of the river and the level down to that point at Mode Wheel?—Yes.

362. What is the difference of level?—About 12 feet.

363. How many miles is it from Broughton Bridge to Mode Wheel?—About four miles.

364. What fall would your sewer require?—One in 1,250.

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365. That would be about four feet a mile?—Yes.

366. Would you not want a greater fall?—Yes.

367. Where do you start, below the surface; what is the average depth of your sewers?—I have a section here which shows that it has as large a fall as can be got to take the existing sewers.

368. Is it proposed to lift it to the surface of the water there?—No; it lifts it about eight feet above the ordinary level of the river below Mode Wheel Weir; we start above the surface of the water here (*pointing to the section*).

369. Do you lift it eight feet above the level?—Yes.

370. Then you lift it to the level of the ground?—Nearly so.

371. (*Chairman.*) What height above the Ordnance datum?—I think about 100 feet.

372. (*Mr. Morton.*) Have you considered how many acres are needed for cleansing the sewage, supposing an irrigation plan were adopted?—No; we have not gone into that matter. There is a committee appointed to consider the question of an intercepting sewer, and I was directed this morning to prepare information of that kind for the committee.

373. I presume you know that the area which could be fertilized by your sewage and return you a profit, and the area which would be all that was needed to cleanse it are two very different things?—Certainly.

374. 36,000 acres might be needed for 370,000 people if the object where to get the greatest benefit from the use of their excrement; but 3,700 acres or less might be all that was wanted to thoroughly cleanse the sewage?—Yes, I think there is no doubt that we could get any quantity of land about Chat Moss and the adjacent lands.

375. Do you know what the difference of level at Chat Moss and the adjacent land is?—It is pretty nearly all on a level.

376. As a matter of fact, are not the mosses higher than the adjacent land; they sink when they are drained, do they not?—Yes.

377. Is the distance that you spoke of in a straight line?—Yes; that is following the line which has been laid down for an intercepting sewer. The fall of the river which I gave you is the difference of level between a point at Broughton Bridge and Mode Wheel Weir.

378. (*Dr. Frankland.*) You spoke of an improvement in the privies and ashpits in those bad districts, does that improvement involve the abolition of the sleeping rooms over privies?—No; the object has been to try, if possible, to retain the sleeping rooms by carrying a shaft right through it to ventilate the privy below, that ventilating shaft is taken outside wherever we find it practicable to do so.

The witness withdrew.

MR. JAMES FLETCHER (a member of the Town Council) examined.

Mr. J. Fletcher

379. (*Chairman.*) I believe you have taken an interest in the matter now before the Commissioners and have a statement to make?—I wish to make an observation or two on some of the practical points with regard to the sewage question and the river question, for these are matters that I have thought about and feel interested in. It has been stated that great difficulty would be found in getting rid of our sewage. If we had the intercepting sewer between Throstlenest and Cliff Point there is an ample fall, and we should go through from Broughton. It is Broughton and the lower parts of Salford that suffer the most from intermittent floods, the greater part of the houses in Broughton have watercloset, more than in Salford, and the intercepting sewers would in my opinion do a great deal towards purifying those places. Upon the occasion of an ordinary flood, the water covers the opening of the main sewers, rising as much as 8 or 10 feet, and the sewage and gases are forced back through the grids and traps. I suggest to take an intercepting sewer from the highest point in Lower Broughton, Cliff Point, and down Greengate to Chapel Street, Ordsall Lane below Throstlenest weir; there is a fall of 10 feet 5 inches, and I recommend that a water wheel should be put up there, it would not require a very large one for Salford, and you there have any quantity of water required as power to pump the sewage. From Knot Mill through Worsley, Chat Moss, and Leigh, and also by the other branch of the Bridgwater Canal, through Stretford, Ashton, and Urmston all the way to Runcorn, there are no locks. By taking that course if you were to pump the sewage some few feet above the level you then would have a natural fall all the way of 90 feet from Throstlenest to Runcorn. In heavy floods I would have the means of having the intercepting sewers flushed, and when the water became comparatively pure I would have means of passing the overflow direct into

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the river instead of pumping it. I was present yesterday in the Town Hall at Manchester, when the Town Clerk was giving evidence and he seemed to me to lay much stress on the great difficulty of carrying out these sewers. I was rather astonished to hear what he said; I venture to say that there is no difficulty in getting rid of the sewage, either of Salford or of Manchester, and no two towns need be better situated for the purpose. There is a great quantity of land which is used for the purpose of cultivating vegetables for the Manchester market below Stretford and Urmston, and also at Ashton but that, I should say, is not like Chat Moss. At Chat Moss we should have to pump perhaps 10 feet above the height of the canal, not more than that; but at Ashton, if you ran an intercepting sewer on the canal side, you would have an ample fall to carry sewage across the moss. Again, if you carried it on the canal bank as far as Runcorn and tapped it at different places, you might irrigate all the land the whole way. I think that in a practical way of dealing with these things we have had this matter before us for some time. In my opinion it is desirable that the Government should bring in a general Act. The inhabitants of the large towns do not represent the whole who pollute the rivers, because there are manufactories, print works, and bleach works above us, and they are now and have been doing it for a very long time past. We and they have adopted a wrong system. For instance, a man establishes say a print works on the bank of a river, and he turns the water down, after he has made use of it, polluted to his next neighbour below, and this next neighbour to the next below, and in most of these cases they have to settle and filter it. I recommend for the future that every one, beginning with the first on the stream, should be compelled to filter or purify the fluid refuse before it is turned again into the river. We should then have a clean river, because everyone using the water would return it back again clean. The law, as it exists, is not enforced. Suppose a case, a man is in occupation of a mill at the head of a stream and has been so for 20 years. I take another place below his; after I have been there for say five or six years, the man above may, by extending his works, and employing a different system of bleaching to that previously used, so alter the character of the water as to render it unfit for my use. I commence an action against him for polluting the stream; he says in answer, I was here 20 years before you; and he brings old people to speak to these things, so that I get no remedy. There have been a great number of similar actions brought by neighbour against neighbour, and damages and injunctions obtained; this is a most unsatisfactory state of things. I was astonished to hear the evidence of the Town Clerk of Manchester suggesting, as he did, that it would cost two or three millions of money to take this sewage away, and after that sum had been spent, to turn the sewage into the sea, when at the same time the land would be very much impoverished for the want of it. It would be, in my opinion, a great loss to the human race so to deal with it. The water-closet system is by far the best, for you get rid of the excrement at the moment, and you have not the nuisance of emptying them three or four times in a year, as is the case with middens and privies. I would also suggest that the sewers be ventilated by connecting them with large chimney stacks. Large chimnies would to a great extent draw off foul gases and prevent escape at the higher parts of the sewers and street grids, of which we have had complaints.

380. (*Chairman.*) The suggestion as to the water power which might be obtained at Throstlenest weir, for lifting the sewage and utilizing it, is a good one. This would enable the sewage to be pumped to a given height, and do away with the mechanical difficulty?—The more I consider the sewage question, the more I am convinced of the great benefit that will result to the country when it is properly dealt with, especially with such examples as Edinburgh and Croydon, where they have been applying the sewage for many years. In Edinburgh there are 240 people to an acre, and in Carlisle where the deodorizing system is carried on there are about 210. If we take, say 200 people to an acre, we should find the benefit of it, and we could go on with a thousand acres and upwards. The more land you can let the sewage flow over the better, and if you could double the price of 2,000 acres of land, that would be far better than doubling merely the price of 560 or 600 acres, and I think you would more than do that.

381. (*Mr. Morton.*) Is there always power at these weirs?—Yes, always. At the driest time you have sufficient power to do twice as much as you want.

DR. EDMUND JOHN SYSON further examined.

Dr. E. J. Syson.

382. (*Mr. Morton.*) I believe you have some additional evidence to offer?—I wish to set myself right on one point. Since I sat down a friend of mine has accused me of turning my back on the dry system in favour of the water-closet system. Now I have not set myself up as an advocate of any system, my position has been merely this, to give all systems a trial, and I really cannot say which I should adopt for myself. Supposing water-closets were adopted to-morrow, our present system of sewers is quite inadequate to carry off the additional burden which would be thus laid upon them. Before any large increase in the number of water-closets is allowed, we must be prepared to re-sewer the whole town, I sometimes am inclined to go in for water-closets solely on this ground, for, though the cost would be great, our sewers generally are in so disgraceful a state that anything which would necessitate their re-laying would be an inestimable, though costly, benefit. At present, nobody knows anything about our sewers; even the exact whereabouts of many of them is a mystery. The sooner we hear no more of the absurd nonsense of "Streets being well sewered," the better. I do not for one moment blame those who laid these sewers for their past work, but I do blame them for not having the manliness to come forward now, and confess that they are failures. Thanks to our sewers, we have miles and miles of cesspools constantly generating, or, according to some, *exciting* fevers in our midst. The water-closets, and universally defective house drainage, render this death-dealing system as perfect as it could possibly be. There is scarcely a sewer that does not stink, and this alone is a proof of their imperfection. A water-closet ought to be so constructed as to discharge immediately into the main sewer. Any water-closet which simply discharges itself into the drain, and gradually by a *vis a tergo* force propels the previous discharges forwards, is necessarily imperfect, and is also a nuisance dangerous to health.

Adjourned till to-morrow at Bolton at 11 o'clock.

The Borough Court House, Bolton.

Thursday, 29th April 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

383. (*The Town Clerk.*) The following information has probably reached the Commissioners, but it was thought desirable that it should be delivered to them in a more complete form.

Further Statement from Bolton.

29 April 1869.

With respect to series Nos. 2 and 3 of the printed queries submitted by the Commissioners, the Council of Bolton have some further information to impart. Since the answers to those queries were framed the question of dealing with the Bolton sewage has engaged public attention. This attention originated in a memorial to the Home Secretary praying for an inquiry under the provisions of the Sanitary Act, 1866, into the alleged neglect of the Council, as the nuisance authority, in taking measures to abate a nuisance arising from the retention in reservoirs within the borough of water taken from the river. The Corporation exercise what they claim as a prescriptive right to discharge the town sewage into the river. The reservoirs mentioned form part of the Springfield Paper Works, and the water contained in them is taken from the river and used in the manufacture of paper at those works. The complaint was that the water stored in those reservoirs being mixed with sewage was a nuisance. The proprietors of the works claiming the right to use the water the Corporation felt a difficulty in dealing with the question. An inquiry took place consequent upon the memorial, and notwithstanding the contention of the Corporation that the nuisance complained of involved a question with respect to which they were looking for assistance in the result of this Commission, and that it was reasonable to wait for that result before being forced into the adoption of any remedial measure occasioning much expense, the inspector conducting the inquiry made a report (a copy of which is now handed in) recommending that the Corporation should be required at once to construct intercepting sewers so as to divert the sewage from the river, but leaving the question of the ultimate disposal of the sewage for subsequent consideration. The contemplation of this plan provoked further difficulties—owners of works lower down the river objecting to have the sewage brought more near to them in a less diluted form, and the works above fearing injury from a consequent abstraction of water. The memorialists manifesting impatience the Corporation have been impelled to the adoption of a scheme of partial interception, for which the borough engineer is now by direction of the Council preparing plans, and the inspector as a further incentive, has sent a communication (copy of which is now put in). The scheme which the engineer is so directed to prepare for, is the construction of an intercepting sewer laid along the bed of the river, the upper end of which is near to Great Bridge, within the borough, and the lower end immediately below the weir which diverts the river water to the Springfield Works. The special features proposed in favour of this scheme are that it will take a considerable portion of the sewage below the Springfield Works without taking the surface water in times of rain. The Council would have preferred waiting for a more comprehensive plan, but have yielded to the representation of the inspector that the immediate adoption of intercepting works cannot be detrimental, as they must inevitably form part of any works recommended by this Commission.

The communication of the inspector, Mr. Arnold Taylor, which has been put in, refers to the desirability of immediately resolving upon some plan of ultimately disposing of the sewage, and as regards this, it may be stated that the borough engineer is preparing a scheme for dealing with it by irrigation, which he will shortly be in a position to submit to the Council.

MR. ALDERMAN FERGUS FERGUSON examined.

Mr. F. Ferguson.

384. (*Dr. Frankland.*) Have you directed your attention to any influence upon the health of the population that might be perceptible from the river's flowing by or through the town?—Before the river bed was paved I regarded it as a source of disease.

385. Have you noticed any special outbreaks of fever immediately on the banks of the river?—The portion of the town through which the river flows has always had a large mortality, considerably greater than that of any other part of the borough.

386. Do you attribute that increased mortality to the influence of the river, or are there other causes at work?—I believe it was exclusively and exceptionally caused by the proximity of the river.

387. Was it at that time in a comparatively stagnant condition?—In the summer time, when there was but a small quantity of water running down, the stream flowed very sluggishly, and the sun's rays penetrated through the water to the mud deposited.

388. Was any mud exposed to the atmosphere without having any water upon it?—Frequently in the summer time, especially towards mid-day, and generally during the cessation of the works.

389. Has the rate of mortality on the immediate banks of the stream decreased markedly since the improvements to which you referred have been made?—It has; the mortality is less as compared with other parts of the town.

390. Is the mortality in the other portions of the town, away from the stream, higher now than it is on the stream?—It is less now than it was.

391. (*Mr. Morton.*) That is to say, the improvement generally is greater in one part than in the other?—Yes.

392. (*Dr. Frankland.*) Are we to understand that the mortality in general has decreased of late years?—It has markedly decreased; the mortality is 32 or 33 per 1,000 for the 10 years ending 1855.

393. By referring to the return before me I find that in 1858 it was 27·9 per 1,000, and in 1869 29 per 1,000?—Yes. I am stating the average of 10 years from 1846 to 1855; take the average of the 13 years succeeding, the mortality will not be more than 28 per 1,000.

394. Can you furnish us with the mortality in the first 10 years you have spoken of?—It has been published, but I have not a copy of it. The returns of the mortality are a little imperfect in Haulgh; there is a population of about 2,000, which form part of another registration district, and there

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is no separate return made. I am estimating the lower rate of mortality there, and that I believe will reduce the mortality for the last 13 years to not more than 28 per 1,000, taking the average of the 13 years as compared with the previous 10 years.

395. In what year did the improvement in the condition of the river take place?—It was not finished before 1867.

396. (*Chairman.*) When was it begun?—In 1865.

397. (*Dr. Frankland.*) Do you know what the rate of mortality in Bolton was in 1868?—I do not.

398. Do you consider that the river was considerably improved by the paving operations from the commencement and even for some time before they were completed?—An altered state of things immediately followed.

399. Are you much affected here by zymotic diseases?—Not as a rule. Typhus and typhoid fever have been comparatively rare, but they have been more common this year than I have known them for the last 15 years; the last 10 years we have had several severe epidemics of scarlet fever.

400. And measles?—That has also been epidemic several times, and severely during the last 10 years.

401. Do you attribute the prevalence of those epidemics to any particular condition of things in the town?—I think they are attributable in the greatest degree to overcrowding; to the back to back dwellings, close courts, and cellar dwellings.

402. Do you attribute any influence to the mode in which the excrementitious matters are dealt with in Bolton?—I believe it has been a considerable source of disease until within the last few years, from the great quantity of fluid which has been accumulated in the cesspools and cesspits.

403. Are you of opinion that a dry cesspit is much preferable to a wet one?—Yes, much preferable; and we have endeavoured to prevent any water from going into the cesspools that can be avoided, and have caused down spouts to be made, so as to carry to the sewer the rain falling on the privy roof.

404. Are the middens and cesspits, as a rule, drained into the sewers?—Yes; but we are very anxious to prevent the necessity for anything flowing into them, and thence into the cesspits.

405. How many people are there to a house in the worst parts of the town?—I have met with instances in which there have been as many as 11 individuals of both sexes sleeping in an apartment not containing more than sufficient air for four, allowing to each individual 350 cubic feet, which we consider is a very small quantity.

406. Is that of rare occurrence?—Overcrowding is of very common occurrence.

407. Do you attribute to that cause the prevalence of some epidemic forms of disease?—I believe that there is no one source of disease, or one as certain in its operation, as overcrowding, whether it be regarded as a cause of disease, or whether it be regarded as a means of spreading disease.

408. Did you suffer in Bolton from cholera during the visitations of 1832 and 1849?—Upon both occasions; but, as compared with our neighbours, but slightly. The visitation of 1832 was by far the most severe.

409. How was the town supplied with water in 1832?—From 1824 it was from Belmont, the same source that the Sweetloves reservoir is now supplied from.

410. You have also the Heaton reservoir?—That has been constructed since 1832.

411. As I understand you, the supply was from the same source as that now obtained from the Sweetloves reservoir?—Yes.

412. Was there at that time an ample supply?—Yes.

413. Was this water generally used by the inhabitants in 1832, to the exclusion of well water?—No, it was not; well waters were always used.

414. Was there any difference in the proportion of well water that was used in 1849 as compared with 1832?—A considerable difference.

415. In 1849 was the use of well water less prevalent than at any other time?—I have no doubt of it.

416. In 1854 had there been any further improvements as to the water supply, leading to a further discontinuance of the use of well water?

(*Mr. Baylis.*) Heaton was put in in 1856. The extension of the Belmont gathering ground, I believe, was in 1843.

417. (*Dr. Frankland to the Witness.*) What was the mortality from cholera in 1854 as compared with 1849?—I cannot give you the number.

418. Have you had any experience of the comparative wholesomeness of filtered water, as distinguished from unfiltered water supplied to a community?—No.

419. Have you formed any opinion as to the comparative effects on the public health of the privy and midden arrangement as compared with waterclosets, or the wet process of removing fœcal matter?—I should decidedly prefer the dry system, if it were properly carried out, and if the people could only be taught to throw ashes daily over the excreta; I believe it may be made comparatively innocuous, as well as inoffensive.

420. What would you do with the urine?—The ashes are sufficient, as a rule, to absorb what little fluid must necessarily flow in.

421. That is, in the ordinary use of the privy?—Yes.

422. Would that be the case if the slops were also thrown into it?—I am supposing two things, that there is nothing of the kind thrown into the privy, and even that the wet from the top of the privy is prevented from going into the cesspit, and that is what we are steadily aiming at in Bolton.

423. Do you consider that urine, when it enters into a state of putrefaction, is less noxious than the solid fæces?—I am not aware of any comparative experiments having been made.

424. You cannot distinguish between the liquid and the solid?—No.

425. Supposing that the thing could be conveniently done, do you agree with the Medical Officer of the Privy Council that it is desirable to remove the excreta of the population from a town while they are still quite fresh; would that, in your opinion, be advantageous or a matter of any moment?—I am looking at it as a question of practice, and I think the difficulties in its way are very great.

426. But apart from that, and supposing that it could be done easily, what is your opinion upon it?—If it could be done as easily as letting it remain, I should say let it be removed; but, looking at it as a matter of practice, and how it can be done, I see some difficulty in the way.

427. Do you think that there would be great difficulty in doing it?—Yes. I think there is no doubt about the desirableness of having it done, but great doubt of the facility of doing it.

428. Have you met with any cases in which the gases from the sewers have penetrated into houses in Bolton?—Yes.

429. Is that a matter of frequent occurrence?—Yes, because the great mass of the cottages have no traps to their slop stones, and where they have traps they do not seem to have fear enough of the sewer air to keep them in use. In some houses the smell has been to me intolerable, and I have found that it came from the slop stone, which in many instances had a bell trap, but the moveable bell and grating covering it had been removed, and therefore the drain was untrapped.

430. Have you known gases to force their way from the sewers through a trap which was in working order?—I have not. I am thoroughly satisfied that our sewers are very imperfectly ventilated, and that is another source of disease to which I attach great importance.

431. Have you traced any cases of fever to the escape of gases into the houses in the manner just stated?—I have.

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432. Many cases?—Not a large number.

433. Are the sewers partly ventilated by down spouts?—Yes.

434. What is your opinion as to this mode of ventilation; are the sewer gases introduced through the spouts into surrounding dwellings?—In very many instances the down spouts are not sound, and if the spouts are near to doors or windows the sewer gases will find way into the house. The down spout should be thoroughly sound to make the connection with the sewer at all free from danger.

435. (*Chairman.*) Are the down spouts ever entirely sound?—I think they are. I take care to have my down spouts perfectly sound, and every joint examined.

436. But the mass of the people probably do not do so?—I am afraid they do not, simply because they do not know it is of importance.

437. (*Dr. Frankland.*) Are fever cases located in particular districts, or have you any nests of fever here?—When we had a large number of cellar dwellings fever was scarcely ever absent from them.

438. Do those cellar dwellings still exist, or any of them?—There are not more than 380 or thereabouts occupied now, and I am of opinion that these should be gradually closed, and so get rid of cellar dwellings altogether.

439. As a matter of observation have you found that the health of a particular district has become improved by the removal of these cellar dwellings?—I believe that the health of the town is generally improved, but in some localities, where cellar dwellings were very common, overcrowding is now as common, and therefore it makes it very difficult to judge. The union surgeon for the eastern part of Bolton gave evidence upon an inquiry with respect to a nuisance at Springfield Works (to which reference has already been made), and he stated that the most unhealthy locality in that district was a number of houses known as Bolling's Barracks, inhabited by upwards of 700 persons of all ages; there are two ash-pits, and not more than 19 privies for the whole of that mass of population.

440. What number of houses are there in the district of which you are speaking?—There are 122 dwellings.

441. Do you know the total number of inmates?—I do not know the exact number.

442. What becomes of a closed cellar? what is the mode of operation—closing it and locking it up?—Yes, in a great majority of instances.

443. Are there any drains or slop stones in these cellars?—In many of them there are, or there were, unless they are removed.

444. Is it the practice to abolish these drains, or close up the pipes of the slop stones on closing the cellars?—I am not aware.

445. If it is not done, would there not be an escape of gases into the cellars from the drains?—Necessarily so.

446. So far as you know, no precaution is taken when such an occurrence takes place?—No.

447. After being closed, are the cellars ever made receptacles for rubbish?—To this same Bolling's Barracks the Mayor and myself paid a visit last summer; we were taken to examine some of them, and we found that they had been made the receptacle of indescribable abominations.

448. As a matter of fact are excrementitious matters deposited in those closed cellars?—Yes, sometimes.

The witness withdrew.

Mr. Henry Baylis, C.E., examined.

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449. (*Mr. Morton.*) Are you borough engineer and superintendent of all the works which are under the control of the Corporation?—Generally I am.

450. And the scavenging?—No, that is under a separate control; we have an inspector for that department.

451. Are you acquainted with the details of the scavenging?—Yes.

452. Is the whole of the town drained into the river Croal?—Part in the Tonge, but it is into the Croal principally.

453. What is the area of the town?—1840 acres.

454. Of those, how many acres are drained into the Croal?—720. I am speaking now of the drained area; there are 924 acres which are suburban, and which are totally without drains.

455. What proportion of the 80,000 inhabitants do you suppose drain into the Croal, as compared with the Tonge?—Three-fourths.

456. Does the drainage include the whole of the liquid excrement?—Yes.

457. Are they middens and privies throughout?—Generally they are, but not wholly.

458. Are the middens all drained into the sewers?—Yes.

459. Does that in point of fact make them dry?—Yes; the ashpits as a rule are either drained, or kept dry, excepting the urine, which finds its way in, and which is generally absorbed by the ashes.

460. Still there are exceptions, for instance, where a drain is stopped?—Yes.

461. How often are the middens and privies cleaned out?—When they are full they are reported by the scavenging people and are cleansed.

462. Referring to the 16,800 tons of refuse removed from the middens in one year; do you know how often they were cleaned out to produce that quantity?—I cannot answer that question.

463. (*Chairman.*) Does the whole of the 23,000 tons come out of the ashpits?—Yes.

464. Are there nearly 6,000 thrown away?—Yes.

465. (*Mr. Morton.*) Where is the separation made between that which is thrown away and that which is sold as manure?—It takes place generally in the Corporation yards.

466. Is all the stuff thrown into one cart by the night men?—Yes; but it often happens that a cartload is taken away which is wholly unfit for manure; it is teamed into the tip.

467. The whole contents of a midden may thus be thrown away?—Yes, frequently; we usually find that in cases where ashpits become rapidly filled with débris, the upper part of the pit is useless for manure, and it is carted at once to the tip, and the most offensive part, which is at the bottom, is taken away to be used as manure.

468. Does the most offensive part occasionally contain brick bats, lumps of slag, and other rubbish, and are these thrown away?—Yes, occasionally.

469. Where is the depôt to which the stuff is taken?—We have several tips; one of them is here (*pointing to a plan*).

470. Is that the depôt where you collect the whole of the stuff, and where the division is made?—No, that is the place where they deposit the whole of that which is used for refuse, and which is not fit for manure; the depôt is situated on this side of the railway (*pointing to the plan*).

471. Is it all carted to that place?—Yes; there is also one a little further on.

472. As I understand you the division is made at the depôts and then carted away?—Yes; the bulk of the soil is carted to a place called Bullfields, and it is then sent out into the country without being stored for any length of time; a small portion is taken to a yard and is carted away into the country.

473. Do the farmers send for it?—Yes.

474. What do they pay you for it?—They pay 1*s.* a ton or a load.

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475. Is it worth carting away any distance?—The farmers fetched it for a long while before we sent it away by rail some four, five, or six miles.

476. Do you now send it by rail?—Yes; we have a depôt out in the country, and we send it five miles there.

477. What do you receive for it?—I do not remember.

478. Is it enough to pay for the carriage?—Quite enough.

479. Are the tips in the immediate outskirts of the town?—They are in the least populated parts of the town; the principal one is almost in the heart of Little Bolton.

480. Is not the town increasing in size?—Yes.

481. And by-and-bye those places will be built upon?—No doubt of it; but the refuse that is tipped there is almost always that which is the least offensive.

482. (*Chairman.*) That is a question of degree?—Yes.

483. (*Dr. Frankland.*) Have you known any cases of fever or disease to arise from a bad foundation to a house?—I am not aware of such a case, but, for example, where this stuff is tipped one load is mixed with perhaps 20 or 30 loads of other material; the tip is 20 feet deep.

484. (*Mr. Morton.*) With regard to the amount of nuisance created by the cleansing out of the privies, are there in the town rows of houses standing back to back with a central gangway, along which the contents of the privies have to be wheeled?—No; there are very few instances of that sort in the older parts of the town, in the newer parts of the town the privies are in the streets along which carts can go; the contents are loaded at once, and there is no use for the wheelbarrow.

485. Do you have the privies cleansed out on receiving notices from the owners?—Yes, and without making any charge.

486. Do you cleanse the privies in an entire district at the same time, or are the night men scattered about the town?—We take a district, as a rule, but the men are sent wherever they are required out of a district in any case of urgency.

487. In cases when the privies are massed together, is there a common cesspool for the whole of a block of houses?—Yes, and those are the most offensive places.

488. How often are such large middens cleaned out?—There is no fixed time; as soon as full; in fact, many of them are cleaned out before they are full.

489. In the case of a midden where the drain is stopped how do you get rid of the water; is it ladled out?—It is thrown up into the carts; the men use ladles and shovels.

490. Can they get rid of all the water in that way?—Yes.

491. Is there a great deal of slop and filth over the street or the gangway?—Not usually, except in the case of the older cesspits, that are, as a rule, ill-drained; there the slops accumulate; but it is not so liquid as some of the sweepings of the place. Some of these cesspits are ten feet by six and four or five feet below the level of the ground.

492. Would such a cesspit take two or three months to fill?—They never get filled, because they are running over at the place where the ashes are teamed into them. The pit is running over even before it is filled, or anything like it.

493. Are these places drained through a grid?—Yes.

494. Do those grids get choked up?—Yes, sometimes.

495. Are they then left with the water standing in them?—No, they are always cleansed out.

496. Do you use any disinfectants?—Yes.

497. Are they always used?—Generally in the hot weather.

498. What disinfectant do you employ?—Chloride of lime and carbolic acid.

499. Does the whole of the liquid and some of the washings get into the river?—Yes, all through the sewers.

500. As to other pollutions which the river receives through the town, is there not the waste of so many mills?—Yes.

501. What class of mills are they?—We have bleach works and a few dye works, and the ordinary mill works, from which there is not much; the bleach works are the principal foulers of the stream.

502. Are they in the town?—Yes.

503. Does their waste go into your sewers?—No, it goes direct into the river.

504. In what state do you receive the water of the Croal, as it comes to you?—The Croal is tolerably pure, except where it gets some water pumped into it from the mines outside the town.

505. Is there much population above you on the Croal?—No.

506. Are there many works situated above the own on the Croal?—Not many.

507. So that Bolton itself is almost entirely responsible for the state of the water?—Yes; no doubt it comes to us pure, and it leaves us in a foul state.

508. You are virtually at the head of the stream?—Yes.

509. (*Dr. Frankland.*) What is the drainage area of the Church Bank Sewer?—Ninety-six acres.

510. Does the sewage issuing from the outfall of that sewer fairly represent, so far as you know, the average sewage of Bolton?—Yes.

511. Is there no other sewer that would more nearly represent it than that?—I think not.

512. Had you a scarcity of water last summer?—Yes.

513. To what extent?—We were compelled to reduce the quantity delivered daily to one-half the usual quantity for the space of about a month.

514. Was it cut off for a certain length of time?—At different periods it was altogether cut off, and then it was put on again, but the whole town was supplied at intervals during a month to the extent of one-half of the usual quantity consumed.

515. What is done with the waste products of the gas works in Bolton?—They are disposed of.

516. Do the works belong to the Corporation?—No.

517. Do they purify with lime?—Yes.

518. What do they do with the waste lime?—That is used by the farmers.

519. You have spoken of the rivers being polluted to some extent above by mines; what mines do you refer to, and what is the character of the pollution?—I think it is from sulphuric acid.

520. And ocherous water?—Yes, a little of that occurs, but not so much as you often see in a stream.

521. Is it acid?—Yes.

522. Is the Entwistle reservoir the source of your new water supply?—Yes.

523. Can you tell us what is the amount of water supplied at present in Bolton, per head, of the population?—The domestic supply is 16½ gallons a head per day, and 3½ gallons go to the mills, making up 20 gallons per day.

524. Supposing that the privies in Bolton were converted into watercloseets, what additional supply of water per head do you think would be necessary?—That, of course, is a matter of pure conjecture, but I should think we should want at least 20 per cent. more water.

525. How do you arrive at that quantity of 20 per cent. more?—As I have said, it is a matter of pure conjecture, but I think it would require that additional quantity at least.

526. Do you not take into account how much a person uses?—I think that that forms a very small proportion of the quantity that is required; if you fitted up all the houses in Bolton with watercloseets, there would not be 20 per cent. of the watercloseets allowed to remain in a state of proper repair in the course of a month, because the habits of the people are so bad.

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527. Are you acquainted with that peculiar form of watercloset which is called the *trough closet*, and if so, do you consider that by the adoption of that so large an additional supply of water would be required?—No, but it would require a much greater amount of accommodation for storing the refuse in tanks, and for a greater time.

528. Do you know what the practice is in Liverpool?—I do not.

529. Do you think that no contrivance could be adopted to prevent the waste of water when a watercloset gets out of order?—It is a mere matter of care on the part of the tenants; I think that with fair use the closets ought to be adopted in large towns where water is not merely sufficient, but abundant, and where the sewage system is complete; that is to say, so complete as to be useful not only for the conveyance of the refuse from houses, but for the utilization of the sewage when it is taken away.

530. Has your water supply in Bolton been abundant?—I should scarcely say that, because last year we had to reduce the quantity for a month.

531. When the new works are completed, will there be an abundant supply of water?—Yes.

532. (*Mr. Morton.*) The water supply to a population of 80,000 at the rate of 12 or 14 gallons a day per head, would it not represent a million gallons a day?—A little more than that, I think.

533. Which would be 5,000 or 6,000 tons?—Yes.

534. Then the sewage of the town would amount to about 5,000 or 6,000 tons a day?—Yes.

535. With 5,000 or 6,000 tons of sewage a day, would you not require to have 400 acres on which to use the sewage, supposing it was used in the way of irrigation?—Yes, I have always been under the impression that we should want very much more than that.

536. Why have you thought so?—The present population of Bolton I consider to be about 80,000. We have increased during the last 30 years at the rate of 1,000 a year, and I think at the present time we are increasing more nearly at the rate of 2,000 a year, so that in a few years we shall have an immense number of people gathered together in this town.

537. And you would, as I understand you, provide for the next generation?—Yes.

538. Do you know what an acre of land is capable of, in the way of cleansing sewage?—No, not of my own knowledge; but I have seen what they have done at Croydon and at other places.

539. The quantity which is required to cleanse sewage, and the quantity which is required on which profitably to utilize it, are two very different things?—No doubt of it.

540. Do you think it is possible to obtain 500 or 600 acres of land below the town?—I think it is possible to do so. I have a scheme at the present time under consideration, the object of which is to utilize the sewage by way of irrigation. I will describe the scheme and explain the plans. This (*pointing to the plan*) is the course of the river through the borough, and the course of the stream runs in this direction. The whole of our sewage comes down to this point, so that it would require pumping, and the proposition is to pump it back along a line like this (*describing on the plan*) to this *Moss*. The lift would be about 300 feet, more or less, and it would form the ultimate point for disposing of the sewage. But as all the intervening land is nearly all grass land, we should be in the position of having the pipes always charged, working under pressure for the purpose of supplying the farmers *en route* at so much per acre for the irrigation. The *Moss* we must acquire, and the effluent water would pass into the Croal again, flow through the town and the valley below, so that the mills would not be at all injured, and the town would be benefited.

541. Can you state what the cost of pumping would be?—No; but I am going into that question at the present time.

542. (*Chairman.*) You propose to lift it up hill instead of taking it down?—Yes.

543. (*Dr. Frankland.*) The object of that being to give a supply of water to the mills below?—Yes, and to utilize the sewage and save us from action by the millowners for loss of water.

544. (*Mr. Morton.*) Is there no land close to the sewer outlet?—No, the valley is too narrow.

545. (*Chairman.*) Could you not convey it by gravitation?—We have nothing on which to put it, the valley is so narrow, and if we take it down we are told that we shall be liable to an action, as some of the millowners claim a right to take the sewage.

546. You have availed yourselves of the gathering grounds and water courses, and the owners of the mills claim compensation from you, and insist upon your giving them a certain portion of the rainfall?—We are under an agreement to give them compensation for the water that is taken, and in one case we give 15 cubic feet per second for 12 hours every day, and in another we give five cubic feet per second.

547. Does that compensate them for the water which you have taken away from them, and which passes into your sewers?—It compensates them for that which we take for drinking purposes, and foul and turn into the sewers. Some millowners would take this ground and say, you compensate us in another way, and give us a further proportion of the rainfall which you turn into the sewers and thence into the river at a certain point, where we are benefited by using it again as power.

548. What do you charge for the water supply to watercloseets?—Five shillings a year. But it acts as a prohibitory tax here; it is the same for baths.

549. What is the average rental of the houses which are occupied by labouring men?—About 3*s.* a week.

550. Do they contain one family or more?—They are calculated for one family, but in many cases I am afraid they hold more.

551. (*Dr. Frankland.*) What is the number of the population drained by the Church Bank sewer?—I can only assume that I think it is about three-fifths of the whole population.

552. That is, in point of fact, your main sewer?—It is.

The witness withdrew.

MR. THOMAS KAY examined.

Mr. T. Kay.

553. (*Mr. Morton.*) Are you inspector of nuisances?—Yes.

554. What are the duties specially performed by you?—I have to examine into all cases of nuisances, and to attend to all complaints as to overcrowded dwellings, lodging houses, slaughter houses, and houses where fever and other zymotic diseases take place. I am also inspector of smoke.

555. When would you consider a house to be overcrowded?—If there is more than one family in it, and if a house does not contain sufficient sleeping room, namely, 300 cubic feet of space per head for adults.

556. Has it been under your inspection that cellars have been abolished in the town?—Partially; several hundreds have been abolished.

557. Are they, as a matter of fact, drained; have they all slop stones?—Yes, a drain trap.

558. Are those drains connected with the sewers?—Yes.

559. Does not the efficiency of the trap for preventing the sewer gases from coming up depend upon it being continually used?—Yes, properly used.

560. When a cellar is closed is it filled up?—No; I may say that in many cases some 600 or 700

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of them are now occupied as kitchens and workshops.

561. When the cellars are closed is anything done to the slop stones?—The slop stones are invariably covered up.

562. What is the nature of the drainage from the cellars?—Many of them are closed in consequence of being badly drained.

563. Is that done as a general rule?—Yes.

564. Do you take the state of the middens under your inspection?—I receive all the applications that are made, and when we find that they are filled we enforce the emptying of them. The superintendent of scavengers takes them from my books.

565. Is it a part of the duty of the scavenger to clean the steps when he has emptied the middens, and to wash down the gangway?—It is, and in some cases the neighbours very willingly assist us.

566. In many cases I suppose one privy serves for the occupants of many houses?—Yes; the old part of the borough is not well supplied with privies and ashpits.

567. Who keeps the privies clean in that case?—The neighbours wash it in turn.

568. (*Chairman.*) Is it not practically dirty?—Yes, some portions of it.

569. (*Mr. Morton.*) Have you occasion to report that sometimes, or do you receive reports of that kind?—I very often have to stop and see them clean it, or I am not sure that they would do it.

570. As a matter of fact the ashes that are thrown in do not destroy the smell or even hide the dirt?—Where the people are alive to their own interest and comfort they use the ashes to advantage, but that is not generally the case.

571. (*Chairman.*) Is it within your knowledge that people are generally alive to their own interest?—I cannot say that they are universally so, but we do try to direct them towards it.

572. (*Dr. Frankland.*) Are you aware that any nuisance or inconvenience arises from the admission of steam or hot water into the sewers in Bolton?—No, I am not aware of that, there are no complaints.

573. So far as you know there is no objection to that being done?—No, but I do not know of one case.

574. It is admitted that it takes place; I mean the condensing water is so dealt with?—They send it down, but our gullies are trapped. I may say that we have not had one case of typhus or typhoid fever or zymotic disease within, perhaps, a quarter of a mile of the river Croal.

575. Has scarlatina been prevalent in this locality?—We have not had a case near the river for some time.

The witness withdrew.

(*Chairman.*) I believe there are present gentlemen who reside on the banks of the river, or have property on the river, a little below the town, do you consider that you have any just ground of complaint against the inhabitants of the town for destroying your comfort or injuring your health, or that you have any ground of complaint at all?

(*Mr. Rushton.*) I speak, Sir, on behalf of Mr. Rideout, who is present, and who would feel very much delighted if the Commissioners would go and look at his works, and see what state the river is in at present.

(*Chairman.*) Does Mr. Rideout complain of the state of the river?

(*Mr. Rushton.*) Yes, he does; he owns a house at his works, which has been unoccupied for 10 or 15 years, and which must have cost in erection 2,000*l.*, but nobody will live in it.

(*Mr. Rideout.*) I have to live in another house, and the house to which Mr. Rushton has referred has been unoccupied all that time. It immediately adjoins the river, where there is a weir, and I do not know that you could have a better illustration of the effects of the offensive smell arising from the river.

Mr. James Lomax examined.

Mr. J. Lomax.

576. (*Mr. Morton.*) I believe you have a scheme to propose for the purpose of dealing with the sewage of Bolton?—Some time ago, when the matter was brought before the Corporation, I was a member of the sanitary committee, and after a scheme had been proposed by the borough engineer, I suggested an alternative scheme, which has been a matter of discussion by the Council for a couple of years, and it has ultimately ended in the partial adoption of that scheme. When the former Commissioners were appointed and came here, I took the matter into consideration in another point of view; my object then was to prevent a nuisance, instead of dealing with it after it had been made. I have looked at the matter with a view to prevention instead of cure, and I drew up a report then, which I intended to present to the Commissioners, but, after that, I presented it to the Mayor, and a short time ago I forwarded that report to Mr. S. J. Smith, the secretary to the Commission, and received a reply informing me he had brought the same under the notice of the Commissioners. If you will permit me I can shortly state to you the mode in which I propose to deal with the matter. In the first place I propose to abandon waterclosets entirely; we have 380 waterclosets in Bolton. I also propose to abandon the practice of emptying the contents of ashpits into the streams by a mode of emptying which I can explain, and keeping the contents entirely out of the sewers, and at the same time to employ a plan by which the ashpits can be emptied at a great deal less cost.

577. (*Mr. Morton.*) Do you propose to remove the liquid and the solid excrement apart from the ashes?—I only propose that the urine portion should get into the ashpits, my plan being to construct the ashpit so that no rainfall should get in. I mean that a screen or grid should be placed on the top of the ashpit, so that all refuse, and the heavy portions of the ashes or cinders, would come back into the yard to be dealt with as dry material, and that the other portions should fall into a box in the bed of the ashpit prepared to receive them, and the ashes would act as a deodorizer.

578. We have seen middens constructed very much upon that plan under the direction of Mr. Lynde, at Manchester?—I have not seen them.

579. (*Dr. Frankland.*) What would you do with the slop water?—Under my system the slop water would still go into the sewer, it goes there now, and very few persons put it into the ashpits.

580. What would you gain on the method at present pursued?—I believe I should save about 3,000*l.* a year to the borough, and I should at once prevent all the wash that now goes from the surface of the streets from going into the river. At the same time I should really benefit the occupiers of the houses by reason of giving them a plan by which they would save a large amount of capital which might be derived from that sewage which is now carted away and used for filling up hollows.

581. Should you still contemplate sending the sewage into the river, as is done at present?—No, I propose precipitation for that.

582. By what process?—I should do that in tanks. I should first intercept and then precipitate it.

583. Should you employ some chemical agent?—No, it would be done entirely by simple subsidence.

584. Have you tried your plan with sewage which has subsided, and if so, has it not become afterwards horribly offensive?—Yes, for three or four months I have experimented upon it, and I do not find that it is so offensive, nor do I believe that there would be any more objection to it than I imagine there would be to drainage water off irrigated land. I believe that if the amount of sewage in Bolton can be reduced to a minimum, that might be more easily dealt with than it is at present, taking the sewage of the entire drainage area.

Mr. J. Lomax.

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585. (*Mr. Morton.*) Would you allow the slop water to be carried into the river?—No; I should intercept it all, and let only the rainfall pass into the bed.

586. What would you do with the subsiding sewage?—That is a matter for after consideration.

587. Would you send it into the river?—No; but I think, after the subsidence had taken place, if the water were allowed to go into the river, it would not be complained of.

588. Are we to understand, then, that you would send it into the river?—I have not supposed that; but I do not think it would be complained of if it went into the river I think that here we shall be compelled at all times to have a certain amount of pollution in the river unless we can remove all our works to the sea-shore and take into the river rain water only.

The witness withdrew.

Mr. Charles Skelton examined.

Mr. C. Skelton.

589. (*Chairman.*) You are desirous, I understand, of bringing some facts under the notice of the Commissioners?—Yes; I am a member of the sanitary committee of the Town Council, and I have made this question my study for some time past. I would do away with all waterclosets. I believe that it is a great deal more easy to carry the excrement before it becomes mixed with water than to mix it first with water, and then to have standing tanks for the purpose of separating it. I believe that it could be done at one quarter the expense. I would have traps to all drains in yards, courts, alleys, and street gullies. I would employ a proper staff to attend to and clean out the traps, so that no solids should pass into the sewers. It would be more valuable as manure to take it away in the state that I suggest than to mix it up, to have settling tanks, and thereby go to a greater expense, for the farmers would very likely not purchase the manure.

590. (*Dr. Frankland.*) Have you taken into consideration the relative value for manurial purposes of the solid parts of the excrements and the liquid parts?—As far as I understand it, there is not much value as manure in it when you have mixed it up with water.

591. Is not the ammonia a valuable manure?—Yes; but that, I think, escapes after it is mixed up with water.

592. Would it make any difference in your views about that, if you were told that four-fifths at least of the goodness lie in the liquid part of it, and only one-fifth in the solid?—If I could believe that, it would alter my opinion.

593. You suppose that farming is not so liberally conducted but that the manure heap might be a good deal larger with advantage?—I may say that in this part of the country farming does not pay, and the wages of farm labourers are comparatively small, that is to say, they can get better wages in the towns.

594. Do you propose to keep all the liquid sewage out? and if so, what would become of the drainage of your middens?—That, I believe, is not in a bad state when it is drained through the ashes.

595. As I understand, your plan does not contemplate any very considerable alteration of the existing one, because the middens will be dry, and the water that is in them will find its way out into the sewer, and so into the river?—Yes; but it will be in a clear state when it gets into the sewer, and I think that the greater proportion of the offensive matter will be left behind as it drains through the ashes.

596. The same thing takes place now?—Yes; anything which drains from the middens does not cause any great nuisance in the River Croal; it is the drainage from the waterclosets and slaughter houses.

597. In your view the sole mischief which is now done to the river is done by the 300 waterclosets and slaughter houses?—No, not the whole of it; but they contribute some portion.

The witness withdrew.

Adjourned till to-morrow at Bury at 11 o'clock.

The Athenæum, Bury.

Friday, 30th April 1869.

PRESENT:

Major-General Sir William Denison, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

Mr. James Park examined.

Mr. J. Park.

598. (*Chairman.*) Are you chairman to the Bury Improvement Commissioners?—I am.

599. Do you wish to make a statement to the Commissioners regarding the water supply of Bury?—I wish to state that we have a very large margin of collecting ground over and above our capacity for storage. More than thirty years ago a survey was made of the tributaries of the Irwell, and a company formed to carry out very extensive impounding reservoirs (*handing in a plan*). The Commissioners will see that it was proposed at that time to construct about 15 or 16 reservoirs on that stream, and this was not proposed to be done for the purpose of supplying water for domestic use, but for manufacturing purposes and power.

600. (*Dr. Frankland.*) What is the character of the gathering ground?—Moor land, pasture land.

601. Is there any arable land?—I do not think there is any.

602. Is the pasture land manured?—I should think so more or less so.

603. Is any farmyard manure put upon it?—I do not know.

604. What is the water supply per head per day in Bury?—(*Mr. Harper.*) It is twenty gallons per head per day.

605. How much of that is for domestic purposes, and how much for manufacturing purposes?—I cannot tell you the proportions, it is very variable.

606. (*Chairman.*) Is that the quantity that you get?—We get it, excepting in dry weather, and then I admit we are short of water.

607. (*Dr. Frankland to the witness.*) To what extent does it run short; was there a deficiency last summer?—We bought from a neighbouring company about 100 millions of gallons, and to get it we laid down about two miles of 6-inch pipes along the turnpike

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road. I should think that such an expedient was never adopted before.

608. Did you, in point of fact, supply your customers with a proper quantity of water?—Yes, and they never were one day short; but we were obliged to stop the supply of water for the watering of the streets for a time, and also obliged to restrict the supply for manufacturing purposes and confine it to domestic purposes.

609. Are you acquainted with the sewerage of Bury?—Yes.

610. What is the area and the population that is drained by Pym Hole sewer?—I should think that it takes in two-thirds of the town's sewage.

611. So far as you know does that sewer fairly represent the sewage of Bury and the quality of it?—I should say it is a very fair representation of the sewage.

612. Is there no other sewer that would more fairly represent it?—None that I know of.

The witness withdrew.

Mr. Thomas Wrigley examined.

Mr. T. Wrigley.

613. (*Chairman.*) I believe you are a paper manufacturer?—Yes.

614. Have you anything to add to what you have already forwarded in your replies to the queries that were sent to you by the Secretary to the Commission?—I am only afraid that the Commissioners, with the best intentions, may be led away into some abstract theory. The Commissioners are, no doubt, well aware that although water may appear quite clear, yet it may at the same time contain many noxious qualities, and be as bad as the worst water; in the middle of last summer the water came to me after passing through Heywood and the district very clear to all appearance, but in truth it was in the most abominably stinking state that one could possibly fancy. With respect to the refuse which is discharged from my works being composed largely of chemicals of a deodorizing and purifying character it does counteract to a very great extent the sewage which comes down the river. The river itself must to a great extent be a sewer of the district, and I consider that it is entirely hopeless to attempt to restore it to its former pure and unpolluted condition. If you were to ask me to purify or keep back the liquid refuse from my mill, without meaning any offence or desiring to obstruct the Commissioners, I should simply decline to attempt it, because I know that it be would be utterly impossible. At the same time it cannot be denied that the rivers have been very much abused, and it is a question whether or not the throwing of cinders into the river should not be entirely prohibited, although I do not believe that they injure the river. I do not know whether the bed of the river has been raised at all by them, but it certainly has not in the part with which I am acquainted. The manufacturers have quite enough to do just now, taking into account the taxes which are imposed upon them, and the difficulties that are thrown in their way by sentimentalists. All these things have a tendency to cripple their ability to compete with *foreign nations*,* and unless they are left with the power to carry on their operations on economical principles, I am afraid there is a very bad future for them.

615. (*Chairman.*) It is part of our instructions to see whether the river cannot be cleansed without doing any injury to manufacturers and others.

The witness withdrew.

Mr. William Harper examined.

Mr. W. Harper.

616. (*Chairman.*) Are you clerk to the Bury Improvement Commissioners?—Yes.

617. (*Dr. Frankland.*) Can you give us any information as to how far the rate of mortality has been affected in Bury by the construction of sewers?—After the construction of our first sewers several overcrowded and unhealthy districts have been very much improved in health. There are certain courts which are ill-ventilated and which are not sufficiently drained. There are many privies and ashpits which are not yet constructed on proper principles; they are not sufficiently drained, and are not conveniently accessible. There are also overcrowded dwellings. I do not want to shift the blame from the river that justly attaches to it, nor from the sewers, or from defective sewers the blame that justly attaches to them, but I do not want the authorities of this town to be blamed for the high death-rate (and there is no doubt the death-rate is high), which does not arise from causes which are entirely within their control.

618. Do you find that the mortality is greater near the banks of the river, or further away from it?—Not at all.

619. (*Mr. Morton.*) With regard to the middens, do the whole of them drain into the sewers?—They are all of them drained through a great mass of ashes and gravel into the sewers.

620. Is there a grid at the bottom of the ashpit?—Yes, which is surrounded by large stones and coarser ashes, into which they drain; but it would be better if these places were better constructed, and if means were taken to prevent the rain and slops going into the middens.

621. Last year there was no great quantity of rain to fall into them?—No.

622. What was their condition then; was the mortality in the town less?—No, but that was affected by other causes.

623. I see by the return that you only obtain 100*l.* for 7,000 tons of stuff; how do you explain that?—It it so over-mixed with ashes and the immediate neighbourhood of the town is so overdone with night-soil, that without going to the expense of railway conveyance there is no demand for it. Then there is another cause, the farmers will not buy it if they have to come for it during the night. We are obliged to remove the night-soil during the hours of the night.

624. Is it carried out to the land itself, or is it taken to a depôt?—It is taken to a depôt outside the town, wherever we can get it.

625. With respect to the separation of the manure from the ashes, does the scavenger divide it into two lots at the ashpit?—It is done at night by lamplight. We cannot tell how it is done, but it is over mixed.

626. Is the stuff that you call dry ashes mixed with the soil?—We call dry ashes what is taken from the houses, with the dust and the soil, and put into the midden; it is then no longer dry ashes.

627. What I want to ascertain is, whether the whole contents of the middens are taken to the land, or whether a part is thrown away upon spoil heaps?—It is selected.

628. Do you mean that a portion of the contents does cover the ground ultimately?—Yes, but I think you may take this for granted, that no part of the contents of the ashpits or middens will consist wholly of ashes, and no fœcal matters or sink slops are taken to the depôts but to the land.

629. Then the separation cannot be complete?—No, it is not; it is mixed up, and then they select some of this stuff to fill up holes with. That operation causes a great deal of trouble and expense, but it is the only plan we adopt. We have not a sufficient

* See Part IV. pp. 283–288.

water supply to carry out the watercloset system to its full extent, and if we had we should then have the river in a very much worse condition than it is now.

630. Is the large expenditure that you have made, of nearly 5*l.* per head, simply for the supply of your own town?—Yes.

631. It appears by the answer to the first question that the amount expended for waterworks has been 142,000*l.*?—But that applies to the whole cost of the waterworks which supply Bury, Ramsbottom, Edenfield, and Radcliffe. The supply is for 70,000 people.

632. (*Dr. Frankland.*) Are there any privies or cesspools within dwelling houses?—I believe not one.

633. Are there any sleeping rooms over privies?—Not one to my knowledge. If there were any they would very soon be put a stop to.

634. Are there many zymotic diseases prevalent in the borough?—At times the town is very unhealthy. In the last year scarlatina and small-pox sometimes prevailed, and particularly in the overcrowded districts of the town.

635. Are the sewers in the town ventilated?—Yes.

636. By what means?—They are ventilated by down spouts, and there is such a fall that they are not at all offensive; at all events, they are not like the sewers in London, which you can smell as you pass over the grids.

637. Have any complaints been made of the gases of the sewers escaping into the dwelling houses?—Sometimes the large sewers are offensive unless they are properly attended to, and they are a great trouble and a nuisance.

638. To whom do the gas works belong?—The Commissioners.

639. Do they purify with lime?—Yes.

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640. What is done with the refuse lime?—Some of it is used for logging, and some for agricultural and other purposes.

641. Does any of it pass into the river?—None whatever; it is too valuable.

642. Does any of the gas liquid find its way into the river?—There have been such instances.

643. (*Mr. Morton.*) How much do you get for the spent lime?—It is sold for 2*s.* 6*d.* a ton, and it goes to the farmers.

644. With regard to land available for irrigation, is that the flat land we have seen below the level of your sewer?—Yes, it is; but I think that it is over manured already. With regard to weirs I do not think we have answered fully enough the queries relating to them. There is a brook called Fearnbrook, to improve which we have spent a good deal of money, and have diverted all the sewage from the brook.

645. Does that brook run between the two rivers?—Yes. In the Pym Hole sewer the nuisance is not completely done away with, as there is a great mass of stagnant mud, the collection of years, but there are private rights on that brook which we cannot purchase, and which totally prevent our being able to completely improve it, or we should do so by dredging and paving the bed. The great cost, financially speaking, is one obstruction, and the difficulty of getting possession of the private rights is another. They are prescriptive rights, but if they are founded on original encroachments they are no less property now.

The witness withdrew.

Mr. Matthew Fletcher examined.

Mr. M. Fletcher.

646. (*Dr. Frankland.*) You are a medical practitioner, and I believe in extensive practice in Bury?—I have been.

647. What do you consider to be the sanitary condition of Bury at this time?—I first inquired into the sanitary condition of the town in 1843, and I made a report, but my decided opinion is, that since that time the health of the town has improved.

648. During the last three or four years what have been the prevailing diseases in the town?—In 1866 there was a very bad fever, which continued into the year 1868, and it may be important to mention that it began at a village on the east bank of the river Roach, and that is within about 100 yards of the point where the main sewer empties itself into the river Roach.

649. Is that the Pym Hole sewer?—Yes, and of course you cannot but suspect that that might have had something to do with the matter. That fever was the only serious one. We have had from time to time scarlatina since.

650. What fever was it?—Typhoid, of a kind that we call gastric.

651. Is that particularly infectious?—No, but I think it often arises from noxious gases.

652. Has there been much scarlatina prevailing in the town?—Yes, we have it here at present; there has been a good deal of it from time to time.

653. To what do you attribute the prevalence of scarlatina?—For many years the sewage of the north part of the town had been poured and ran down on the surface of a field, and a pond of sewage was thereby created. Two years ago a sewer was formed there, but some bad cases of scarlatina have occurred since; in one house in particular it was extremely fatal, and the question was whether we should be justified in attributing it to the condition of that field, or to the construction of this sewer, to which of course the house drains were connected. I was living in one of the houses at that time, and I noticed very foul smells, which evidently proceeded from the sewer. I pointed this out, and it was subsequently remedied by a wooden trough or screen. I also noticed in the house where scarlatina in a very malignant form prevailed, and where it was fatal in four cases, that the wooden trough had there decayed. I thought that might be the reason, but the house which I have mentioned was in a very bad state, independently of that.

Mr. M. Fletcher.

654. Do you consider that any of the scarlatina cases arise from the state of the middens or privies in the town?—I do not; but I believe that where the complaint is prevailing the cases have become much more malignant, and are aggravated by foul smells.

655. Has there been much diarrhœa in Bury?—From time to time there has been a good deal of it.

656. Was there any diarrhœa last summer in Bury?—Yes.

657. To what do you attribute diarrhœa?—I think it originates from the same cause in many instances; when the cholera prevailed in 1849 it was not in the very filthiest localities, but in the closely confined houses in some of the courts in the town which were in very decent and clean condition, that the cholera prevailed the most.

658. In what year was that?—In 1849.

659. Do you remember how this particular part of the town was supplied with water at that time?—From the same source as now.

660. Were these particular courts to which you have referred supplied with water in the same way?—Yes.

661. Are there any wells in Bury?—Not now.

662. Were there any wells at that time the water of which was used?—No; those had been given up for some time.

663. Was there any cholera in Bury in 1866?—I think not.

664. Do you consider that the mode of getting rid of the excreta in Bury is altogether a satisfactory one?—I think it may be put as an alternative; I would rather have watercloset, but from what I know of the habits of the cottagers here waterclosets would not not be kept in good condition.

665. Are you acquainted with the tank or trough

Mr. M. Fletcher.
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closet, which is used outside a house?—Yes; but I do not know exactly the construction of it.

666. Up to what year were you supplied with water from the pumps?—Up to about 1838 or 1839.

667. Do you know what was the hardness of the well water that was used at that time?—I do not know what it was; these things were not so looked into and tested then.

668. (*Chairman.*) Are there any wells now?—None, nor pumps, at least I do not know of any.

The witness withdrew.

Adjourned till Monday next, at 11 o'clock, at Rochdale.

The Council Room, Rochdale.

Monday, 3rd May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.
DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.
MR. S. J. SMITH, *Secretary.*

MR. THOMAS WALKER examined.

Mr. T. Walker.
3 May 1869.

669. (*Dr. Frankland.*) Are you the borough surveyor?—Yes.

670. It has been stated that in executing sewerage works in Rochdale a number of springs were tapped, and the effect was to lower the water in many of the wells; is that so?—Yes, it was.

671. Were these wells subsequently deepened?—They were in only two cases that I know of.

672. I presume the water from those wells was subsequently employed?—Yes.

673. For what purpose was that water used?—For domestic purposes.

674. Was it used to supply single houses or only to supply a district?—Not more than eight or ten houses from each.

675. Is there any other source of supply at Rochdale besides the Corporation Waterworks?—I am not aware of any.

676. Is there not a spring near to the churchyard?—Yes, and the Corporation have that.

677. To what extent is the spring near the churchyard or any other spring used by the Corporation for the supply of Rochdale?—That is the only one that I am aware of. I do not know the quantity that it yields. The Wardleworth well is the second, and is in Yorkshire Street.

678. What is the well called near the churchyard?—It is called Packer's Spout.

679. Is the supply from Packer's Spout well kept separate to deliver to a particular district?—It is; a supply is also given at the "Packer's Spout" by a tap, and anyone can get a supply from it.

The witness withdrew.

MR. ZACHARY MELLOR examined.

Mr. Z. Mellor.

680. (*Dr. Frankland.*) You are town clerk of Rochdale?—Yes.

681. With regard to the supply of water, is any part of the town specially supplied from the spring near the churchyard?—The water from that spring supplies a public water tap, called "Packer's Spout," and also a district which comprises Packer Street, Fleet Street, King Street, and the low parts of the town below the supply reservoir near to the foot of the Church steps, and it also supplies some houses across the river, and up Yorkshire Street as far as the "White Swan Inn."

682. Is it supplied through mains?—Yes, separate from the other waterworks.

683. To what extent was there a deficiency of water last summer in the general supply?—We were very short of water, and had to resort to the use of lurries or waggons with large puncheons upon them containing water; these we carted along the streets to the different consumers.

684. Was a considerable portion of the population of Rochdale supplied with water in that way alone?—It was carried in that way to the higher parts of the town; in the low parts we had water.

685. Are you at present extending your waterworks so as to prevent such inconvenience being felt in future?—Yes.

686. What is the estimated cost?—Above 100,000*l.* The works are in progress at the present time.

687. (*Chairman.*) Are you taking in a larger area of catch ground?—We are taking in double the present catch water area from commons called Brandwood and Whitworth, which will comprise 1,500 acres of gathering ground.

688. Is the whole area 1,500 acres?—Yes, for the new works; it is put down 7,000 acres in the return; that is a mistake. The present catch water area of the old works is about 700 acres. The gathering ground for the new works is about 900 acres for Cown reservoir, and about 600 acres for the other.

689. Can you tell us what the average rain fall is upon that ground?—I will get that information for you; I may state to the Commissioners that water was pumped and conveyed in pipes from a large colliery at Dearnley to the water-works, and that was the means of obtaining a large supply of water for the town during the droughty weather.

690. (*Chairman.*) Was that not very good water?—Yes.

691. Can you tell us the expense to which you were put by carting the water about last summer?—We entered into a contract with the proprietors of the Dearnley colliery, and I think we were to give them for the water and pumping 500*l.* for three months in the year; 650*l.* for six months in the year; and 900*l.* for nine months in the year. We entered into a contract with them for three years. These sums do not include any expense for carting, which was paid for by the Corporation.

692. Were they not obliged to you for lifting the water from the colliery?—I should think they were; it was so much money in their pocket.

693. (*Dr. Frankland.*) We have it stated in your returns that there are some cesspools under houses in Rochdale, can you tell us in what condition those cesspools are?—The Inspector of Nuisances will be better able to tell you that.

The witness withdrew.

MR. ALDERMAN G. L. ASHWORTH examined.

Mr. G. L. Ashworth.
3 May 1869.

694. (*Chairman.*) Have you any statement to make?—Yes; you just now asked what efforts the Corporation had made to obtain a supply of water in the droughty season. The general supply cost the town 5,000*l.* in addition to the annual sum that we have to pay and also the cost of laying a 10-inch main from the colliery to our reservoir, a length of 3,200 yards; from the colliery we have certainly a million gallons of water a day at our command.

695. (*Dr. Frankland.*) Do you consider that with the new works you are now constructing, there is no likelihood of such a scarcity happening again?—The works we have in hand will give storage equal to 500 millions of gallons, and in addition we have the one million of gallons a day from the colliery.

696. Do you know anything of the quality of this water?—We had analyses made by a gentleman of great eminence in Manchester, and the result was that it was considered in the highest degree satisfactory.

697. Can you put in those analyses?—I believe there is no objection to that.

698. (*The Town Clerk.*) We have an analysis from Dr. Letheby, which I will hand in. (*The same was handed in as follows.*)

"College Laboratory, London Hospital,
DEAR SIR, 2 Sept. 1868.

THE following are the results of the analysis of the sample of water which was sent here for examination on the 18th ultimo. The water was perfectly bright, and when examined in a glass tube two feet in length, it was found to be of a blue tint, and therefore quite free from organic tint. The saline and other constituents per imperial gallon were as follows:—

	grs.
Carbonate of lime and magnesia -	13·19
Sulphate of lime - - -	8·71
Chloride of sodium - - -	1·20
Nitrate of soda - - -	3·65
Silica and alumina - - -	0·81
Organic matter - - -	0·11
	27·67

The amount of ammonia per gallon was only the 0·008 of a grain, and the hardness of the water was 15·5 degrees. These results show that the water is of excellent quality; and, although a little hard, is nevertheless well suited for domestic use.

I remain, dear sir,
Yours truly,
HY. LETHEBY."

The witness withdrew.

MR. ALDERMAN TAYLOR examined.

Mr. Taylor.

699. (*Chairman.*) Have you any evidence to lay before the Commission?—I am anxious that the actual facts of the case should be properly stated. I think there is a great error in what has been sometimes stated, that the water taken from the colliery was abstracted from the river. The moment the pumping in the colliery is stopped, the water would find its way out elsewhere, perhaps at a great distance.

700. What is the depth of the colliery to which you allude?—It is 80 yards.

701. I suppose there is an adit to the colliery?—No, they have to bring it to the level, and then to pump half as high again to the town reservoir at Buckley Wood. The cost of getting that water is cheaper for the town than by any other process of getting it; it is 15½ degrees of hardness, and that is an objection for its use in washing; there is a very small quantity of organic matter in it.

702. (*Dr. Frankland.*) If you can get plenty of such water as you obtain from your present source you had better not use the colliery water.—Of course objectionable it is for some purposes, but for drinking it is the best.

The witness withdrew.

MR. EDMUND ASHWORTH examined.

Mr. E. Ashworth.

703. (*Chairman.*) Have you any evidence to give?—It is important to bear in mind that the water from the colliery is pumped and delivered into the reservoirs, but it only reflows into the river through the ordinary channels of water supply to the town; there is a mile and a half of the river which is left destitute of one million of gallons during the drought time when it requires it the most.

704. (*Mr. Morton.*) Does the water flow into the river when they cease pumping?—No.

705. (*Chairman.*) You pump a portion of the water from the colliery to supply the highest part of the town?—Yes.

706. (*The Town Clerk.*) If there was no pumping not a drop of water from the colliery would go into the river Roach; it is lifted from a depth of 80 yards.

The witness withdrew.

MR. NORRIS TAYLOR examined.

Mr. N. Taylor.

707. (*Mr. Morton.*) Are you the inspector of nuisances?—Yes.

708. The number of privies cleansed by the servants of the Corporation is stated in round numbers to be 4,000?—I believe there are more than that.

709. Do you know the quantity of manure that is taken out of the privies?—I do not.

710. It is returned at about 45,000 tons?—I do not know the quantity.

711. What is the average size of the middens?—They vary in size; in some there is scarcely room for a man to work, and others are about two yards square.

712. How many feet deep are they?—From two to three feet deep.

713. (*Chairman.*) Is three feet the maximum depth?—Yes.

714. (*Mr. Morton.*) How often are they cleaned out in the course of a year?—About 100 a week.

715. Then they are not cleaned out more than once a year?—There are a good many privies connected with factories, and in a mill of five or six storeys high there is a privy in every story; these are emptied about once a month or six weeks.

716. Are the privies which are on the different storeys all connected with one large midden below?—Yes; but we have reckoned them as privies in the number given of 4,000.

717. How many cesspools have you?—I cannot answer that question.

718. Is the stuff which is taken out of the cesspools all taken to a depôt?—No, it is taken directly out of the town, either in boats or in carts, into the farming districts; the boats take it into Cheshire.

719. Is all the stuff so taken used as manure?—No, the dry rubbish is picked out and put into a large gulf; the excrement goes with the ashes into the boats.

720. Is the separation made at the mouth of the cesspool?—Yes.

721. Is it done at night?—Yes.

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722. Is what you call the dry stuff really dry?—No, it is not really dry, and it is difficult to get it so.

723. Does it contain some excrement?—Yes, but it is wet with water from the roof of the privy, and from people throwing in slops.

724. What becomes of this so-called dry stuff?—It is picked out just within the borough, and thrown into the large gulf before alluded to, which nature seems to have left to be filled up.

725. Is the building of houses extending in the outskirts of the town?—Yes.

726. Is it likely to extend over this gulf?—I do not think so. It was rather dangerous before they put the rubbish there, and it is on the bank of the river.

727. Does the river run through this gulf or by it?—It runs by it.

728. As a matter of fact does it take away anything from it?—No.

729. (*Chairman.*) But it will, I presume, when you have filled it?—I do not know.

730. (*Mr. Morton.*) Can you tell me what is done with the street sweepings?—We have a depôt, and sell what we can.

731. Are they used as manure too?—Yes, the greater portion.

732. What do the farmers give for the street sweepings?—The price used to be 7*d.* a yard, but now it is 4*d.* or 5*d.*; if we get 1*s.* for a two-horse load we do very well.

733. (*Chairman.*) Do the farmers carry it away?—Yes.

734. (*Mr. Morton.*) Then there is no gully-hole, or other arrangement by which the contents of your scavengers' carts can be tipped into the river?—None at all.

735. Are the cesspools attached to the houses?—Yes.

736. Are the cesspools close to the foundations of the houses?—No; not as a rule.

737. The Commissioners have seen rows of houses standing back to back, probably 20 or 30 feet apart with a central gangway wide enough to wheel a barrow, and on each side of these gangways there are privies, one to each; is that the usual arrangement?—Yes; but the Corporation have caused a great many of the privies which were close to the houses to be altered. Some of the privies used to be adjoining the sculleries, but they have had them removed, and put them two or three yards from the ends of the houses.

738. Are there not a few instances still of cesspools being under dwelling-houses?—There are not more than two instances, and one of those belong to a gentleman who ought to know better, for he is a doctor.

739. Are there any instances in which privies are inside a house communicating with a cesspool close to the house?—I do not know of an instance of that kind.

The witness withdrew.

MR. OLIVER HOLT examined.

Mr. O. Holt.

740. (*Chairman.*) You are, I believe, desirous of communicating something to the Commissioners?—Yes. I wish to speak as to the cesspools, and the manure taken from the mills. The condensing water from the steam engine runs through the bottom of the cesspools, and from the cesspools it is washed into the river.

741. (*Mr. Morton.*) Do the cesspools drain into the sewers?

(*The Inspector of Nuisances.*) I do not know of one case.

742. (*Mr. Morton to the witness.*) What becomes of the water; is not the man who cleans out the cesspools often up to his knees in water?—They have large buckets for the purpose.

743. But I am talking of an ordinary house midden; are these drained into the sewers?—No.

744. Is there any dry stuff which comes out of them?—Yes.

745. What becomes of the waste water used in the house and the chamber slops?—That goes down the common sewer.

746. Outside the house?—Yes.

747. (*Chairman.*) Then, as I understand you, the midden receives the ashes and fæces?—Yes; but in some cases water and slops are thrown in.

748. (*Mr. Morton.*) In those cases of course you cannot clean out the privy with a spade, you must use buckets?—Yes; but buckets are principally used in cesspools which are connected with large foundries and large cotton mills.

749. There is nothing but ordure in the cesspools?—Just so. There are, perhaps, 500 or 600 hands in the mill that daily use the privies connected with the cesspools.

750. That is the sort of material that would be worth more to the farmers?—Yes, no doubt of it, and the Corporation are just finding that out.

751. (*Chairman.*) Is steam passed through these large cesspools?—The injection water flows through the cesspools and wash the contents into the river through their own drain.

752. Are we to understand that these cesspools have a communication with the sewers?—They have a communication with the sewers of the mill, the overflow being in the river, and a communication with the public sewers also. They use the injection water to wash the contents out of the cesspool into the river.

The witness withdrew.

DR. FREDERICK W. BOOTH examined.

Dr. F. W. Booth.

753. (*Dr. Frankland.*) I believe you are in practice as a physician in Rochdale?—I am.

754. How long have you lived in Rochdale?—I have lived in Rochdale seven years.

755. Do you know any particular localities in Rochdale that are specially unhealthy?—The crowded parts of the town, in which I may mention Packer Street, King Street, Church Lane, and the intersecting alleys and streets joining them are particularly unhealthy. If the Commissioners will grant me their attention for a few moments I will lay before them a brief statement of a few considerations pertinent to the present inquiry. My object in troubling them has reference to the matter in its sanitary aspects, of which, during the seven years that I have resided in close contiguity with the river, I have possessed some opportunities of making myself acquainted. For seven years I have largely shared the medical duties relating to the parochial district of Castleton, a district which embraces nearly the whole of the south bank of the river during its passage through the town, and my visitations amongst the poor have brought before me from time to time the varied conditions of health and disease which exist amongst the numerous population exposed to the influences of the noxious emanations from the river. During the whole course of my observations zymotic diseases have been endemic, sometimes subsiding into infrequent attacks of a comparatively mild type, and again becoming aggravated into a widely spread scourge of a malignant and fatal character. During the last 12 months the rate of mortality has been greatly increased. Compared with former years the death-rate has been augmented, judging from my own experience, by 15 or 20 per cent. The increase is due to the wide prevalence of scarlatina, smallpox, typhoid fever, diarrhœa, and cholera.

I do not believe scarlatina and smallpox are produced or propagated by river pollutions, except in so far as physical systems enfeebled by the respiration of noxious air are rendered more liable to their accession. The other diseases are, in my opinion, largely caused, or at least developed and propagated, by the miasmata of organic decomposition, which are considered to be the effluvia arising from excrementitious matter, and the winter months are known to be favorable to their development. Even if actual disease is not produced there is an adynamic condition of body entailed which seems to establish a proclivity to disease. Every autumn and winter we are visited by an outbreak of typhoid fever. In the course of the last six months the visitation has been unusually severe and fatal, and, in numerous cases which have fallen under my own observation, disorders, which at first presented but slight febrile characteristics, have, from the infected condition of the atmosphere, become associated with a depressed typhoid condition of the vital powers. In cholera and diarrhœa the effects of the pollution of the river have been definite and marked, and its present condition is such as to favour the exhalation of deleterious gases. The sewers bring down into the river fœcal matter and mill refuse. The solid portion of this sewage forms a thick embankment of organic mud, and lines the channel of the river throughout the greater part of its course through the town, the weirs preventing it from being washed down by high floods. The water for several hundred yards is thus rendered almost stagnant by the weirs, and the decomposing accumulated excreta in the river bed emit exhalations, which becoming diffused throughout the atmosphere of the town, may spread disease and contagion over a wide district. When the river bed is cleaned, a very cursory examination of the mud will convince anybody of its nature. When the rains have raised the river level so as to cover the mouths of the drains, the disturbed mud in the drains gives forth offensive odours, which, not being able to escape into the open air, are forced into the dwelling houses. Of this I have had frequent experience in my own residence with most disagreeable results. Flushing the sewers periodically would, in my opinion, be of service in mitigating this evil. I think it is of the utmost importance for the health of the town that sewage should be prevented from entering the river. I must leave to others the task of saying how this is to be accomplished by works of irrigation, or otherwise; but I do not think any more effectual means can be adopted than the plan of irrigation adopted in many towns. The present state of the river is most injurious to health and comfort, and I am convinced that to it is due a perceptible portion of our annual mortality.

756. You have spoken of several specially unhealthy localities in Rochdale; to what cause or causes do you attribute the unhealthiness of those particular localities?—To their being overcrowded, and to the consequence of the people constantly breathing impure and polluted air.

757. Air polluted by what?—By a want of cleanliness and by the atmosphere from the river.

758. Are all those unhealthy localities in the immediate neighbourhood of the river?—Yes.

759. Are there other localities which you have not yet mentioned that are also unhealthy, but which are away from the river?—We never find fever when it assumes an epidemic character altogether absent from those localities.

760. Have you found typhoid fever to prevail greatly in Packer Meadow?—We have had very many instances there.

761. Do you consider that the retention of the excrements of the people in the town has any effect upon the public health?—I do, certainly, in cases of epidemics.

762. Do you attribute such effect to the mode of disposing of the excrementitious matter in Rochdale?—I think that, allowing the excreta of patients suffering from typhoid fever to be washed down the drains and to accumulate in the river bed where it is prevented from escaping by the weirs, has a most prejudicial effect upon the health of the people.

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763. Was cholera epidemic in Rochdale in 1866?—We had a good many cases of choleraic diarrhœa.

764. But had you any cases of true Asiatic cholera? We had no cases of true Asiatic cholera.

765. Are you aware whether in 1854 there were any cases of Asiatic cholera in Rochdale?—No, for that was before my medical experience began.

766. You have spoken of a high death-rate last year, can you state what was the death-rate for 1868?—I do not know the exact numbers; I only judge from the increased number of interments.

767. It appears by the returns that there was a very high death-rate in 1865, the numbers being 29·2 per 1,000, to what cause would you attribute that high death-rate?—I believe there was a great deal of typhoid fever as well as smallpox in that year.

768. It appears that the people in Rochdale have a choice between soft water and hard water, have you noticed that they manifest any preference for the one or the other?—I believe they prefer soft water as a rule.

769. Do you know what the maximum density of population is in those very overcrowded parts of the town, and what is the maximum number of inmates in a house?—I cannot give you that.

770. Are you able to give us the area and population of Packer Meadow?—I am not.

771. If I understand you rightly, you attribute the zymotic diseases, or the greater proportion of them in Rochdale, principally to the pollution of the river?—I consider that zymotic diseases are very much aggravated by it.

772. (*Mr. Morton.*) What is your opinion as to the comparative salubrity of a house, the cesspool in which is water-tight, and has no connexion with a sewer, and a house, the overflow from whose cesspool is turned into the river?—My house is on the bank of the river. A drain from the cellars communicates with the river. I think that fetid odours frequently, especially when the mud in the river is disturbed, come up that drain.

773. I presume you would prefer to have a cesspool which might be emptied three or four times a year, and which should retain all the fœcal refuse of the house?—I would have it emptied more often than that; and I should like to deodorize it with earth if I had a cesspool of that kind.

774. Looking at the average condition of the middens in Rochdale, do you think it would improve the chances of health in the town if their contents were washed out into the river, or if they were left, as at present, watertight, to be cleaned out by the scavengers at the intervals of which we have heard, three or four times a year?—I think it would be better to have them cleansed out as at present. If the Corporation deodorize them and mix the contents with earth so as to prevent any exhalations from them I should infinitely prefer that mode of dealing with them to letting any human excreta whatever flow down the river.

775. (*Dr. Frankland.*) Do you know whether the sewers in Rochdale are well ventilated?—I do not.

776. Have you come in contact with any cases, and if so, with many, in which the gases have penetrated from the sewers into the houses?—Yes, many cases; they do so in my own house.

777. Have you ever traced typhoid fever or scarlet fever, or any zymotic disease to that cause?—I could not refer to any specific case of typhoid fever and attribute it to bad drainage.

778. In the cases where the gases penetrated into the houses, were the drains untrapped or were the gases forced through the trap?—The sewers were not trapped.

779. If that were so the sewers were badly ventilated?—Yes.

780. Are you quite clear that the gas escaped through the water in the traps, and that the traps

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were not defective?—I will not undertake to say precisely what the medium was through which the smell came.

781. (*Mr. Morton.*) How often do you think these privies ought to be cleaned out in order to avoid all these evils?—That I think would depend in a great measure upon the quantity of earth or ashes with which they were mixed. I believe that a mixture of earth and ashes has a deodorizing and disinfecting influence upon the excreta, and that it should be kept dry.

782. If it is kept dry the interval probably is not so material. A privy might be left for a longer time?—I do not think they would be more injurious to health if the contents were properly mixed with ashes, than when they respread, for example, in a field.

783. (*Dr. Frankland.*) Do you think that zymotic disease is capable of being communicated by excrementitious matter diffused through the air, as dust?—That is a very difficult question to answer.

784. Have you noticed any cases that you think you could attribute to propagation in that way?—I have noticed that when the water in the river has been very low for a considerable time, it has been followed by sickness and ill-health.

785. Does the mud of the river then become dry and dusty?—It is merely uncovered by the water; it is still mud, and not dusty; it bubbles up and exhalations ooze through the mud.

786. (*Mr. Molesworth.*) (*Through the Chair.*) Does the sewer empty itself into the river just by the foot bridge?—It does.

787. Have you noticed a great stench from that?—Yes, a most intolerable one, and most disgusting.

788. Do the contents flow perfectly black?—Yes, as black as ink.

The witness withdrew.

Mr. Ashworth examined.

Mr. Ashworth.

789. (*Chairman.*) Did we not send to you the series of questions addressed to cotton and woollen manufacturers; you have not returned answers?—Yes, during my absence, and it passed from my observation, I am very sorry for it, and for that reason I attend here to-day. I support Dr. Booth's testimony as to the state of the river and sewers. I have resided here for 40 years, and am able to speak to it. My office is situated immediately above one of the weirs in the town, and immediately below one of the large factories which have been mentioned as passing the contents of its cesspools into the river without let or hindrance. Last summer during the intensely hot weather it was impossible, under any consideration whatever, to have the windows facing the river opened. I and others in my employ suffered, in my case it terminated in a very serious attack of English cholera, which I attributed to the stench arising from the river. I think the removal of weirs within the borough imperative. The immense deposit of mud stopped by the weirs is flushed out from the mill lodges above on Saturday; the mill occupiers then collect the water in all their reservoirs, and very little water flows down on Sunday. I rent a mill in another part of the town; the whole of the water for engine purposes has been supplied from one of the main sewers in the neighbourhood; the overflow goes into a well within the precincts of the mill, and it is then pumped up into a cistern at the top of the mill, and the odour from that is of a most disgusting character at all times; at the period to which I have referred, it was intolerable, and nothinh but a very free ventilation of the mill rendered it possible to work in it at all. That sewage water and the hotw ater from the mill, and I am speaking now of half a score of others in the same neighbourhood, all goes down, after being boiled up and used, into the river to the lower parts of the town, and I believe that the using of such water for manufacturing purposes, and then returning it to the river, must of necessity be greatly injurious to health, and that the existence of these weirs within so dense a population is perfectly incompatible with the proper flow of the river, which should carry away the excrements. I think also that some note should be taken of the fact that there are a number of houses in this town provided with the most modern class of waterclosets, which cause no offence themselves, but which pass, by using a quantity of water, all human excrement into the public sewers, and from thence it is washed into the river, so that while the individual is preserved the public suffer.

790. (*Mr. Morton.*) Does the weir of which you have complained provide power at your mill?—Not at all at mine.

791. What do you suppose is the value of this weir?—I cannot give you any idea of its value.

The witness withdrew.

792. (*Chairman.*) If there are any gentlemen present who have property upon the banks of the river below the town who are desirous of stating whether the river itself has any injurious effect either upon their health or upon their business operations we shall be glad to hear them. We have distinct evidence that within the town itself much discomfort is experienced.

793. (*Mr. Holt.*) Since waterclosets and cesspools have been drained into sewers and thence into the river, and the water used for steam boiler purposes and turned in again, it has made matters worse. Keep the sewage out and the river would be in a better state.

794–7. (*Mr. Taylor.*) (*To Mr. Holt.*) Will you be ready to treat with the Corporation for the sale of the weir?—That is another thing.

(*The Town Clerk.*) I wish to state that the Council are now making a trial, so far as the ash-pits and privies are concerned. The cleansing has been hitherto let by contract; but we have altered about 140 privies, and are carrying the excreta and refuse to a manufactory and mixing it with ashes, for the purposes of sale. The trial is now going on.

(*Chairman.*) You will be able probably, by the time that the Government or the Legislature gives you authority to deal with the nuisance, to say that you have done something.

(*The Town Clerk.*) We are anxiously waiting for the recommendation of this Commission. We are trying a system with a view to prevent as much as possible this foul matter going into the river, and to make money by it.

Adjourned till to-morrow at 11 o'clock at Oldham.

The Town Hall, Oldham.

Tuesday, 4th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

Mr. Robert Lynam examined.

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798. (*Dr. Frankland.*) Are you the borough surveyor?—Yes.

799. Can you tell us whether the gas works in Oldham belong to the corporation?—They do.

800. What is done with the refuse from the gas works?—It is sold and carted away.

801. Is the purification performed by means of lime or the oxide of iron?—I believe it is by lime.

802. What is done with the spent lime?—I believe it is disposed of to the farmers as manure, and there is also a ready sale for it.

803. Does none of the refuse go into the stream or the sewer?—None at all.

804. I believe there are no cesspools in Oldham?—None.

805. And no privies over which sleeping rooms have been built?—I do not know of any now; there were some a short time ago, but they have all been removed.

806. Are there any wells or springs that are used in addition to the corporation water supply?—Not half a dozen wells.

807. Are the wells much used, or only by single houses?—To a very inconsiderable extent. Nook Pump is used more than all the rest put together, and perhaps by 200 or 300 families.

808. In what part of the town is that situate?—In Henshaw Street, on the north side of the town.

809. You experienced difficulty, I presume, in obtaining water last summer?—Yes.

810. To what extent was the supply short?—The mains in this district were only charged two or three hours a day. There were many districts where for days and weeks together they were unable to draw any water.

811. What was done for water; was it carted about at that time?—No; people fetched it in buckets from the mains in the lower part of the town.

812. Is it in contemplation to extend your works in consequence of the insufficient supply?—We have been in Parliament during this session with a waterworks scheme, which, I am sorry to say, was unsuccessful.

813. At what cost is it contemplated to extend the works?—The estimated cost of the proposed works was 225,000*l.*

814. For what total population was that intended?—The present population within the limits of supply is 123,000.

815. Do you contemplate a proportionate increase?—Yes. The population of the borough increases at the rate of 2,000 inhabitants in a year.

816. Are the sewers in Oldham well ventilated?—Yes, tolerably so.

817. By the return I find they are ventilated in three ways, by manholes, gullies, and by down spouts?—And by side entrances they are specially ventilated.

818. Do you mean that they are at the sides of houses?—No; I mean those in the streets.

819. Are there many of those entrances at the sides of the houses?—No; the principal ventilation is by down spouts.

820. What has been your experience of the efficiency of the mode of ventilating by down spouts?—I think it is perfectly unobjectionable if it is carried out in a proper manner.

821. Have you heard any complaints of the gases from the sewers being blown into the windows of the houses?—No; but it is desirable, in the first place, that the pipes should be air-tight ventilating pipes, and, in the next place, that they should be taken in such a position that the gases could not possibly get into the bedrooms.

822. Is it not often the case that the down spouts are put together in lengths, and that the joints are not air-tight?—That is what I had regard to when I spoke of doing the work in a proper manner; we should make them air-tight.

823. Have you known any cases in which there has been an escape of gases into the houses from the sewers?—I think that that is a thing which occurs at all times at Oldham. There are many old sewers which are untrapped, and where they are connected inside the houses with the sinks the gases from the sewers must necessarily get into the dwellings.

824. Do you think there are any houses in which the gases are forced through the water in the traps?—I have not found that to be the case.

825. Are there any cellar dwellings in Oldham?—Yes.

826. Are they gradually being reduced in number?—Yes, they are.

827. What is done with the cellars when they are closed. I suppose they have slop stones and sinks in them?—I believe that those that we have closed, in some instances, have been filled up with good material.

828. Do you think that there are none which have been closed with the gullies and sinks in them left in their original condition?—I daresay in some cases that they have been so left.

829. Is there no one whose special duty it is to see that that is not the case?—That depends upon the landlord; we have no compulsory powers in the matter.

830. What is the supply of water in Oldham per head of the population?—It is rather less than 23 gallons per head.

831. Have you at all considered what would be the probable increase of water required, on the supposition that waterclosets were used in place of privies in Oldham?—I think that if waterclosets were substituted for privies universally in the borough there would be required an increase in the quantity of water supplied of 15 gallons per head per day.

832. How would that increase in the quantity of water required be caused?—My experience is that waterclosets are always losing the water, that is, that they are always wasting it.

833. If there was good inspection of these matters, would there be anything like that additional quantity required?—I think that, practically speaking, waterclosets always involve a considerable waste of water.

834. But assuming the waste to be prevented, what, in your opinion, would be the additional quantity required?—Perhaps 10 gallons a head per day.

835. How much do you calculate escapes from the pan each time a watercloset is used?—That depends upon the size of the cistern, but I think it is from two to four gallons.

836. Have you had any experience in any particular district of Oldham of the conversion of privies into

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waterclosets, and the consequent increase in the consumption of water?—No.

837. Then what you have stated is only an expression of your opinion?—Yes.

838. Supposing that tank closets in place of waterclosets were used, would the additional consumption of water then be anything so great as you have mentioned?—I should think not.

839. Have you made any estimate of what the additional consumption would be in that case?—I have not.

840. (*Chairman.*) Are you able to state what number of inches of rainfall there is in this district?—The average for the last 10 years has been 36 inches.

841. (*Dr. Frankland.*) What kind of drainage pipe is used in Oldham, is it the butt joint pipe?—No, they are all socket pipes.

842. (*Mr. Morton.*) I see that there are in Oldham 2,305 privies?—Yes.

843. There are also 2,735 ashpits; are they connected with the privies?—Yes, in the majority of cases.

844. Then the 2,305 privies or middens and the 700 waterclosets are the total number of places of that kind in Oldham?—Yes.

845. Making altogether about 3,000?—Yes.

846. In the return from this borough you have stated that there are in Oldham 2,305 privies and 2,735 ashpits, that does not mean, I presume, that there are 5,000 places of that sort, but it means that there are only 2,305 privies, each of which has an ashpit attached, and that there are certain ashpits in addition; is that so?—That is so.

847. In cleansing out the middens, do you act upon notices from the owners, or do you employ local inspectors, whose duty it is to attend to that operation?—We have two local inspectors.

848. Is the stuff that is got out separated into that which is useful for agricultural purposes and that which is useless?—Yes.

849. Where is that separation made?—At the mouth of the ashpit or at a depôt; it is generally done at the ashpits themselves. From the form of ashpit which is used here we are able to separate the night-soil from the dry ashes, so that we only remove the night-soil in the night time, and then we take it away in carts which are especially provided for the purpose, and thence loaded into the railway waggons and taken away.

850. Is there no connexion between the privy and the ashpit?—The ashpits have a false bottom, or rather, I should say, they have two bottoms, so that the night-soil is in the lower compartment, and the dry ashes are thrown on the top.

851. Are the ashpits drained into the sewers?—They are in some cases, but not in all.

852. In those cases where there is no drainage, does not the water accumulate?—Yes, it does.

853. And wets the ashes and raises them up?—Yes, there are some few cases where they are very wet, but generally speaking the water percolates away.

854. In that case it would wet the surrounding soil, would it not?—Yes, it does.

855. What is done with the so-called dry ashes?—Those are taken to the tip, and they are deposited in the valley below here.

856. Are they used to fill up hollows?—Yes.

857. Do you suppose that buildings will be extended over those places ultimately?—They will probably over a part of them, but we are particularly careful to avoid sending any night-soil with the stuff.

858. What is the average size of the ashpits?—In some places they will hold 10 or 12 cubic feet of stuff, and in other places they will hold as much as 40 cartloads.

859. Is there only one of these places connected with a large number of houses?—Yes.

860. How often are they cleaned out?—As often as required.

861. How often is that, or how many cleanings do the 2,305 middens undergo in a year?—On an average five or six times in the course of a year.

862. I see that the quantity of refuse is spoken of as 50,000 tons; is that only a rough estimate, or is it anything like accurate?—I think it is accurate.

863. Is the whole of the refuse useful for agricultural purposes?—Only partially so.

864. What proportion of it would be dry?—Upwards of 20,000 tons.

865. Is any price obtained for the dry stuff?—No.

866. Is anything paid for the street sweepings?—Yes.

867. What sum is obtained for it?—About 50*l.* a year.

868. It appears that there are 69 boxes, what are they?—Those are boxes which are used for the receipt of the night-soil in places where they could not very conveniently erect privies, and those boxes are all removed once a week, and emptied into the night-soil carts.

869. Is that at the instance of any particular company or persons who have to deal with it?—No; it is simply an emergency which is brought about by the peculiar mode of erecting the houses.

870. In that case I suppose they have to carry the refuse through the house?—It is very frequently so. The boxes are about 2 feet 3 inches long, about 12 inches wide, and 14 inches deep.

871. Is there a box for each house?—No; in some cases they serve for several houses.

The witness withdrew.

MR. THOMAS PLATT examined.

Mr. T. Platt.

872. (*Dr. Frankland.*) You have been, I believe, for some years in practice as a medical man in Oldham?—I have.

873. How long have you been so engaged?—For about 13 years.

874. Do you know any localities in the borough which are specially unhealthy?—Not at the present time.

875. Are they all equally healthy?—My experience has been very varied from the time I came here until now. In the earlier time there were some Irish localities which were densely populated, there were a great many cellar dwellings and a good many privies and ashpits that were at that time in a much worse condition than they are now.

876. Do you consider that the town at present is upon the whole in a tolerably satisfactory or unsatisfactory state?—There are a few localities still in which there are old buildings and narrow streets, and it must of necessity be worse there than in other parts.

877. Do you find that zymotic diseases prevail in those localities?—Yes. In previous years we have had epidemics of scarlet fever, and a notable one occurred, I think, in about the year 1862, which increased in severity until about the middle or end of 1863, and at that time it was very bad indeed.

878. That, I presume, accounts for the great increase in the mortality of that year?—I should think so decidedly, because at that time there were many families that lost three or four children; and the notable part of that epidemic was this, that although the houses were new and built upon modern principles, yet still it was to be observed that wherever they were built upon recently filled up land, there the mortality was the greatest.

879. With what had the land been filled up?—I can scarcely tell you. I should fancy it was the ordinary materials used in filling up—very miscellaneous refuse.

880. Would ashes form a part of them?—Yes.

881. Was there no other special cause to which you could attribute the prevalence of disease in these new houses besides their being built upon new land?—The districts that I more particularly refer to are Lyons Dam and Prince Albert Street, which is bounded by Ratcliffe Street, and I think that in one or two instances lodges had been filled up. It is in a very high part of the town, with a very good fall.

882. Not near to the river?—Not at all.

883. Are you able to attribute to any special cause the high mortality in Oldham in 1865 and 1866?—I think that from 1865 a good deal of the mortality was owing to zymotic diseases; scarlet fever was very bad in that year.

884. Was there any typhoid fever?—Not much; but we had, I think, distinct typhoid fever last year more decidedly than at any other time that I can remember. I do not think it was very fatal. I have only just this morning seen the tables.

885. In order to complete the table can you give us the mortality in the year 1868?—I cannot.

886. (*Mr. Lynam.*) It is here (*handing in the same*).—(*The Witness.*) I see typhus 37. I think it is so marked at the bottom.

887. (*Dr. Frankland to the Witness.*) Have you noticed any prevalence of zymotic diseases on the banks of the streams?—We have no streams; they are, as I may say, under the ground; we do not see anything of them except the great sewer at the bottom of the park, and that is so much below the ordinary level that we do not even smell it.

888. Do you not even suffer discomfort from it?—No; the drainage of Oldham has been of late years very much improved, and there has been much less of emanations from the sewers; but there is one great difficulty, and that is the imperfection of the communications between the cottage houses and the sewers.

889. What is the nature of that imperfection?—The smells often come into the houses.

890. That is to say they, the branch drains, are not properly trapped?—In many cases I think it is so.

891. Have you noticed on many occasions that the gases from the drains make their way into the interior of the houses?—Yes; at the end of last year it was notably so, as the water supply was so deficient that the sewers did not get thoroughly flushed and cleaned out. In almost every case of typhoid fever it was typhoid fever well marked, entirely uncomplicated with any other disease. I found these cases depending upon some defective atmospheric cause in connexion with either a drain or a sewer.

892. Have you traced many of those cases to the actual admission of gases from the drains or sewers into the houses?—Yes, either from the dry condition of the waterclosets or the imperfect connexion of the slop stones with the drains.

893. Did some of those cases occur where there were waterclosets?—Yes, and a most notable instance was one in which every member of the family but one had been attacked and some died. From the month of October till the month of March isolated cases were coming on one after the other, and I thought that outbreak must have resulted from the drain being blocked up. In that case I detected a smell on the first visit, and when I found sickness beginning I had everything looked after, and when the drain was examined it was found to be entirely blocked up with dry sewage.

894. Do you think that arose from a scarcity of water?—I think undoubtedly it arose from a deficient supply of water to the closet.

895. Was it known that the water did not flow into the closet when the handle was drawn up?—Yes, but the water was not to be got. The house was rather elevated in position and they had not any water in the house; they even had to fetch it for cooking purposes.

896. Has there been much diarrhœa in Oldham?—There has been much less diarrhœa of late years. In 1862 or 1863 I had in my district about Priest Hill, and there were two decided cases of cholera, but since that time there has been a new sewer made, and new pavement put down, cellars have been closed, and one or two nasty ashpits have been entirely removed.

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897. During last autumn had you no particular attack of diarrhœa in Oldham?—It was not very severe, indeed much less than I expected.

898. You are no doubt aware that it was elsewhere very prevalent at that time?—Yes; I may mention that we seldom have pure typhus.

899. When had you the last epidemic attack of cholera in Oldham?—I think it was in about 1865 or 1866. I think we had a little then.

900. Was it really epidemic cholera in 1866?—No; I think they were really sporadic cases.

901. How many deaths occurred on that occasion?—About three.

902. Do you know whether cholera was epidemic in Oldham in 1854?—In my own experience there were many cases of diarrhœa, but not of true Asiatic cholera.

903. I presume from what you have said that your knowledge does not extend back to 1849?—It does not.

904. Do you consider that the retention of excrementitious matters in a town has any effect upon the health of the inhabitants?—Undoubtedly it has.

905. An injurious effect?—Yes.

906. Do you think that the removal of excrementitious matters before they have entered into a state of putrefraction is very desirable?—I should think that it would be the best and safest plan to remove them undoubtedly.

907. Are you acquainted with any dry method of treating excrements by which that object can be obtained?—I have had no experience in that way.

908. Can you tell us what is the maximum density of population in Oldham, or, in other words, what, in your opinion, has been the maximum number of persons living in a house, and the size of it?—I really cannot do so at present, but I know that the number is now very much diminished. My own district is very much less crowded with people by at least one-third.

909. Do you believe that there is overcrowding in Oldham?—There is very little indeed.

910. Do you know the Nook Well spoken of by the borough engineer?—Yes, and it is a well of great reputation.

911. What is the quality of the water from that well?—I think it is very pure, although I do not know its analysis; it is very pleasant water to drink, and it comes from the very highest portion of the town. It cannot possibly receive any pollution from any source of drainage.

912. Are there no houses near to it?—There may be, but if so they are nothing but a few cottages in the vicinity.

913. Have they privies attached to them dug out of the soil?—I daresay they are not very far off, but I fancy the water comes through the rock.

914. Have you or have you not traced any cases of disease to the use of that particular water?—I do not think I have.

915. Have there been any cases of typhoid fever about that place?—I do not think it is the healthiest portion of the town.

916. Where did the deaths from Asiatic cholera occur?—They occurred in the crowded neighbourhoods, in Lords Hill Street and Hopwood Street, in the higher quarters of the town.

917. Not near to "Nook Well"?—No. I think there were very few cases; scarlet fever was bad there.

918. Have you noticed that the ventilation of sewers by down spouts causes any gases to get into the bedrooms of the houses?—I do not think that it does.

919. Do you attribute any of the unhealthiness of Oldham to the middens and ashpits in the town, or to their not being emptied?—I consider that they are much more efficient now than they were in former years. The cesspools and middens were then badly

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connected, and the water and a portion of the excrements used to ooze out and cause offensive smells.

920. Mr. Lynam stated that in some cases the watery portion of the excrements did percolate into the surrounding soil?—Yes; I see that myself now occasionally, but it does not occur so often as it used to do. They line the cesspools now with bricks and cement, and they are considered to be water-tight.

921. But would that percolation, where it did occur, be in your opinion a cause of unhealthiness?—I should think so decidedly.

922. Do you think upon the whole that the rate of mortality, or, in other words, the healthiness of Oldham is improved?—I do, and notably so, but the time is not sufficiently far advanced to give any very correct data upon that head.

923. You have got down now to what it was in 1859?—Truly, and that is not saying very much for it.

924. How do you explain the very low mortality in the year 1864, when it was 21·57 per 1,000?—I cannot explain that.

925. Have you noticed that there has been any difference in the mortality of wet years as compared with dry years in Oldham?—I do not remember specially noticing the mortality in that way, but 1864 was a dry year.

926. And also last year?—Yes, and as long as the dry season lasted it was comparatively healthy, but when the wet came we had a good deal of sickness.

927. Was not the mortality in Oldham for 1868 lower than it had been since 1864?—It was so.

The witness withdrew.

MR. JOHN PONSONBY (Town Clerk) examined.

Mr. J Ponsonby.

928. (*Chairman.*) I believe you wish to put in some tables?—Yes, for the purpose of showing the density of the population. Whilst in many places there are only 21 or 22 persons to an acre, there are in Scullcroft 263 persons to an acre and in Hopwood Street 322 to an acre, therefore in those two localities there is the most of the local overcrowding in dwellings that has been referred to, for in some cases there are 12 or 13 persons living in two rooms. This will be confined to those two localities and to limited spaces.

929. (*Dr. Frankland to Mr. Platt.*) Have you found those particular portions of the town to be more unhealthy than other parts?—At one time they were, but now they are much less crowded, and are undoubtedly healthier. One part has in a great measure been re-sewered, but the other part, Lords Hill Street, is still unimproved.

930. (*To the Witness.*) The figures you have given refer to the present condition of the houses in the town?—Yes, they have just been obtained for the purposes of this inquiry.

931. Do you know what is the density of population in the whole of the borough, how much per acre?—It is about 20 or 21, taking it altogether.

932. (*Mr. Morton.*) Is there not a large portion of the area which is not yet built upon?—Yes; there is not more than one-fifth or one-sixth built upon. Referring to the streams flowing by or through this borough, although they are very small and very insignificant, it seems to me that it would be very desirable that the recommendations of this Commission should result in placing the conservancy, even of small streams like these, under the care of the municipal authorities. The waters of those streams are utilized for manufacturing and condensing purposes; they are stored in reservoirs, and consequently there is a great amount of sediment deposited in all the mill lodges, which are from time to time flushed or slushed out. The consequence is, that all that mud and dirt is thrown down upon the mill-owners below when they have no notice of its coming, and other things no doubt happen of the same kind on a stream which the corporation have no power to interfere with in any shape or form. But with regard to the principal stream, such as the Sheepwashes Brook, it has now become the main sewer through the town, and it cannot be called anything else but the main sewer. It is covered over throughout the whole of its passage through the town. Mr. Platt has already stated that the probability is, that no ill-effects arise from the condition of the stream, because it is remote, as it were, from the population, but still if you approach it you cannot but be assailed by the offensive smells that arise from it.

933. As I understand, you have no jurisdiction over the streams now?—Not at present.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock at Stockport.

The Court House, Stockport.

Wednesday, 5th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

HENRY HEGINBOTHAM, Esq., M.R.C.S., (Mayor of Stockport,) examined.

H. Heginbotham, Esq.

934. (*Dr. Frankland.*) How many years have you been in practice in this borough?—For 20 years.

935. Until very recently have there been no tables of mortality kept in this borough?—There have not.

936. The return which has been made to the Commission shows the rate of mortality to be 32 per 1,000?—Yes; but there were exceptional circumstances that accounted for that excessive mortality.

937. What were those exceptional circumstances?—We had an epidemic in the form of scarlatina, and to a large extent the mortality was essentially amongst children.

938. To what cause or causes do you attribute that epidemic?—It was almost an unaccountable one, but it affected all parts of the town alike, those that were well drained as well as those that were inefficiently drained.

939. Are there any localities in Stockport which are specially unhealthy?—No doubt there are such localities.

940. Are they near the river?—One district is near the centre of the town, near a small stream called Hempshaw Brook, or Lower Car Dam, which used to be clean, but is now very much polluted. In that locality the mortality has been large.

941. Do you attribute the excessive mortality in that particular district to any influence or effect proceeding from the river?—Not from the river, but from the Hempshaw Brook.

942. Along the course of that brook where does the excessive mortality show itself most?—Through the whole of its course.

943. Has there been any special outbreak of disease near this reservoir (*pointing to the plan*), where it is comparatively stagnant?—No; a little higher up, I think, is the place.

944. Are there houses in Stockport which have privies and cesspools within them?—Yes; enclosed within the walls of the houses. I do not know of any where people are living over them.

945. Have you ever traced cases of zymotic disease to such a source as that?—Not to any very great extent.

946. Do you think that the mode of disposing of the excrementitious matter in Stockport has any influence upon the health of the inhabitants?—If there was a more efficient mode of removing the excrementitious matter no doubt good would result; but the difficulty is, that we have no organized system of removing it.

947. Do you think it is desirable to remove excrementitious matters while they are fresh, and before they have entered into a state of putrefaction?—I should think that it would be far better to have them removed when they are fresh.

948. Are the sewers in Stockport well ventilated?—They are very imperfectly ventilated.

949. Are complaints made that gases escape from the sewers into the houses?—We have many complaints of that kind.

950. In your opinion has any disease arisen from that cause?—I cannot trace it directly to that cause.

951. Do you consider that any effect is produced upon the health of the inhabitants by the character of the water with which they are supplied?—I must say that the water supply is better than it was; still it is capable of improvement.

952. Do you mean in quality or in quantity?—We have quantity, and the quality is good; but it is not sufficiently purified or filtered.

953. Can you state to the Commissioners what is the maximum density of population, or the greatest number of people crowded into one house?—In some of the localities which are overcrowded the people are massed together in large numbers.

954. I suppose it is the intention of the Local Board of Health or Corporation to register the mortality in the town?—They are doing so now; they have been doing so for the last year.

955. What was the mortality for the entire year of 1868?—31·35 per 1,000 per annum.

956. For the March quarter of the present year, what was the rate of mortality?—That was for the entire year. In the March quarter of last year it was 34·04, and for the March quarter of 1869 it was 24·72.

957. So that it would appear that there has been a great improvement?—Yes.

958. As a matter of fact is any nuisance caused, or any injury to health by the removal of the night-soil?—Not directly. I think it is more a local effect when the night-soil is removed.

959. Had you an epidemic of cholera in Stockport in the year 1849?—Yes.

960. Can you state how many deaths were caused by it?—I do not remember.

961. Was it a severe epidemic?—No.

962. Was the attack severe in 1854?—No.

963. Was there much cholera in Stockport in 1868?—Very few cases.

964. Were those cases of real epidemic cholera, or were they sporadic cases?—I think they were cases imported principally.

965. Is there much water taken from the shallow wells in Stockport by the people?—There used to be. The quantity has been very much diminished of late.

966. Do you consider that the people prefer soft to hard water, or the reverse?—For the purpose of drinking they prefer hard water, and for domestic purposes they prefer soft water.

967. The present supply, I believe, is soft?—Yes. There is one point that has been mentioned, and that was as to the removal of the night-soil; and I would refer to the removal of the night-soil, because the owners have to pay for emptying the middens in some cases at a very high rate, on account of the difficulty of removing the contents.

968. (*Chairman.*) Can you tell us what the householder pays?—It depends entirely upon the inconvenience connected with the removal. If a midden or a privy is situated convenient for removal the charge is 1*s.* a load; or sometimes it is done without any charge. There are instances where as much as 7*s.* a load is charged for the removal in places from which it could not be wheeled.

969. (*Dr. Frankland.*) Is there much typhoid fever in Stockport?—There has been occasionally, but there is not much now.

970. During the last year was there much typhoid fever in the town?—There was a good deal of fever—low fever.

971. Is there much diarrhœa in Stockport?—Not to any very large extent. I think Stockport is comparatively free from it.

972. Are there many cellar dwellings in Stockport; and if so, do you attribute much unhealthiness to those cellar dwellings?—Yes; and that will add very much no doubt to the mortality.

973. Are those cellar dwellings being gradually closed?—Yes.

974. What is done with the cellars after they have been closed?—They are added to the houses above them.

975. Do they become occupied?—Yes.

976. Are they never made the receptacles for rubbish?—No; they are closed entirely and connected with the house by an internal communication.

977. Is phthisis very common in Stockport?—I cannot say that it is; it is comparatively so. We have many cases of consumption.

978. Do you think that the employment of the people in factories tends to develop that disease?—I think there is no doubt of it.

979. Is there much disease which arises from the neglect of mothers towards their children?—Yes. I think that the health of the children is very much affected by the mothers leaving them at home in the hands of nurses while they go to work in the factories.

980. I suppose that the mortality from zymotic diseases could scarcely arise from that cause?—No; except in this way, that the constitutions of the children become debilitated by neglect on the part of the nurses.

981. (*Mr. Morton.*) Do the figures 54,682 represent the population in 1861 or in 1868?—In 1861.

982. Does the number of houses which is set down as 12,000 refer to 1861 or 1868?—That is the present calculation.

983. What is the present population supposed to be?—I do not think it has altered much. I may mention that the cotton failure took a large portion of the population away from Stockport, and they have not up to this time returned; but yet they return by degrees. Still the number of the people in Stockport in these depressed times, when the factories are stopped and work is scarce, is small, because they leave Stockport to seek for work in towns where there is more of it.

The witness withdrew.

H. Heginbotham, Esq.

5 May 1869.

Mr. JOHN JACKSON examined.

Mr. J. Jackson. 5 May 1869.

984. (*Mr. Morton.*) Are you the town surveyor?—Yes.

985. The number of middens is stated to be 3,624; is that correct?—I do not know.

986. With regard to the dry portion of the contents of the middens, what becomes of that?—It is taken away.

987. Is all of it taken away for agricultural use?—Yes.

988. Do you know of any instance in which buildings have been erected on ground which has been made by dry rubbish?—Not to my knowledge.

989. (*Dr. Frankland.*) Do the gasworks belong to the Corporation of Stockport?—Yes.

990. What is done with the refuse material from the gasworks?—It is all sold.

991. Do you purify with lime?—Yes.

992. Is the refuse lime sold to the farmers?—Yes.

993. Does none of it go into the rivers?—None of it, nor the ammoniacal water either. The refuse is a source of revenue, and is worth from 1,500*l.* to 2,000*l.* a year.

The witness withdrew.

JOHN WILDBLOOD examined.

J. Wildblood.

994. (*Mr. Morton.*) Does your duty partly consist of inspecting the state of the middens?—Yes.

995. The number given in the return is 3,624?—Yes.

996. What is the number of privies in Stockport?—There are 5,660 privies and waterclosets in the borough.

997. What proportion of those are waterclosets?—I cannot say.

998. How has the number which has been returned been ascertained?—We have been through the whole of the district and have taken account of them.

999. Have they not been counted separately, the waterclosets and the privies?—They have not.

1000. Can you state to the Commission how often the privies are cleaned out?—On the average they are cleaned out twice a year.

1001. Can you tell us the ordinary size of these receptacles?—It varies.

1002. Is not the cleansing done under your direction?—Yes, it is done under my direction.

1003. Do the people themselves perform the operation of cleansing?—They do.

1004. Does the proper officer enforce the cleansing?—Yes.

1005. Do you or your subordinates continually examine the state of the privies?—Yes.

1006. If you find that a privy is full do you give notice to the tenant of the house as to its being emptied?—Yes, at once.

1007. As a matter of fact do the tenants have the middens cleaned out without notice from you, or are you often obliged to give directions for the purpose?—We have not been obliged to do so often latterly.

1008. What is the process; if a householder finds that a midden requires to be cleaned out, what does he do?—He applies to the night-soil man to have the contents removed, and if not he applies to me, and I then send a man.

1009. Is that man your servant?—No; but we have a number of men in the borough who contract for the cleansing of the middens.

1010. Do they sell the stuff to the farmers?—Yes.

1011. Is it then taken to a depôt?—No, it is taken out of the borough.

1012. Are these middens connected with the sewers?—Some of them are.

1013. In the case of those that are not so connected, are they full of water?—No.

1014. What becomes of the liquid part of the excrements?—The ashes absorb them.

1015. Are these receptacles water-tight?—Yes.

1016. Do you sometimes find that a privy is wet?—Yes.

1017. How do you cleanse it or get it cleansed?—We serve the parties with notice to drain it.

1018. Do they then drain it into your sewers?—Yes.

1019. Is there a large proportion of them unconnected with the sewers?—Yes, a very large proportion.

1020. Is the subsoil here clay, or is it loose and porous?—The subsoil is sandy.

1021. Is the whole of the floor of these receptacles made with cement?—No.

1022. Then, in point of fact, I suppose they drain into the soil, and not into the sewers?—No doubt of it.

1023. Is there any depôt where any of the dry stuff, which is not useful to the farmers, is deposited within the borough?—Nothing except the street sweepings.

1024. Are the street sweepings under your direction?—No.

1025. Are the night-soil men not allowed to deposit any of this stuff within the precincts of the borough?—No, they remove it all away.

The witness withdrew.

Mr. HENRY COPPOCK (Town Clerk) examined.

Mr. H. Coppock.

1026. (*Chairman.*) I understand that the authorities have a power to impose a penalty upon parties for throwing solid or bulky substances into the river?—There is such a power under the Mersey Preservation Act.

1027. Are you acting under that Act?—Yes, and we have done so since 1863, I think.

1028. Clause 4 of that Act forbids such substances being thrown into the river, and inflicts a penalty upon persons who deposit "heavy substances or "bulky refuse in the river"?—Yes.

1029. Is that provision of the Act carried out?—Yes; and I gave evidence upon that point before a committee of the House of Commons only last week, and I believe it was in some measure owing to our having enforced that provision of the Act that the committee threw out the water bills which had been applied for. We showed them that we had done everything in our power to carry out the penalties which the Act of Parliament enforced, and that in no other place had they done so. I may state that a case, as to the pollution of the river under that Act is to be heard this morning before the magistrates; the complaint is against certain parties for throwing ashes into the river. If there is the slightest infraction of the Act, even by persons whose houses are on the sides of the stream, they are immediately prosecuted.

1030. What is the effect of your applying this Act, has it lessened the evil or not?—The ashes from factories and iron foundries and refuse from iron works were formerly thrown into the river, and formed a cone, the base of which extended to both sides, and dammed up the river. This could not be got rid of for a long time, but by bringing the Mersey Protection Act into force we prevented them from doing it. If the people above us on the stream were prevented from doing that which we do prevent people in Stockport from doing, the river would resume its original bed.

1031. Have you ever taken proceedings against the people above you for pouring deleterious ingredients into the river?—No, but there was an action commenced by Messrs. Marsland, the owners of the waterworks company, against Mr. E. Potter, calico printer (Dinting Vale Print Works), and in that action the waterworks company obtained a verdict against Mr. E. Potter, but the plaintiffs had framed their legal proceedings in some way erroneously, and in consequence of the flaw, which was found out by the late Lord Chancellor (Lord Cairns), all the proceedings were futile, and nothing resulted except the expenditure of money on both sides to a very serious amount. I should mention that arsenic, supposed to come from those works, was found in the cisterns in Stockport.

1032. Have you not got rid of the arsenic at the present time?—The waterworks company do not supply water from that source now.

1033. (*Dr. Frankland.*) Do you mean to say that arsenic was actually found in the drinking water in the cisterns at that time?—There is no doubt of it; it was found in the cistern at "The George Inn" in the centre of the town, and there was evidence of that given upon the trial; of course it was in very minute quantities.

1034. (*Mr. Morton.*) Is there a large number of factories within the borough?—I cannot give you the number exactly, but the assessment is 40,000*l.* out of 140,000*l.*; the proportion will be rather less than one-third.

1035. What is done with the ashes from those factories?—They get the farmers to cart them away for the purpose of repairing roads. It is a bad material for it, but there is always plenty of it. Formerly it was sold at 1*s.* 6*d.* and 2*s.* a load, but at last it became such a drug that no one would pay for it, and now you may see put upon boards "cinders given." Even then several of them got paid for their cinders the marketable value, but they did nothing with them but fill up holes.

1036. (*Dr. Frankland.*) Had you a scarcity of water last summer in Stockport?—Yes; no extraordinary scarcity, except that which was caused by the drought.

1037. To what extent was there a shortness in the supply to the town?—I think the supply was cut off for two hours. It was on for eight hours. The Waterworks Company followed the practice in Manchester.

1038. Did that cause very serious inconvenience to the people in Stockport?—It was, of course, very inconvenient.

1039. (*Chairman.*) Is the supply constant?—Yes, and that is the cheapest way of supplying it.

Mr. H. Coppock. 5 May 1869.

1040. (*Dr. Frankland.*) Are the waterclosets supplied from cisterns?—Yes, and the cisterns are supplied from the water mains.

1041. Would there be no scarcity of water in the waterclosets on account of the scarcity of water?—I do not suppose that there would, but in the township of Stockport the authorities, until the Local Board came into operation, only about five or six years ago, would not allow waterclosets to be put down. When we built the armoury we put down waterclosets, and connected them with the sewers, the authorities went the length of taking the pipes up, and caused a number of cesspools to be made. I may also mention that a surgeon in the town, Mr. Massey, wanted to drain his watercloset into the sewer, and they would not allow him to do it; but eventually they permitted him to build a large cesspool on one side in front of his house, and the refuse of that cesspool was allowed to go into the sewer, which was, I think, a very mistaken notion of theirs, but that state of things is now altered. Very fortunately we are now under a Local Board, and the Act of Parliament prevents them prohibiting waterclosets.

1042. Are there a considerable number of waterclosets in Stockport?—Yes, their number is increasing.

1043. Have you at all taken into consideration what additional supply of water per head will be requisite, supposing waterclosets generally to supersede the present middens?—I am not of opinion that waterclosets do consume so much water as people imagine.

1044. Have you formed any definite estimate as to that?—The quantity which is used is small, if a watercloset is made properly, so as to economize the water, and yet give a sufficient amount of flushing. We are all very anxious to do away with nuisances, for there can be no question that the nuisances are so great that they should be removed; but how that is to be done, whether by national means or otherwise, it is not easy to say. I do not believe that Parliament would ever pass any Act that would throw the expense of removing these matters entirely upon the borough of Stockport, because it is the entire district which causes the nuisance, and the matter is only to be dealt with by an entire district rate. It would have to embrace all the basins of the particular streams to which it was made applicable, and to be laid upon all the surrounding property which contributed to the nuisance. As to what measure it shall be, I think that that must be left to the wisdom of the Commissioners and to the wisdom of Parliament.

The witness withdrew.

Mr. PETER EDWARD MARSLAND examined.

Mr. P. E. Marsland.

1045. (*Chairman.*) I believe you are deputy chairman of the Stockport district waterworks?—Yes.

1046. Have you any statement to make to the Commissioners?—Yes. My father or grandfather purchased the water right of the river as it flows through Stockport from the lord of the manor about the year 1791 at the annual rent of 500*l.*, which sum has since that time been paid. The lord of the manor of Stockport had up to 1791 used the water for turning an ancient corn mill, and at that period salmon and trout existed in the river. In that right for the payment of 500*l.* per annum there was an old corn mill attached with the manorial privilege of grinding the corn. About 1825 my father established waterworks in Stockport, having got an Act of Parliament for that purpose. The town was divided into two levels; the lower level was supplied from artesian wells, the higher level from the river without any filtration; the river water then was only 3·7° of hardness. It was analysed by Dr. Phillips, the Government chemist at the time. Afterwards the works were established on the stream the water gradually became affected, and filtration of the water had to be resorted to. In 1850 the waterworks become the property of a joint stock company, and in 1854 the Manchester Corporation obtained powers to reduce the quantity of compensation water that they were required to send down the river Etherow, and the terms agreed upon were, that the Stockport Waterworks Company should have a portion of that water which they ceased sending down; it was from five millions and a quarter to five millions and a half gallons, and the waterworks company and the Corporation of Manchester agreed that the Stockport Waterworks Company should have one million gallons of those five millions and a half. They were to send down originally under the Act of Parliament 75 cubic feet per second, and then they got another Act to reduce that quantity to 55 cubic feet per second if the owners of the stream agreed to it. The Manchester Corporation has been blamed most unjustly, it being alleged that they do not turn down the full quantity of water, but the inconvenience to Stockport arises more from the large reservoirs of Messrs. Andrews at Compstall intercepting the water on its way down. By the Factory Act you are only allowed to work from 6 to 6, and the Manchester Corporation turn down their water from 5 to 6; but it does not come down to Stockport

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in that way; it does not come down to Stockport till 12, and therefore, in reality, the millowners have only half time to work. The pollution of the river still continuing, the company had to call in the aid of chemists to trace the cause. At this time all fish had disappeared. The rivers Kinder, Goyt, Glossop, and Etherow were examined from Stockport up to their sources, and arsenic was found in the water, and also in the mud of the company's reservoir. Bills of complaint were filed in the Court of Chancery against several parties for fouling the stream, and subsequently actions were tried at Chester and London, and verdicts obtained in favour of the company. At this time the company were engaged laying down pipes to convey Manchester water to Stockport. The calico printers commenced then to encourage a rival scheme for obtaining water from Lyme Park, and every assistance to that scheme was given by the Corporation of Stockport, but we have received no advantage at all in fighting these battles against the pollution of the rivers; it has cost many thousands of pounds in fighting to purify the water. Stockport is now supplied from two sources, Lyme and Manchester. Houses of 8*l.* rental and under are supplied with a constant supply of water at 6*s.* per annum when paid for by the landlord, and there are nearly 6,000 houses which are supplied in Stockport at that rate. An inspector of water fittings having been appointed, out of 6,254 houses that he visited between August 1868 and March 1869, he discovered nearly 1,000 houses where the water was running to waste; indeed, we found that where it was supplied to cisterns they had never had any ball-cock, and the water was running right through the cisterns down the waste pipe. The pollution of the river at Stockport is greatly increased by the Corporation allowing all the refuse from water-closets to be turned direct into the sewers. In my house in Greek Street, I turn all refuse from the watercloset into the ashpit, from whence it is carted away to put on the land as manure, the liquid matter being filtered through cinders before it runs into the sewers. But at the Stockport workhouse, containing about 700 inmates, it is quite different, the whole of the privy refuse being flushed direct into the drains, causing a most abominable stench. Then another evil arises in the town from the sanitary committee not having put any ventilating chimneys at the end of the sewers to prevent the gases from being forced into the houses. Fever has prevailed very much in Turncroft Lane, one of the most elevated parts of the town, and it is attributed to this cause. There has been no filtration of the sewage with the exception of Heaton Norris and Hazel Grove. With regard to the pollution of the river, and tracing the cause of it by chemists, I may say that we have brought three actions at very great cost to ourselves, some thousands of pounds spent, for the benefit of the town. There were certain returns got through the Court of Chancery of the amount of drugs used in the printworks situate on the Goyt, one of which I now hand in.

(*The following return was handed in.*)

Account of drugs used by Mr. John Walsh, Calico Printer, from July 1st 1858 to July 1st 1859. Mill situate on the Goyt.

	Cwts.	qrs.	lbs.
Garancine	794	3	14
French madder	41	0	14
Rasped peachwood	344	2	10
Rasped logwood	221	2	19
Shuma	39	1	4
Dunging salts	4	0	0
Glue substitute	577	0	8
Cow dung	2,672	0	0
Quercitune	38	3	7
Ground bark	82	0	6
Print clearing powder	176	0	14
3,358 gallons iron liquor	0	0	0
2,137 do. red do.	0	0	0
2,628 do. tin red do.	0	0	0
Flour starch	2	2	6
Extract of indigo	14	3	3
Chlorate of potash	1	1	0
Soda crystals	66	1	26
Arsenic	30	1	26
Muriatic acid	0	0	363
Nitric acid	0	0	480
Alkaline liquor	0	0	521
Tin liquor	0	0	471
Catichu	33	3	0
Logwood liquor	124	1	17
Gum starch	167	3	14
Finishing starch	449	2	21
Imperial gum	168	2	15
Gum Barbary	47	0	18
1,229 gallons pyrolignious acid	0	0	0
Tartaric acid	2	0	17
Prussiate potash	3	2	24
Madder thickening	224	2	8
White sugar of lead	5	2	26
Tallow	4	1	18
Oxalic acid	3	3	18
Madder roots	16	1	10
Pale British gum	44	3	21
Tin crystals	5	2	4
Sal-ammoniac	22	0	21
China blue	1	2	10
Nitrate of lead	21	1	15
Ultramarine blue	1	3	5½
Bi-chlorate of mercury	7	3	12
Acetate of soda	6	3	15
Soap	40	0	11
115 gallons lemon juice, 63 litremeter	0	0	0
Ponpre Romaine	2	0	9
Copperas	15	2	0
Dutch oxide	4	0	0
Acetic acid	9	1	14
Foreign gum	9	1	12
Supan liquor	5	1	17
Wheat starch	26	0	26

I may also state, with regard to the evidence that was given at Chester on the 10th of May 1859, it was proved by the manager, Mr. McConnell, in the case that was tried before Mr. Baron Bramwell, that 3¾ cwt. of white arsenic were turned into the stream between the 10th of May and the 9th of August.

1047. (*Dr. Frankland.*) Was that thrown in by one company?—Yes; it was the Kinder Print Works, and 17,000 gallons of vitriol.

1048. (*Chairman.*) I think you stated that 75 cubic feet of water per second were poured into the Etherow?—Yes; and they have reduced that quantity now to 55 cubic feet besides that which comes into Stockport. After those actions were tried trout and other fish began to appear; but what is very singular with regard to the Goyt and its tributaries is that even at the head of the stream and above all the printworks chemical analysis proved that arsenic was present in the water.

1049. (*Dr. Frankland.*) Can you tell us what the supply of water per head per day is to the population?—That I cannot tell you.

1050. What do they consume, or with how much do you supply them?—I take it that the quantity is about 14 gallons per head.

1051. Are you not able to supply more than that?—Yes.

1052. Your supply consists partly of the water in the reservoir and partly of the 1,000,000 gallons that you receive from the Manchester waterworks?—Yes; but we have never taken anything like 1,000,000 gallons from Manchester. During all the drought our reservoir was going down day by day for more than six months.

1053. You say that you supply about 14 gallons a day?—Yes.

1054. Is that the quantity that the people want, or do they want more?—No; they can draw 20 gallons a day if they like.

1055. According to what has been stated to us elsewhere the wants of the people are greater, for at Manchester they say that 20 or 23 gallons a head per day are supplied?—They are not limited. We have found in Stockport that the consumption has not been near so much since the inspector has gone round to examine the fittings.

1056. What are the sources from which you obtain your water?—The sources of supply are Lyme and Manchester.

1057. Are there not two others?—Only in Lyme, from the artesian wells during a time of drought; but we never use them except there is such a drought as we had last year.

1058. (*Chairman.*) How deep does the water lie?—About 150 feet down.

1059. (*Dr. Frankland.*) When you pumped water from the river into what reservoir did you pump it?—Into the Woodbank reservoir.

1060. Is that reservoir still used?—It is used for the Lyme water.

1061. Is that on the bank of the river?—No.

1062. Is it not near it?—No; it is in the highest part of the town.

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1063. Is it above the level of the soil, or is it sunk down into the soil?—It is above the level of the soil.

1064. Is all the water above the level of the soil?—There is no water runs into it from the soil.

1065. As a matter of fact, is it excavated?—Yes; but it will not run out.

1066. (*Chairman.*) I suppose it is partly excavated out of the soil, and partly banked up?—Yes; we never run it down below the soil.

1067. (*Dr. Frankland.*) How deep in the soil is it excavated?—About seven feet down, and it is six feet above.

1068. On the 27th July, in the last year, we took a sample of the water from the baths and wash-houses in Stockport; was that a fair sample of your supply at that time?—It is a very dirty part in comparison with any other part of the town.

1069. Then I suppose you would consider what we took rather a bad sample of the water?—Yes.

1070. Was that water obtained from Lyme, or partly from Lyme and partly from Woodbank?—It was all from Lyme.

The witness withdrew.

1071. (*The Town Clerk.*) With regard to ventilating chimneys for the sewers, the Chairman of the Highways Committee has been obliged to leave, and he requested me to say that they are now putting ventilating chimneys into the sewers; they are doing their best to ventilate the sewers. Then with regard to the settling tanks, those at Hazel Grove have acted well, but those at Heaton Norris have never been in action. They were made with money borrowed from the Government under the "Public Works (Manufacturing Districts) Acts," to prevent actions being commenced or indictments for a nuisance; and the authorities were obliged to put down one or two settling tanks, and they have done everything which the Court of Chancery could compel parties to do. The settling tanks at Heaton Norris have not been worked because the Government did not pass the Bill that was promised when the works were commenced; at least, when I say the Government I mean their officer, Mr. Rawlinson, who gave us to understand that some Act would be passed for the future maintenance of those sewers and works. I may say that there should be an acknowledged statutory power given for the future holding of those tanks for the benefit of the public. The guardians made them, and the guardians were willing to work them and keep in work, but their powers expired with the cotton famine and the Relief Acts, and now there is no authority whatever over those settling tanks. The fact is that they do not belong to anybody; they are public property which has been paid for with public money, but Parliament has never given anyone power for the preservation or repair of them. This is a great oversight, and wants rectifying.

1072. (*Chairman.*) Then it would seem that they are large empty holes in the ground, or are they full of anything?—They are brick buildings covered over; they are not exactly holes, they are flagged or bricked at the bottom, and they are made to hold sewage to a depth of two or three feet. The sewage runs in, and one of them is worked successfully in this way at Hazel Grove, but at Heaton Norris it is not so.

1073. Do you know what is the action of those at Hazel Grove?—Very good.

1074. Does the sewage run into them?—Yes.

1075. What is done with it?—It is at a dead level, and therefore there is no current except that which is formed by the gravitation of the water; it goes in very impure, but it comes out to the eye perfectly pure.

1076. (*Dr. Frankland.*) I suppose that all you do is to allow it to subside?—Yes.

1077. What do they do with the stuff at the bottom?—Mr. Legh, the landowner, is going to empty it for the farmers.

1078. Has it never been emptied yet?—No; they are full now, and we have no power over them. The guardians have not any power, and therefore we cannot do anything with them. I saw Mr. Legh's attorney in London the other day on the subject, and he advises that Mr. Legh should take the sewage before it gets into the tank, and make a provision for throwing it upon the land. Therefore he will tap the sewer before it gets into the settling beds.

The witness withdrew.

Mr. Alderman Ephraim Hallam examined.

Mr. E. Hallam.

1079. (*Chairman.*) Are you chairman of the Sanitary Committee of Stockport?—Yes.

1080. You have, I believe, some explanation to give?—Yes; there are some discrepancies in the returns which have been furnished to you as to the number of waterclosets and privies in Stockport. In the returns it is stated that there are about 3,624 privies, but now the number is something like 5,660. Very many complaints having been made about the quality of the water, I caused a bottle to be filled with water supplied to this Court House, and sent it to Dr. F. Crace Calvert, of Manchester, and he analysed it, and found that the water was not so bad as it had been represented to us. On the former occasion when the Commission visited Stockport I informed you of the state of some of the wells. We have been obliged to close two wells on account of the water being so impure. We also sent a sample of that water to Dr. Calvert, and to a chemist in the borough to analyse it. Dr. Calvert did not give us his analysis, but the analysis made by the borough chemist showed that there were 80 grains of mineral matter and 40 grains of organic matter and volatile salts in one gallon of the water.

1081. Were there 40 grains in one gallon?—Yes. Dr. Calvert stated that the water which we forwarded to his laboratory was so very impure that a common analysis would not show sufficiently the impurity which seemed to exist in the water. We then immediately shut up the pump, and it has remained shut up ever since. We have cleaned out the well, and the water has been analysed a second time, and it was found to contain so much sewage matter that it was really quite unsuited for drinking purposes.

1082. Of what depth was that well?—I cannot give you the depth.

Mr. E. Hallam.
5 May 1869.

1083. Did it go down to the red sandstone?—It was 15 feet down at least, or perhaps 20 feet.

1084. Was it a surface well?—Yes; it was in the red rock. A good deal of the water came from an open sewer, which is called Carr Brook, that runs down past this place, and it no doubt percolates through the red rock.

1085. (*Dr. Frankland.*) Were any cases of sickness traced to the use of that water?—Yes. A case of sickness occurred that was mentioned to the Sanitary Committee, and hence our attention was called to it.

1086. What description of ailments were they?—Bowel complaints and diarrhœa.

1087. Was there any typhoid fever?—No.

1088. (*Mr. Morton.*) Are the ashpits in Stockport generally connected with the privies?—Yes, they are all connected with the privies, excepting where there are waterclosets.

1089. (*The Town Clerk, through the Chair.*) In your experience as chairman of the Sanitary Committee, have you found the powers of the Act sufficient to compel the owners of property to empty their privies?—Yes, quite sufficient.

1090. I believe it has never cost the Corporation anything, because the entire expense has been paid by those who were defaulters?—Certainly.

1091. (*Mr. Morton.*) In a case where one privy is used by the occupants of three houses, who then bears the burden, if there is such a thing as a petty belonging to different owners?—We should summon the owner, and not the occupier.

1092. Have you also summoned the owners before the magistrates for not having provided a sufficient amount of privy accommodation?—Frequently.

1093. (*Chairman.*) They must provide one at least to three houses, and if you find that that is not done, then you make an application?—Yes.

1094. (*The Town Clerk, through the Chair.*) With regard to cellar dwellings, have you brought several cases of that kind before the magistrates, who have directed them to be closed?—Yes.

1095. I am informed that within a very recent period as many as 150 cellar dwellings have been compulsorily closed, is that so?—Quite that number. I wish to hand in this analysis. (*The same was handed in as follows.*)

"Royal Institution, Manchester,
September 2nd, 1868.

Sample of water supplied to the town by the Stockport Waterworks Company taken at the Court House, August 1868.

SIR,

In accordance with your request I have most carefully analysed the sample of water you kindly forwarded to my laboratory, and find it to be composed per gallon as follows:—

	Grains.
Mineral matter	14·63
Organic ditto and volatile salts	2·70
Total residue	17·33

The mineral matter consists of,—

Permanent degree of hardness 3·7°.	Chloride of calcium		4·15
	Chloride of sodium		
	Sulphate of magnesium		
	Nitrates		
	Sulphate of lime		1·23
Total hardness 12·5°	Carbonate of lime		9·25
	Carbonate of magnesia		
	Carbonate of iron protoxide		
			14·63

The foregoing figures show that this water is not highly impregnated with organic matter, and the amount of mineral substance is only moderately large; in fact, the water can be considered on the whole a fair one for all domestic purposes, except for washing, as the high degree of hardness of the water would entail the decomposition of a rather large amount of soap as non-detergent. The same remark may apply to the use of this water in all manufacturing operations in which soap is largely used. Further, the analysis indicates a large quantity of carbonate of lime, which salts will have a tendency to rapidly incrust boilers if proper means are not employed to prevent it. In conclusion, not only the quantity of organic matter is small, but I have not been able to detect any large quantity of sewage matters.

I remain, sir,
Your obedient servant,
F. CRACE CALVERT, F.R.S."

The witness withdrew.

Adjourned till to-morrow at 11 o'clock, at Ashton-under-Lyne.

The Town Hall, Ashton-under-Lyne.

Thursday, 6th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.
DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.
MR. S. J. SMITH, *Secretary.*

MR. W. MARSHALL (Town Clerk) examined.

Mr. W. Marshall.

1096. (*Chairman.*) You wish to make a few corrections in the answers that have been already sent to the Commission?—We stated that the area of Knott Hill gathering ground was 600 acres. I find that it is 350 acres. The supply from Knott Hill gathering ground is not nearly so good as that from Swineshaw and the other moor land district in the valley of the Tame. That supply, however, must within a very short time be cut off, and then the only supply to Ashton-under-Lyne, Stalybridge, and Dukinfield, with a population of 110,000 (which is increasing rapidly) will be the gathering from the Swineshaw works covering 1,290 acres; that is quite inadequate to supply the wants of so large and so rapidly increasing a population. A great many of the mills are supplied from the river with water for condensing purposes; and in summer and time of drought are obliged to use the sewage also. The point lost sight of in the recent inquiry before the Parliamentary Committee was the effect that the diversion by Oldham from this watershed of the water gathered on 4,000 acres would have upon the river Tame in a sanitary point of view between Ashton and Dukinfield, and through the centre of Stalybridge? There are four weirs between Ashton and Dukinfield, and it is believed that that compensation water would not cleanse these

weirs, or even the sewers. In other respects, the taking away of the water from one watershed to another is injurious in a sanitary point of view apart from the question of power. That is a question I take it that the Commissioners may feel it within their province to consider. With regard to the question of irrigation, I agree entirely with Mr. Heron, the town clerk of Manchester,—that it is simply impossible in this district. All the way down the valley to Stockport there is very little land, except such as is covered, or which will be covered with buildings. If, therefore, irrigation is to be adopted the sewage must be carried beyond Stockport.

1097. You say at present as to the water supply:—"The town is at present supplied from waterworks "belonging to the Corporation. The principal "source at present is from a reservoir about two "miles from the town, constructed upwards of 30 "years ago, and an additional supply is also obtained "from a shaft sunk for a coal pit within the borough; "extensive works are now being constructed at "Swineshaw; in about a year this supply will be "available, and then the water from the coal-pit "shaft will not be required." If you are so short of water why reject that which is underground, and which is said to be very good?—It is not suitable for domestic use. We use it for manufacturing purposes. We pump a large quantity of water from the coal field and run it through our sewers into the river, and that enables the factories to obtain water for condensing purposes. Ordinary summer flow is not sufficient for the purposes of the mills on the stream in the town. If the privies in this borough are to be converted into waterclosets we estimate the cost at from 60,000*l.* or 70,000*l.* Any scheme for cleansing rivers should be a general one, and not one confined to a particular district; otherwise you will drive traders from one part of the country to another, assuming that people will think that the terms are too restrictive to enable them to profitably work their concerns.

Mr. W. Marshall.
6 May 1869.

The witness withdrew.

MR. JOHN GALT examined.

Mr. J. Galt.

1098. (*Dr. Frankland.*) Are you an alderman of this borough, one of the medical officers of the infirmary, and in extensive practice in this district?—Yes.

1099. Can you give us the rate of mortality for the year 1868, so as to complete the table already furnished to the Commission?—I cannot.

1100. What are the principal zymotic diseases which prevail in Ashton?—The people here suffer more from atmospheric changes than from zymotic disease.

1101. Have you a large mortality in Ashton from phthysis?—Yes. Seven out of every ten of the medical patients in the district infirmary are persons suffering from phthysis at one stage or another.

1102. How many cases of typhoid fever have you in twelve months?—I have not seen a dozen cases of typhoid fever in the last twelve months. Scarlet fever has prevailed very much, and that sometimes assumes a typhoid character. We had an epidemic of small-pox about three years ago.

1103. Would you say that scarlatina had prevailed as an epidemic?—Certainly.

1104. Has it prevailed particularly in any special localities?—No.

1105. Was it equally diffused throughout the neighbourhood?—It was more equally diffused in the last attack than in any previous one that I am acquainted with since I came to Ashton.

1106. Does any large proportion of the population reside on the banks of the river?—No. Dukinfield is more on the banks of the river than we are.

1107. You have scarcely an opportunity perhaps of judging whether the condition of the stream affects those who reside immediately on the banks of it?—No.

1108. Had you cases of cholera in 1849?—I do not remember any cases. We had one or two cases of diarrhœa.

1109. In the year 1854, had you cases of cholera?—I do not remember.

1110. In 1866 were there any cases of cholera?—No.

1111. Do you consider that there is any sickness produced by the mode of dealing with the excrementitious matter in Ashton?—I have never been able to trace any.

1112. Are the ashpits generally well kept?—They are.

1113. Are they at a distance from the walls of the inhabited houses?—They are particular in that respect.

1114. That is in regard to new buildings, but referring to the older ones, do the privies to those join up to the dwelling houses?—There are very few cases; and whenever a nuisance has been found to exist the Sanitary Committee have taken immediate steps to have it removed.

1115. Have you known instances in which the soakage from particular privies has been complained of, and has given rise to disease in a house?—Undoubtedly there have been cases of that kind, but they have been very few in number. Speaking of the death-rate, the returns of the Registrar General do not give a correct estimate of the death-rate in the borough of Ashton; for this reason, there is within the borough the workhouse for the union which embraces a large district, and the number of deaths in that establishment during the last quarter was 55.

1116. Where is the workhouse situated?—It is to the north-east of the town.

1117. Out of the town?—Yes; but it is within the municipal boundary.

1118. The death-rate nevertheless is not particularly high?—No, it is not.

1119. Apart from the question of cost or convenience, do you consider it desirable that the excrements of the population should be removed while they are fresh?—I think that the more speedily they are removed the better.

1120. Before they enter into putrefaction?—Yes.

1121. Are the sewers in Ashton well ventilated, and have you known any cases in which gases have escaped into the houses from the sewers?—I am of opinion that the sewers are not ventilated as they ought to be. The only ventilation is by down spouts; and in the great majority of the cottages the windows are in a line with the top of these spouts, and of course the gases escaping from the sewers will float into the rooms. I think that the ventilating shafts should be carried to the top of the building.

1122. Have you heard many complaints by the inhabitants of the gases getting into the windows of their cottages?—No; but I have perceived it myself.

1123. Have you traced any cases of illness to that cause?—I have not.

1124. With regard to the gully traps and slop stones which are supposed to be connected with the sewers, have you noticed any escape of gases from these?—Yes.

1125. That implies imperfect ventilation, does it not?—Yes.

1126. Have you known any cases of disease arise from the gases escaping from the lower part of a house?—I have not.

1127. Is there not some well water used in Ashton, and is it not from the colliery before alluded to?—

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Yes; but there is a small well on the north side of the borough which the people are very partial to. It is drained from some of the adjoining fields.

1128. Does it drain privies or ashpits?—I think not.

1129. Is the water at all contaminated?—No; the buildings stand on lower ground altogether than that. It is very good water.

1130. Is it used for washing, or for drinking purposes only?—It is only used for culinary purposes.

1131. We obtained in July last a sample of the water supplied to the inhabitants of the borough; was that water considered satisfactory?—It is very wholesome water, but we were very thankful to have coal-pit water last summer.

1132. Do you know of any ill-health or sickness that was caused by the use of the coal-pit water?—No.

1133. In what direction is the town now extending?—It is extending to the north and also to the west.

1134. Are the buildings which are erected, or are to be erected, on what is termed made ground?—There is very little of that within the borough; all refuse is carted a considerable way out of the town.

1135. Are those places being built upon at the present time?—No.

1136. Have you traced any ill-health or sickness to the erection of buildings upon objectionable ground of any kind?—No.

1137. Have you tried in Ashton the mode of dealing with excrementitious matter called the Eureka system, and, if so, what is your experience of the working of that plan?—I have some cottages on my own property where it has been tried, and the tenants seem to like it very much. I find that their back yards are kept much cleaner.

1138. Does any offensive odour arise from the boxes which are used?—Possibly when the deodorant has not been sufficiently applied; but when it is well managed there is very little smell.

1139. Do you consider that in any case health has been affected unfavourably by it?—No, because the boxes are changed very frequently.

1140. How often are they changed?—I think they are changed about twice a week.

1141. What is done with the contents of the boxes?—It is carried to the outside of the borough and sold as soon as we can find customers. We are now providing a railway siding, and shall then be able to convey it to Lincolnshire or some other place.

1142. How far is the depôt outside the town and away from the population?—It is not more than a quarter of a mile.

1143. From the answers to queries sent from this borough we find that a good deal of steam and warm water is admitted into the sewers; does that cause any nuisance?—There is certainly a very disagreeable effluvium sometimes from the sewers, but from what cause I do not know.

1144. Has the admission of steam into the sewers and the consequent expansion of the air anything to do with the escape of gases through the traps in the houses?—I think it very likely.

1145. Are there any privies actually within dwelling houses in Ashton?—I am not aware of any.

1146. Are there any sleeping rooms over privies?—There are some.

1147. How many instances of that kind do you suppose there are in Ashton?—I do not think there are more than from twelve to twenty.

The witness withdrew.

Mr. John Robinson examined.

Mr. J. Robinson.

1148. (*Mr. Morton.*) Are you the borough surveyor, and is the scavenging of the town under your direction?—I am the surveyor, but the scavenging is under the superintendence of the inspector of nuisances.

1149. Do you know the facts relating to it?—No; the inspector of nuisances will give evidence on this matter.

1150. I wish to ask you a question as to the impossibility of irrigation. Does the map of the district now produced represent the area built upon?—Yes, pretty nearly.

1151. Are the parts in a south-western direction separate fields and unbuilt upon?—Yes.

1152. Is that land considerably above the level of the outfall?—It would vary from fifty to sixty feet.

1153. Are those fields at present in the hands of farmers?—Yes; they are outside the boundary line of the borough.

1154. At the bottom of the map there is apparently a large extent of ground unoccupied by buildings?—Yes.

1155. Are they 10-acre fields, or what are they?—I should not think they would be so much as that; more like two acres.

1156. Does that comparatively unoccupied part of the land extend to Stockport?—There is a sparse population all through the district down to Stockport.

1157. As a matter of fact, is there any considerable extent of unoccupied land?—There is not. It would not be possible to get it on this side of the river.

1158. There are a number of fields I see on which there are no houses, would it not be possible to use any of them if sewage was pumped to a height of sixty feet?—It might be done.

1159. Would there be a considerable volume of water running out at the outfall, even although none of the cesspools, or privies, or waterclosets drained into the sewers?—There would; but it would be all polluted, more or less.

1160. Still there would be a considerable volume of water flowing from the sewers as the drainage of the district?—Yes.

1161. Does that dilute the house drainage to the extent of one-half?—Yes, quite two parts out of three.

1162. (*Dr. Frankland.*) What are the chief pollutions of the river within the borough of Ashton?—The sewage.

1163. Is there no manufacturing refuse?—I do not know.

1164. What is done with the refuse from the gasworks?—A good deal is utilized.

1165. What is done with the refuse gas-lime?—It is carried out of the district and sold.

1166. What do they get for that per ton?—I do not know.

1167. So far as you know none of the gas refuse goes into the river?—No. It used to do so, but it does not now.

1168. To what extent was the water supply deficient last year in Ashton?—I can scarcely answer that question.

1169. For how many hours in the 24 was the supply cut off?—It was cut off for about 12 hours a day, but I am not certain of that.

1170. (*The Town Clerk, through the Chair.*) Do you remember that the traffic on the canal was stopped for several weeks?—Yes, it was stopped, and if they had depended upon the canal, trade would have been stopped.

1171. (*Dr. Frankland.*) As a matter of fact, was the scarcity of water then severely felt by the inhabitants?—It was.

1172. Reference has been made to a tanyard in Ashton, what is done with the refuse therefrom?

(*The Town Clerk.*) It runs into the river.

The witness withdrew.

Mr. Councillor Thomas examined.

Mr. Thomas.
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1173. (*Mr. Morton.*) Are there as many as 6,250 privies in Ashton-under-Lyne?—Yes.

1174. Are they cleaned out four times a year?—Yes.

1175. What is the average size of those receptacles?—The area is about fifteen feet.

1176. That is five feet by three?—Yes.

1177. (*The Town Clerk, through the Chair.*) Is it proposed to carry the refuse from Ashton by railway?—Yes.

1178. Has application been made to the Secretary of State for borrowing powers to enable the Corporation to carry this out?—Yes.

1179. Do you expect when the railway siding is completed that you will be able to carry away the refuse obtained?—Yes, and we expect to get a better price for it.

1180. Is there any reason why the refuse of Ashton is not as saleable as that of Oldham?—Our Act of Parliament is not sufficiently stringent to prevent all sorts of rubbish being thrown into the ashpits, and consequently they are using the places of deposit for refuse of all kinds; the cost of removal of refuse therefore is larger than at Oldham and other towns.

1181. (*Mr. Morton.*) You receive only 95*l.*, as it appears, for 6,000 tons of refuse?—Yes.

1182. Is the whole of the refuse useful for agricultural purposes?—No.

1183. What proportion of the whole is used as manure?—Not more than one half.

1184. What becomes of the other half?—We cart it to outside the borough to the most convenient tip, and where it will be as little nuisance as possible.

1185. Are the 6,000 tons the whole contents of the middens?—No; double that quantity.

1186. I understood you to say that a portion of the 6,000 tons is not worth anything as manure?—Yes, we sell the 6,000 tons.

1187. But what you receive would not amount to 3*d.* a ton?—We get about 6*d.*

1188. (*The Town Clerk, through the Chair.*) Do the railway company take the cinders for ballast?—Yes.

1189. Do you contemplate making a tipping place between here in the agricultural part of the parish and Oldham?—Yes.

1190. As a place of deposit for the dry ashes?—Yes.

1191. (*Mr. Morton.*) Is the place you refer to at present unoccupied with buildings?—Yes, half a mile from any habitations.

1192. Do you think it is a place likely to be built upon?—No.

1193. Where is the separation made between the two parts of the contents of the privies?—At the time they are emptying a privy the men first take the cinders out and keep them separate from the night soil.

1194. If this stuff is thrown in, as you have said, at all times during the filling up of the midden, some of it will be taken out of the bottom part as well as out of the top?—Yes.

1195. Must it not then necessarily be wet?—Yes, a great part of it.

1196. Is it not filthy stuff to have wheeled away as manure?—Yes.

1197. Do the middens drain into the sewers?—Yes.

1198. Are the ash-pits roofed?—No.

1199. So that the sewer receives the liquid parts plus the washings of the solid parts?—Yes.

1200. Are you acquainted with the Eureka process?—Yes.

1201. What is the deodorant which is used?—Mostly carbolic acid.

1202. Does the box simply receive the excrement?—And the urine.

1203. Is it carted away twice a week to the depôt?—Yes.

1204. How is it dried there?—It is not dried there at all.

1205. Is it still a liquid state?—Yes it is, but it is kept separate in tanks from that which is removed from other ashpits.

1206. From how many houses are the boxes removed?—200 to 300 houses.

1207. What amount is received for this stuff?—The amount received is included in the 95*l.*

1208. Is that sum of 95*l.* received at the depôt?—Yes.

1209. Is the expense of carriage borne by the farmers?—Yes, from the depôt.

1210. Is it carried away by railway or by carts?—Generally by carts.

1211. For what distance is it carted?—From one to three miles.

1212. It has been stated in evidence that you propose to have a siding to the railway to enable you to command a larger circle of customers?—Yes, and to move the rubbish further away from the borough.

1213. What is the charge made by the railway company per mile for the use of a truck?—The cost of a truck will be 6*d.* a ton.

1214. For what distance will that charge be made?—Two to two miles and a half, that is for dry ashes only, that which is intended for manure must be sent to another market, similar to that found for the refuse of Manchester and Oldham.

1215. (*Chairman.*) Are you aware that the authorities of Manchester and Oldham have to send the refuse to very great distances, and that the value is thereby diminished?—Yes, it is considerably so; it used to be much more valuable than it is now.

1216. (*Mr. Morton.*) What becomes of the street sweepings?—The wet sweepings are taken to the manure places, and the dry sweepings are deposited outside the town.

1217. Are they divided in the same way as the stuff from the middens?—Yes.

1218. Are the wet sweepings mixed up with that which is sold to the farmers?—Yes.

1219. (*Mr. Robinson.*) They are all drained into the sewers so that the liquid matter falling into an ashpit is taken away into the sewers.

1220. (*Mr. Morton to the witness.*) Is there any filtering bed of any kind?—No: there is a grid in the bottom, and we put about a yard of gravel behind the grid to prevent the ashes going into the pipes and thence into the sewer.

1221. Does the drainage take place through the gravel?—Yes.

1222. (*Chairman.*) I understand, the grid is in the side of and not in the bottom of the ashpit?—It is in the side, but near the bottom.

1223. (*Dr. Frankland.*) What is the water supply per head?—The consumption for domestic purposes does not reach more than 12 gallons a day.

1224. Is that all that is supplied to the people of Ashton per head?—Yes, for domestic purposes.

1225. Is much water used for manufacturing purposes?—Not much from the Corporation waterworks; the water from the collieries is supplied to the manufacturers.

1226. What addition is made to the volume of the river in passing through Ashton?—I cannot answer that question.

The witness withdrew.

(*The Town Clerk.*) The quantity is considerable. There are several collieries in the borough from which water is pumped into the river, besides two collieries that the Corporation use. There are three sets of pipes in the borough, one for the domestic supply, one from the colliery that is used for street

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flushing, and another set from the river for pumping back again for manufacturing purposes.

1227. (*Dr. Frankland.*) Do they all come within the boundaries of the borough?—Yes.

1228. Then they would have formed a considerable portion of the total quantity of the river water last summer?—Yes.

1229. And perhaps that might account for your sending the water out purer than when it came in?—Yes.

Adjourned till to-morrow, at 11 o'clock, at Stalybridge.

The Town Hall, Stalybridge.

Friday, 7th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

MR. GREGORY GILL examined.

Mr. G. Gill.

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1230. (*Mr. Morton.*) Are you the borough surveyor?—I am.

1231. Does all the drainage of the town enter the river through several outlets?—Yes.

1232. That which pours out of those sewers is the rain-fall, the household slops, and the drainage from the middens?—Yes.

1233. From many of the middens does that flow?—About one half are connected with the sewers.

1234. Are all the waterclosets connected with the sewers?—Yes.

1235. Is there any manufacturing refuse delivered into the sewers?—Not that I am aware of.

1236. Does the water that is used for steam-boiler purposes pass into the sewers?—Yes.

1237. Is there any considerable quantity of land drainage or spring water that flows into the sewers and thence into the river?—Very little.

1238. Are the ashpits attached to the middens, and are the privies roofed?—Some few are.

1239. Does the roof of the midden drain into the ashpit?—Yes.

1240. How often are the middens cleaned out?—About four times in the course of a year, and by the owners of the property themselves.

1241. Have you an inspector of nuisances?—Yes.

1242. Is it his duty to take notice of middens that require to be cleaned out?—Quite so.

1243. Are the contents of the middens carried to any depôt?—Yes.

1244. Are the contents used for agricultural purposes?—No.

1245. Is the whole of the contents of the middens—the wet and the rubbish—carried to the depôt?—It is used for raising land.

1246. In the case of the middens that are drained into the sewers is the excrement mixed with the ashes?—Yes.

1247. Is that also used for making or raising land?—Yes.

1248. Is that near the town?—Yes.

1249. Is that land likely to become building land hereafter?—No.

1250. What security have you against that?—It belongs to the town, and the land is not to be used for building purposes; it has been given to the town for that particular purpose, and it never will be sold for building purposes.

1251. Is it steep land?—It is a flat.

1252. Who gave it to the town?—Lord Stamford.

1253. To what purpose do you suppose it will be ultimately turned?

(*The Town Clerk.*) It will be used for the purposes of the town.

(*Mr Morton to the witness.*) It is not to be sold for building purposes.

1254. Is that forbidden, or shall you be at liberty to change your mind upon that subject?—I am not exactly sure about that.

(*The Town Clerk.*) It is a part of the market ground and it will be used for a fair ground.

1255. (*Mr. Morton to the witness.*) As a matter of fact, does it cause any nuisance?—Not to any great extent.

1256. Have any complaints been made about it?—Yes; some few in the warm weather, but the intention now is, and a resolution was passed at a meeting of the Town Council yesterday, that the use of it for that purpose should be discontinued during the summer months.

1257. What will you do with the stuff then?—There are other places in the town or at some distance from the town where it can be deposited.

1258. With regard to land is there no grass land which is suitable and available for irrigation which the outlet of your sewer commands between this and Stockport?—I think there is very little.

1259. Might you not, by resorting to pumping, command a large area?—In our immediate neighbourhood we should have to pump to a very great height; the hills around being very high.

1260. If you were to pump to a height of 30 feet would you not then command land lower down the valley?—I think that a great portion of the land throughout the valley is built upon, and farming land is very rare in this neighbourhood.

1261. Have any complaints been made by the farmers living down the valley as to a want of water for their cattle?—I have not heard of any.

1262. (*Dr. Frankland.*) Do you consider that the ventilation of the sewers is at the present time satisfactory?—I think it is.

1263. Have you ever known gases to escape from them into houses?—Yes.

1264. To what cause should you attribute that?—The branch drains from a great number of houses are not trapped.

1265. Do you know of any cases in which the gases from the sewers have been forced through the water in the trap?—I do not.

1266. Do you consider that the admission of large quantities of steam and hot water into the sewers is likely to produce an effect of that kind?—Yes, and very injuriously so, as it would cause the gas to ascend much quicker to the highest points.

1267. And would the pressure be created at the highest points?—Yes.

1268. Have you known any cases of gas being forced through the water in the trap even at the top of a hill?—No; but we find this that the steam rises through the grids in the streets that are not trapped.

1269. Is it a source of nuisance to the inhabitants in the surrounding dwellings?—It is a benefit, inasmuch as if all these places were trapped, so that the steam could not escape, it would be forced entirely into the cottages, whereas it now goes out at the nearest outlet in the surface of the street.

1270. In the street itself is there any unpleasant smell arising from steam and hot water?—Yes, there is a little; the sewers are particularly clean in Stalybridge on account of their steep gradient.

1271. Are any of the privies in Stalybridge built against the walls of the houses?—In some few cases.

1272. Are there any sleeping rooms over privies?—I only know of two cases.

1273. What is done with the closed cellars?—They are not occupied again.

1274. Are they ever made receptacles for rubbish?—In Stalybridge there are many cottages that can be got without going into cellars, and therefore there is no demand for cellars.

1275. Do people live over those cellars?—Yes.

1276. Are there any slop or sink stones in these cellars?—Generally speaking sinks have not been put into cellars of this kind.

1277. Then is there no communication between those cellars and the sewers?—I believe not.

1278. Does the river in the summer time usually stink?—Not to any great extent.

1279. Last year was of course an exceptional one?—Yes.

1280. What is done with the excrements of the workpeople employed in the cotton mills?—They pass into the sewers.

1281. Do both the solid and the liquids parts go direct into the sewers?

(*Mr. Councillor Ashton.*) The excrements are collected and taken away in barrels.

1282. (*Dr. Frankland to Mr. Ashton.*) Is the barrel placed at the bottom of a shoot?—The privies are in the different storeys connected by a shoot to the place of deposit in the bottom storey, and when this is full the contents are carried away in barrels.

1283. (*Chairman.*) There is, in point of fact, a cesspool for all the tiers of closets?—Yes.

1284. (*Dr. Frankland.*) Is it an excavation that is made in the ground?—Yes.

1285. Does that hole communicate with the sewers?—No.

1286. What becomes of the contents when the hole is full?—They are taken on to the land in barrels.

1287. Are you sure that it does not overflow?—There may be one or two instances, but not within my knowledge.

1288. Are you going to abandon the Dukinfield Waterworks as a source of supply for Stalybridge?—Yes.

1289. Are the storage reservoirs covered?—No.

1290. Are they situate near any buildings or factories?—There are no buildings close to them.

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1291. How many buildings are there within a radius of a quarter of a mile?—Perhaps a dozen.

1292. Will these reservoirs be used in any way in connexion with your new water supply?—I think not.

1293. Or in the case of the water supply for Dukinfield?

(*The Town Clerk.*) Yes; it is proposed to continue the supply from those works to Dukinfield, but with regard to Stalybridge all the water will come from the new works.

1294. (*Dr. Frankland to the witness.*) To what extent is the gathering ground manured?—A large portion of it is pasture land, and no doubt is manured annually.

1295. Is night soil put upon it?—I think not.

1296. Is stable manure used?—Yes.

1297. We have been informed that there are some wells on the other side of the river?—Yes, there are two considerable wells there.

1298. Is the water used by the inhabitants of Stalybridge?—Yes.

1299. Do you know anything of those wells?—The water of those wells is not polluted, and is greatly esteemed.

1300. Where are the wells situated?—At the foot of a steep hill.

1301. Are there any houses up the slope of the hill?—Perhaps eight or ten.

1302. How many privies are there within 100 yards of the wells?—There are none on the land above the wells; these so-called wells are springs, and the owners of the property through which the water flows have formed these small pits or wells for the purpose of utilizing it for the use of their tenants.

1303. Are any wells that are used by the population actually within the town?—Yes, on the Cheshire side of the town.

1304. Near to the central well, from which water is conveyed in pipes to the subsidiary ones, are there any buildings?—There are not any.

1305. Are the surface washings kept out of the wells?—Yes, entirely.

1306. Is the water soft or hard?—It is softer than that supplied by the waterworks.

1307. Is it used for washing?—Yes, and for all domestic purposes. They fetch it from a long distance for the purpose of making tea.

1308. (*Mr. Morton.*) We have been informed that at Ashton there are 6,250 privies and 7,000 houses. In Stalybridge there are 2,000 privies and 5,000 houses. Can you explain that difference?—I cannot.

The witness withdrew.

MR. ROBERT HOPWOOD examined.

Mr. R. Hopwood.

1309. (*Dr. Frankland.*) What position do you occupy in the town?—I am Chairman of the Corporation Waterworks Committee, and I am also in extensive medical practice here.

1310. Are there any zymotic diseases prevalent in Stalybridge at the present time?—Yes, scarlet fever.

1311. Does it prevail to any very great extent?—No.

1312. Is there typhoid fever?—There has not been a case for some weeks, and we very rarely have it amongst us.

1313. Was diarrhœa prevalent last autumn?—Yes, both diarrhœa and dysentery.

1314. To what do you attribute the present prevalence of scarlet fever?—It is very difficult to say. It has attacked cleanly people, living in the healthy parts, quite as much as those of opposite habits living in the dirty parts of the town, and therefore it is difficult to say what it arises from.

1315. Is there a part of the town in which the houses are chiefly furnished with waterclosets?—No; some parts of the town where there are the smallest number of middens or privies are quite free from scarlet fever, whereas there are parts in which the cottages are as well built as possible, with every accommodation, and free ventilation, where scarlet fever is raging with the greatest violence.

1316. Have those houses been recently built?—No, they are quite on the outskirts of the town at Copley and Demesne Street. The low parts of the town, where the people are crowded together, and where the privy accommodation is of the worst kind, is at present quite free from scarlet fever.

1317. You do not attribute scarlet fever to overcrowding, or to the accumulation of excrementitious matters?—I do not know whether it is owing to that cause. I only speak to the fact that in Stalybridge some years ago there was an epidemic of scarlet fever, and that in the very districts which are now free from it, there were the worst cases.

1318. Is not scarlet fever very infectious?—Yes.

1319. If a single case occurred in a block of well-ventilated and well-built houses, do you think it would be likely to spread, independently of all the sanitary precautions that might be taken?—Yes. One reason why it spreads amongst the working

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classes is, you cannot get them to understand the real infectious character of the fever. They will go from house to house, where cases of the fever exist, and take their children with them, thinking nothing at all of it.

1320. From the prevalence of scarlet fever in one particular part of the town you cannot draw any safe conclusion as to its being due to the condition of that part of the town?—No.

1321. But you could more certainly do so in the case of typhus fever?—Yes, that is well marked.

1322. We are informed that the average death-rate for 10 years has been 20 per 1,000. Does that include the death-rate of the country districts around Stalybridge?—No; that represents simply the death-rate of the borough.

1323. Can you tell us what has been the maximum death-rate in any one year during that time?—No. In consequence of the peculiarity of the town for we have three registrars in the borough, but none of their districts are confined entirely to the borough. We applied to the Registrar-General, and he gave permission to the registrars here to furnish us with the returns we wanted, but he coupled it with the condition that we must pay the expense of it. The returns were not got, as the Town Clerk advised us that there was no fund out of which we could pay for it.

1324. You have stated that in former years scarlatina had been very rife in some of the lower parts of the town, are those parts near the river?—Yes; they are Lees Row, Catherine Street, and Henry Street, on the level of the river and very near to it.

1325. The river as it seems to you, is not very dirty?—No.

1326. Does any sewage go into the river above the town?—Very little.

1327. Have you found the condition of it to affect the health of the people in Stalybridge?—No. The river has a rapid flow, the sewers which empty into it have a steep gradient, so that all the refuse is carried away quickly.

1328. Is it, in your opinion, desirable that the excrements of the population should be removed quickly from the houses?—Yes, the sooner the better.

1329. While it is fresh?—Yes.

1330. And before putrefaction begins?—Yes.

1331. Do you know of any dry process that can be carried out?—I have heard of the dry-earth system, but I have had no experience of it.

1332. Do you consider that infectious diseases are sometimes conveyed through the atmosphere?—Yes.

1333. Do you think it likely that they would be so conveyed by dust?—I think it is very likely indeed by the dust of excrementitious matters.

1334. Can you give any practical illustration of that?—No, but I believe with Dr. Carpenter that if you surround people with nitrogenous matter in a state of decomposition you put them in the best condition to contract any epidemic disease, and, as excrementitious matter when decomposing has a large quantity of that in it, people who come in contact with the gases thus generated are of course likely to be infected by such disease.

1335. Have you at all turned your attention to any comparative effects produced upon health by the watercloset system as compared with the privy or midden system?—I have always been in favour of the watercloset system, because by that means we get rid of the excrements as quickly as possible.

1336. Do you think that the risk of the escape of gases through the watercloset, when in a defective state, is more than counterbalanced by the risk of emanations from middens?—I think that there is less risk from the watercloset system.

1337. Do you know what additional quantity of water per head would be required in a house where a watercloset instead of a privy was used?—No.

(*Mr. Gill, Borough Surveyor.*) I should think it would take from two to three gallons per head extra.

1338. Upon what data do you form that opinion?—I think that it would consume two gallons of water each time the closet was used.

1339. Do you find, as a matter of fact, that two gallons of water is used every time?—I have no doubt of it in a great number of cases.

1340. (*Dr. Frankland to the witness.*) Have you traced any cases of zymotic disease to the escape of gases from sewers?—No.

1341. Do you know that gases do escape from sewers into houses?—Yes; there is no doubt about that.

1342. Have you never met with any evil circumstances arising from that?—I have traced case after case of fever where there has been one common privy or midden for a number of houses, and situated near to the doors of the houses.

1343. (*Chairman.*) The privy or midden probably not having been cleansed sufficiently?—Where you have a low population using a common privy you cannot keep it clean; it is totally impossible.

1344. (*Dr. Frankland.*) Do you know any of the wells which have been spoken of?—I know the exit of some of them, and the pipes that have been spoken of as bringing the water, but I do not know the situation of the wells.

1345. Is the water supplied from those wells in your opinion wholesome?—I have not tasted it, nor have I seen it, but I know that the people who live in the neighbourhood think it is good water.

1346. Have you known of any disease prevailing among the people living in the neighbourhood where the water is used?—No.

1347. (*Mr. Morton.*) Are there any weirs in the river that passes through the town?—Yes, there are two.

1348. Is the main sewer, that has been spoken of as pouring forth most of the filth of the middens into the river, above the weirs?—No, it is below both of them.

1349. Is the outfall of any of the sewers in the river above the weirs?—Yes, above the lower one; but they are all small.

1350. Are the weirs at all a nuisance?—A quantity of mud collects in the bed of the river above the top weir which in the summer time smells offensively.

1351. Is the water in the mill lodge emptied every Saturday?—There is no systematic method of emptying it.

The witness withdrew.

Mr. Robert Hopwood further examined.

Mr. R. Hopwood.

1352. (*Dr. Frankland.*) Had you cholera here in 1866?—One or two cases, and they were rather of a doubtful character.

1353. Sporadic cases?—Yes.

1354. Was there any case of cholera in Stalybridge in 1849?—One or two very doubtful cases.

1355. Had you any cholera in 1832?—There were two cases which were reported of Asiatic cholera, but those were considered doubtful. In Dukinfield and at Ashton-under-Lyne they had about 20 or 30 cases.

1356. In point of fact cholera does not appear ever to have been epidemic in Stalybridge?—No, it has not; that is, not Asiatic cholera.

1357. Had you much diarrhœa in Stalybridge in the years when cholera visited it?—Yes.

1358. More than in any other years?—Yes.

The witness withdrew.

Mr. James Lees examined.

Mr. J. Lees.
9 May 1869.

1359. (*Mr. Morton.*) Is the inspector of nuisances a servant of the Sanitary Committee?—Yes.

1360. Is it part of his duty to examine into the state of the middens and privies?—Yes.

1361. If he finds any of them that have not been properly emptied, what steps does he take?—He reports it to the Committee, and a notice is issued to the parties to cleanse them; if that is not attended to, further proceedings are taken.

1362. What are those further proceedings?—The occupiers are summoned before the magistrates.

1363. Is the cost then of cleansing thrown upon those who have neglected it?—It is.

1364. What kind of stuff is taken away and put upon the land?—It is not very savoury.

1365. Considering the number of middens, the contents of which are turned into the sewers, must it not be very filthy stuff?—Yes.

1366. Is the smell complained of?—Yes, of one place of deposit there have been complaints, but the men employed by the Corporation will cease this week to deposit the stuff there.

1367. Are there any inhabited houses near to that place of deposit?—Within 100 yards of it.

The witness withdrew.

Mr. Councillor Ashton examined.

Mr. Ashton.

1368. (*Chairman.*) Are you chairman of the Highway Board?—I am.

1369. To what cause do you attribute the silting up of the river?—The silting up has been caused by an alteration made by the agent of Lord Stamford in the course of the river. Some years ago a straight channel was formed and a loop cut off; since that was done the river bed below the town has silted up two feet.

1370. Is any portion of the town drained into the canal?—Formerly several sewers had outlets into the canal; there is now only one, and notice has been served upon the owners of the property to divert that also. The main sewers can be flushed, but owing to their steep gradient the flow of sewage is so rapid the sewers do not require flushing. Whenever in carrying out alterations to streets the old form of grid or gulley has been met with we have caused them to be properly trapped to prevent escape into the street of sewer gases.

1371. Do you not think that by preventing the free escape of gas into the street you are running great risk?—There are man-holes in all the streets that the Corporation have altered at certain distances apart, and provision is then made for the escape of the gas through charcoal; and we recommend all owners of property to trap both the slop stones and the pipes of all branch sewers.

1372. As a general rule, do you find that gratuitous advice of that kind is ever taken?

(*Mr. Ashton.*) Not as a rule, but it has a certain influence.

1373. (*Chairman.*) With regard to the weirs, have the mill owners who use the power obtained by the weirs a right to raise the height of the weir, and if so do they ever exercise it?

(*The Town Clerk.*) They have not power.

1374. (*Chairman.*) The weir then is a fixture?—Yes, and if they attempted to raise it we should take proceedings against them.

(*Mr. Ashton.*) In consequence of the silting up of the river one weir has become almost useless.

Adjourned till Monday next, at Macclesfield, at 11 o'clock.

The Town Hall, Macclesfield.

Monday, 10th May 1869.

PRESENT:

Major-General Sir W. Denison, K.C.B., F.R.S., in the Chair.
Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.
Mr. S. J. Smith, *Secretary.*

Mr. John May (Town Clerk) examined.

Mr. J. May.
10 May 1869.

1375. (*Dr. Frankland.*) During last summer to what extent was there a deficiency in the water supply?—It was turned off from six in the evening till six the next morning.

1376. Was there practically any inconvenience experienced by the cutting off of the supply between those hours?—There was no inconvenience and no saving effected by really cutting off the supply, because the inhabitants always provided themselves against the period when they knew the water would be cut off; and when the water was turned on again they threw down the sewers that with which they had provided themselves in the mean time.

1377. The supply being a constant one, I presume there are no cisterns in the houses?—Not any.

1378. In the houses provided with watercloset is there a cistern from which the watercloset is supplied?—Yes.

1379. Would that cistern in a time of scarcity be deprived of water?—No, for the supply to it is regulated by a ball tap.

1380. Do you know the district of Macclesfield that is drained by the Hible Bridge sewer?—Yes.

1381. Does that sewer drain a district in which there are privies, or are there many watercloset in it?—There are a few waterclosets, but they are chiefly privies.

1382. Do you consider that the sewage which flows from that sewer is a fair sample of the sewage of Macclesfield?—There are sewers which discharge more feculent matter than that, and therefore it would not be a fair sample.

1383. We found it to be rather a weak sample?—Yes, there are worse sewers than that in districts where the population are more crowded together, and where the sewage is more noxious in all respects.

1384. In the Return you seem to contemplate that the deodorization of the sewage is possible?—No; we never contemplated the deodorization of the sewage. In reply to Query 24 we make a suggestion that the sewage should be deodorized, that hardly represents the opinion which is entertained as to the mode of dealing with it; it was merely as a temporary expedient.

1385. Did you, as a matter of fact, find that the river was less offensive below the town when you applied the deodorants to the sewage?—I am not able to say, because it would only operate upon the sewage, and not upon the refuse stuff from dye works, which is very offensive to the smell even where no sewage is discharged.

Mr. J. May.

10 May 1869.

1386. You mean, do you not, before the river reaches any point where the sewage of Macclesfield is discharged?—Yes; I think the river is exceedingly offensive to the smell. In parts above the town it is almost as offensive as it is below.

1387. Above the points of which you speak is there any sewage whatever discharged into the river?—Yes, from the village of Langley, consisting of from 50 to 100 houses, but it is not appreciable. All the houses have privies, and there is no district sewage or drains discharged in the river.

1388. Are the sewers well ventilated?—They are.

1389. Have you had complaints of deleterious gases passing from the sewers into the houses?—Very rarely; the surveyor is very careful to have all new sewers properly ventilated.

1390. Does the plan of ventilating the sewers by rain water spouts answer?—It appears to have answered very well. The sewers are also connected to the chimney shafts of factories, and this mode of ventilation appears tolerably effective.

1391. Of course you know Sunderland Street in Macclesfield?—Yes.

1392. Is there an offensive stream flowing through Sunderland Street?—There is.

1393. What is the cause of its offensiveness?—In its passage through the centre of the town it receives the refuse from dye works, and a great portion of the sewage of that district, and being a small brook it is very offensive.

1394. Are the weirs upon the brook necessary to obtain a supply of water to steam boilers?—Yes; no doubt the weirs retard the flow of the stream, but if they were altered the deposit in the river would be discharged more freely, and there would not be so large a deposit as at present.

1395. What is the average quantity of water that flows down this brook?—It is very variable in quantity.

1396. Is it most offensive just above the weirs?—No; but just before its junction with the river. Some time ago the Local Board of Health offered to be at rather more than one half of the expense of covering it over at that particular point.

1397. What is the length of the brook from the place where it first receives the pollution to its junction with the Bollin?—About a mile and a quarter, and for the last half of a mile it is especially offensive.

1398. The following complaint has been forwarded to us:—Sunderland St., Macclesfield, May 5th, 1869. We, the undersigned householders living in Sunderland Street, Macclesfield, beg to call your attention to a running water which is very disagreeable and offensive in the summer, causing much sickness, and creating nauseous smells. We shall take it as an especial favour if you will give it your attention. (Signed) John Gosling, William Wayte, George Halewood, Ambrose Brindley. Is this statement correct?—I know that one is an occupier of one of the houses in Sunderland Street, the back doors of which houses open into the yard, through which this stream runs. It is offensive, and I should think injurious to the health of the occupants. If the owners had joined with the Corporation the stream would have been covered over. The Corporation go to great expense in keeping the bed of the stream as clear as possible; the water is not allowed to become stagnant.

1398*a*. Are there many privies which are actually enclosed within dwelling houses?—Not one within my knowledge.

1399. We have sometimes met with privies that are entered from the outside, and which have sleeping rooms over them?—We allow of no such cases as those.

1400. Are any parts of the town of Macclesfield supplied from shallow wells near to the cottages?—Not any.

1401. Have you made any estimate of the relative quantity of water that is necessary, per head of the population, where water-closets are used as compared with what is required where privies are used?—Not of the relative quantity.

1402. Or the additional quantity of water that would be necessary?—The surveyor will be better able to answer that question.

The witness withdrew.

MR. HENRY ASPINHALL examined.

Mr. H. Aspinhall.

1403. (*Mr. Morton.*) Are you the borough surveyor?—I am.

1404. What additional supply of water do you think would be wanted if waterclosets were substituted for privies?—With properly constructed waterclosets, I think, a gallon of water would be wanted each time the closet was used.

1405. How many sewers deliver their contents into the river?—A dozen.

1406. Does any manufacturing refuse pour out of those outlets into the river?—Yes, in some instances from silk manufactories, and dye houses and other works on the stream.

1407. In addition to that is there not the drainage from 220 waterclosets?—Yes.

1408. Also the drainage from 3,000 privies?—Yes.

1409. Are the whole of those connected with the sewers?—Nearly the whole of them are connected with the sewers.

1410. Is the cleansing of the privies done under your directions?—Yes, partially so.

1411. At a cost of 250*l.*?—Yes.

1412. Do the 3,000 tons that you get out include the whole of the ashes?—No, that is about the quantity that we cart away.

1413. What proportion do those 3,000 tons bear to the whole quantity?—About a fourth.

1414. Where is the separation made between that which is used for manure and that which is used for other purposes?—It is made in the street.

1415. During the night?—Yes, by our men, and men employed by other persons.

1416. Is that which is not used as manure cleaned?—No, it is covered with manure, some of it.

1417. Where is it taken?—It is taken to the nearest tip, and some of it is used for making bottom stuff for roads.

1418. Where is the tip to which it is taken situate?—It is just at the outskirts of the town.

1419. Is it allowed to accumulate there?—Yes.

1420. Do you spread it out?—No, it is shot down at the tip, and there is perhaps one load of that to perhaps a dozen loads of other stuff shot down.

1421. Is the town extending in that direction?—It is.

1422. Do you think this ground will be built upon?—It will be built upon ultimately.

1423. What do you get per ton for what you sell?—About 1*s.* a ton.

1424. If you add 150*l.* to the 250*l.* that will make 400*l.*, is that the whole cost of cleaning out the privies?—No, the 250*l.* is the clear cost that the board lose, and with the other part of the money we pay the men's wages.

1425. Then the fact is that of the 400*l.*, 250*l.* is the sole cost of cleansing out the privies?—Yes.

1426. (*Chairman.*) You clean them out and you sell the contents, other people do not clean them out?—We only do it partially.

1427. What number of men is actually employed in cleaning them out, and what wages are paid them?—I have not got that taken out, but I can furnish you with it.

1428. (*Mr. Morton.*) Of the 3,000 tons that are sold as manure, how much is ash do you suppose?—I should think two-thirds of it.

1429. Then there are 1,000 tons of manure, which would be about three tons a day, and 5,000 tons or thereabouts would be the whole weight of the excrementitious matter that you remove from 36,000 people?—Yes, that is all we remove.

1430. Do all the privies drain into the sewers?—Yes.

1431. Does all the liquid part go into the sewers?—Yes.

1432. Are the ashpits roofed?—No, but we are roofing them now, and have been doing so for the last 12 months.

1433. Do the roofs drain into the ashpits?—No; only about one-half of them do.

1434. Then one half of the privies contain the washings of the solid parts of the excrements as well as the whole of the liquid part which goes into the sewers?—Yes.

1435. Do you think there would be any difficulty so to lay down the sewers as to give them one outlet?—No.

1436. Have you any scheme for dealing with the sewage in the way of irrigation?—I proposed a plan to the Board of Health some years ago to collect all the drains into one large main drain, and carry it down below Beech Bridge.

1437. How far off would the outlet be?—Just below the outskirts of the borough. This is a tracing of the borough (*producing the same*), and this is the line of the river (*explaining*).

1438. Where are the lands that you would propose to irrigate?—There is some land below the town at Beech Bridge that could be used without any gravitation, but there is a moss just on the outskirts of the borough on the south side, which is on a level with some parts of the borough, and we should have to pump the sewage up 100 feet; but there are 500 acres of the moss at the present time uncultivated.

1439. (*Chairman.*) What fall is there in the river near the outlet?—The fall through the town is 1 in 150.

1440. Is there water power sufficient to enable you to pump it?—There is at present; but if we drained this moss we should have sufficient water to from under it, which, with the volume of the river would enable us to pump the sewage back to this moss.

Mr. H. Aspinhall.

10 May 1869.

1441. (*Mr. Morton.*) What quantity of sewage do you suppose that this sewer, if brought to one outlet, would discharge?—About two millions of gallons a day.

1442. What proportion would that bear to the quantity of water supplied to the town?—We use a million and a half gallons now per day.

1443. Where do you obtain the other million from?—From breweries, and the extra supply to the town from Hurdsfield.

1444. Is there any outlet for storm water?—No. I should pitch the bottom of the river, in a manner somewhat similar to river *Croal*, at Bolton, and provide outlets, so that the heavy storm waters would find their way into the river, and not, as they do now, into the sewers.

1445. What proportion of the water supplied to the town in which privies and waterclosets exist, goes into the sewers?—The whole of it.

1446. What loss is there by evaporation?—Very little, as the water goes from the houses directly into main drains, and so into the river.

1447. There is also the waste water from the kitchens?—That flows into the sewers, and so into the river.

1448. Are there also the bed-room slops?—Yes.

1449. And the emptyings from the washing tubs?—Yes; that all goes down into the drains.

1450. Do you think there would be any difficulty in getting land here on either side of the river?—There is plenty of land to get it down by gravitation, but there would be a difficulty with the owners of the land.

1451. What is the agricultural value of that land?—That which is close to the town is worth as much as 4*l.* an acre; but it is good land.

1452. Has there been, in the making of the sewers, any considerable addition made to the water running into them owing to land springs?—Very little.

1453. Have there been any complaints made by farmers below of the spoiling of the water for agricultural purposes?—No; there have been complaints from the inhabitants of Prestbury, but not from the farmers.

The witness withdrew.

MR. ALLAN CARSWELL examined.

Mr. A. Carswell.

1454. (*Mr. Morton.*) Do you suffer any injury from the state of the water in the river as it comes down to you from Macclesfield?—Nc, except for cattle drinking purposes, that is all that I have to complain of.

1455. (*Chairman.*) You mean that the cattle refuse to drink it?—Certainly.

1456. (*Mr. Morton.*) Have you incurred any expense in providing water for the cattle?—No, but we have plenty of land, and you must understand that the river drains outside of my farm.

1457. (*Chairman.*) Do you consider that the water is not good or wholesome for the cattle?—Yes, they will not drink it at all.

The witness withdrew.

REV. STEPHEN LEA WILSON (Vicar of Prestbury) examined.

Rev. S. L. Wilson.

1458. (*Chairman.*) Do you wish to give some evidence of the state of the river Bollin at Prestbury?—I do. The Corporation in answer to your Query 21, state "that the dyers of late years have not drained "into the stream the quantity of solid refuse which "they formerly did. The construction of the new "waterworks at Langley, and the compensation supply "of water to the mill owners has given to the river a "constant supply of water, which very much con-"tributes to the purification of the stream." In 1865, soon after this new storage was commenced, the stink was so intense at Prestbury, as really not to be endured, especially on Saturdays and Sundays. Last year it was so intolerably bad that I, and also my family, had to go away. We laid our complaint before the Corporation, and they acknowledged that it was a nuisance, and promised, if possible, as far as they could, to remove it. However, nothing has been done, and on the 18th of December 1866, we formed a sewerage committee, with a view of taking steps against the Corporation, but one of the gentlemen (since dead) begged of us to wait, on the ground that "We are all neighbours, and do not wish to be put "to any great expense in the matter;" and that it was almost impossible to remove the nuisance. Every year it is becoming a greater nuisance than ever. The water is neither fit for washing nor any other purpose, neither will the cattle touch it. I have seen the cattle standing in the water when the flies have been about, but I have never seen sheep or cattle touch it, it is almost as black as ink. On Saturdays, and Sundays, when there is hardly any water running down, it is something so horrible that it almost makes you sick to look at it, and I do think that something ought to be done.

1459. (*Chairman.*) We are very glad to receive statements of this kind, but we find that it is just the same everywhere else?—Two of the Corporation have turned round upon me, and said, "What do you do "with your own sewage?" I wish to say, in answer

Rev. S. L. Wilson. 10 May 1869.

to that, that there is not a drain from Prestbury that goes into the river. There are three depositing tanks, out of which the liquid part is drained and pumped on to land. I have one of my own, with an iron pump attached to it.

1460. (*Mr. Morton.*) Have the inhabitants of Prestbury made any suggestion to the Corporation of Macclesfield?—I believe you will find that there is a suggestion in Mr. Carswell's paper.

1461. Would the inhabitants of Prestbury object if land were taken between Macclesfield and Prestbury for the purposes of irrigation?—Yes, they would on that side decidedly, but not if it were beyond, there would be no objection.

1462. Is there any considerable population below you?—There is hardly any; there is no great population after you pass Prestbury.

The witness withdrew.

(*The Town Clerk.*) I may mention that the Corporation have visited and examined very carefully all the irrigation works in every part of the kingdom, and have sent their surveyor to witness the experiments, and they have sent deputations; and what they are waiting for is, first, to know how the sewage can be usefully and economically applied, and in the next place, whether they can obtain power to do it. They have applied to one owner of land just below Beech Bridge, and he refused to let them have the land, and they have no power to compel him. If they had carried the sewage lower down it would have been done at great expense, and they have no power to do it. They are quite sensible of the effect that is produced at Prestbury, and the Corporation have not been negligent, for they have so arranged all their sewage works that the sewage may be collected and carried down for the purposes of irrigation when they have obtained the power and the means of doing it.

Mr. Allan Carswell examined.

Mr. A. Carswell.

1463. (*Chairman.*) Do you reside at Prestbury, and have you any information to lay before the Commission on irrigation carried on there?—We irrigate forty acres of land close to Prestbury, from the river Bollin, and the people of Prestbury have never complained to me about it. We do not get it regularly, but only when the factories are not working at night and on Saturdays and Sundays. We irrigate in sections. The water as it flows on is black and filthy, but flows off quite clear, but I must say that I should not like to drink it.

1464. (*The Town Clerk, through the Chair.*) I suppose the cattle will graze off the land immediately after it is irrigated?—Yes; the cattle will walk over pasture fields on to it; they do not touch the regular pasture when they can get to the meadows.

1465. (*Mr. Morton.*) Do the cattle no longer refuse to drink the water?—I do not know about that, because it gets beyond us then.

1466. (*Dr. Frankland.*) Do you get large crops from the land which is irrigated?—Yes.

1467. Do you consider that the sewage, diluted as it is by the river water, is strong enough to be applied to the land?—Yes, this river water is.

1468. Is it the Bollin you speak of?—Yes.

1469. (*Mr. Morton.*) Is the water better than if it were clear for your purposes?—Yes; certainly for that purpose it is.

1470. (*Dr Frankland.*) How long has this been going on?—I think it has been going on for something like 14 years.

1471. Is the water strong in its manuring qualities and more fit for your purpose?—I do not know; it seems to me to be very much like what it has been for some years past.

1472. Have you been satisfied with it from the first?—Yes, it has always quite satisfied me.

1473. (*Mr. Morton.*) Do you graze the land, or do you mow it?—We do both; we mow it always during one part of the year, and graze it during the other part; but the difficulty is this, that when we are putting everything right, the millers in screening their corn or wheat empty all the seeds into the river and we in that way get them over our land, and it spoils our grass.

1474. (*Dr. Frankland.*) Does this water flow on to the land by gravitation?—Yes, it does; I wish to hand in this paper.—(*The same was handed in as follows.*)

"Butley, Prestbury, Macclesfield,
"May 3rd, 1869.

"To S. J. Smith, Esq., Secretary to the Rivers Pollution Commission.

"Sir,

"The Bollin is, from the fact that Macclesfield is built on a height on its banks, peculiarly adapted for draining the town. All the refuse from the factories, print, and dye works, gas and other public works, are conveyed into the river, and the fouling has been materially increased by new sewerage and drainage works, which the Local Board have very efficiently carried out to a great extent, thereby emptying the sewage in a more concentrated form into the river. The Bollin has become in fact a great main sewer for Macclesfield; and although the town is much more healthy, and the death-rate lower than formerly, yet the nuisance is only moved further on.

"First.—The use of the river and stream is, under present circumstances, essential to the carrying on of the industry of the district.

"Second.—From the situation of Macclesfield, which is on a high level, arrangement might be made whereby the whole of the sewage and refuse of the town and district might be kept out of the river at a comparatively small cost.

"A main sewer might be constructed from Macclesfield to a point a little above and beyond Prestbury, the whole of the sewage could be kept entirely out of the river, and conveyed to that point. It could then be used for irrigating several hundred acres of land, and would pass into the river comparatively clean. The expense would only be the first cost of the main sewer. The whole of the nuisance would by this means be effectually done away with, and as that part of the district is mostly meadow and pasture land, and thinly inhabited, I do not think anyone would object. I have reason to believe the owner of the land would not object.

"Third.—There are only two weirs on the river between Macclesfield and Wilmslow. I do not think there is anything to complain of in the way of obstructing drainage.

"Fourth.—The effect on the health of the inhabitants in the district immediately below Macclesfield is, I think, inappreciable; the discomfort to the inhabitants of Prestbury is very considerable. There is a weir opposite the village which dams up the water and accumulates filth and rubbish, and the mill-owners in and above Macclesfield impound the water for manufacturing purposes. When that happens in dry weather the river is nearly dry, and then the stench is very great indeed.

"Fifth.—The best mode of protecting individual and public interests in the purity of running water is to compel the Corporation of Macclesfield to construct a sewer as recommended in answer to second question.

"I remain,
(Signed) "Allan Carswell."

The witness withdrew.

Mr. Thomas George Richmond, F.R.C.S., examined.

Mr. T. G. Richmond, F.R.C.S. 10 May 1869.

1475. (*Dr. Frankland.*) Are you a member of the Royal College of Surgeons?—I am a Fellow of the College.

1476. Do you wish to make a statement to the Commission?—Yes. "The stream named the Jordan which runs through Macclesfield after its junction with the river Bollin, empties itself into the Mersey below Dunham Massey; and throughout its whole course (through a beautifully diversified district) is more or less tainted with the sewage and impurities of the town. These impurities at Prestbury (situated two miles and a half below their source) are of a character to create a general nuisance, and affect in a considerable degree the health and comfort of the inhabitants, especially those living in close proximity. The water is always dark and offensive, loaded with noxious ingredients, and in warm close weather particularly disgusting and annoying. This is mostly the case when the water is low, and evaporations from the slimy deposit uninterrupted. An artificial scarcity of water is produced when that element is most needed by the system of collecting and impounding it in large reservoirs for manufacturing purposes. This practice is very severely felt during the dry summer season. The condition of the river thus described is principally owing to the Corporation of Macclesfield 'putting matter in the wrong place,' draining into the water what ought to be discharged upon the land. 'The Chinese are the best, most perfect, and oldest agriculturists in the world. Their fields grow two crops every year, and never lie fallow.' Why? Because they return to the earth the elements taken from it; and in doing so have practically demonstrated that human excreta are six times more valuable than that of the horse, and infinitely superior to that of other animals. But we need not go so far to find examples of the great benefit which would accrue both to landowners and tenants, as well as the general public, by the proper utilization of what now runs to waste, losing its own fertilizing properties, and poisoning the water which receives it. Edinburgh, Croydon, and Worthing, with many other towns and institutions might be quoted where attempts made to utilize sewage have been of a most remunerative and satisfactory character. There can no longer be any excuse for fouling running streams with those fertilizing agents which we are at present importing at immense cost from distant countries. The sewage of Macclesfield, from the elevated position of the town, would have an easy and uninterrupted flow in a north-westerly direction for several miles, and by collateral pipes attached to the main one, could be made available along its whole course for the supply to farmers of liquid manure. The earth closet (Moule's plan) might be more generally introduced, and the present open cesspool either abolished or roofed over to keep out the rain, and ashes (not cinders) riddled over every morning as a manurial preservative and deodorizer. The refuse from gas, bleaching, and dye works, also from tallow chandlers and slaughter houses, ought to be strictly prevented from passing into the river. All water used in dyeing, and every business and manufacture in which its purity has been interfered with and diminished, should be run into subsiding tanks, so that all suspended matters may be deposited before it is allowed to pass into the outlet channel. Water containing arsenical salts or other poisonous substances should also be neutralized, and their action rendered harmless. If these measures, or modifications of them, be generally carried out, a great blot will be removed from our imperial as well as local legislation, and the vaunted civilization of the 19th century be no longer disgraced by the mock philanthropy which sacrifices the health and interests of the many to the advantage and aggrandizement of the few."

1477. You have said "that these impurities at "Prestbury are of a character to create a general "nuisance and affect in a considerable degree the "comfort of the inhabitants, especially those living in "close proximity"?—Yes.

1478. Is that a general statement, or do you know of many special cases of disease that have been traced to the river as the source?—They are special cases which I believe have arisen from emanations from the river.

1479. Do you find that those portions of Prestbury which are situated close to the river are worse in a sanitary point of view than those which are further removed from it?—Yes, decidedly.

1480. Are there no bad parts of Prestbury that are away from the river?—Not that I am aware of.

1481. What is the population of Prestbury?—It is a very extensive parish.

1482. You recommend earth closets?—Yes.

1483. Have you had any practical experience of them?—Not in my own house; I have seen them at the Cheadle Institution, which is in connexion with the Manchester Royal Infirmary.

1484. You have stated that "the refuse from "gas bleaching and dye works, also from tallow "chandlers and slaughter houses ought to be strictly "prevented from passing into the river," do you know that the refuse from gas goes into the river?—I am not aware that it does. I do not believe that it does from the gas works; it may probably from private gas works.

1485. Have you seen the products from gas works in the river at any time?—Yes at times I have.

The witness withdrew.

(*The Town Clerk.*) The Macclesfield Gas Works do not discharge any refuse now into the river, it is all sold.

(*Chairman.*) If there are any gentlemen present who live down the river, and wish to make any statement we shall be glad to hear them.

Mr. James Wright examined.

Mr. J. Wright.

1486. (*Dr. Frankland.*) You wish, I believe, to make a statement?—Yes. I wish to state that the river which has been referred to runs through my land for about a mile and a quarter, and that is, I should think, within five or six miles of Macclesfield, but the river is most offensive even at that distance. It is as black as ink, and it is offensive particularly in dry weather. There is one meadow that we irrigate with this water by a weir, and although no doubt it brings a good crop of grass, I consider it is a very inferior quality. I have a field which adjoins this meadow which is manured, and the quality of the grass grown in that field so manured is very superior to the grass from the meadow, which is irrigated by the sewage of the river. The sewage may bring a good crop of grass, but I think that it does harm. I think it destroys the herbage, and therefore although you may have a greater quantity of grass, I do not think the quality is so good.

1487. Do you think that the miller's seed may affect it?—Yes, but that I do not know anything about.

1488. (*Chairman.*) You say that the distance is about five or six miles from Macclesfield by the river?—Yes, and the river is the boundary between myself and Mr. Legh.

1489. (*Dr. Frankland.*) Do you know the river still lower down than that?—No, it goes through my land about a mile and a quarter, that would make it seven miles from Macclesfield.

1490. At all events at your place it is still very

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offensive?—Very offensive, and of a very dark deep colour, the colour of indigo.

1491. Is there nothing that gets into it between Macclesfield and you?—There is nothing but the ordinary drainage that runs into it, but that is quite clean.

1492. The land drainage?—Yes.

1493. Is there no source of pollution?—None on my property at all.

1494. (*Mr. Morton.*) If the refuse from the mills were kept out of the river, do you think that the sewage would spoil the grass?—I do not think it would.

1495. Would you help the corporation out of their difficulty by offering them some land?—I do not think I could be of any assistance in that way. I am rather too far away.

1496. Would you object to this stuff being put upon the land in your neighbourhood?—I think I should object to its coming over the meadow, because it is so close to the house; it is less than a quarter of a mile from the house.

1497. (*Chairman.*) Have you any doubt that it might be profitably employed for irrigation purposes?—I do not doubt that.

1498. (*Dr. Frankland.*) Do you find that the cattle refuse to drink the water?—Yes, they will not drink it; I have cattle in the meadow I have mentioned, and I have never known them drink it; the cattle are there constantly after the hay is taken off.

The witness withdrew.

MR. JOHN LEA examined.

Mr. J. Lea.

1499. (*Chairman.*) Have you any statement to make?—I wish to speak as to the condition of one of the tributary streams to the Bollin, that called the Dane's Brook. It flows close to some cottages for which I am agent, and is very offensive indeed. I have lost many good tenants through the very offensive condition of the stream.

(*Chairman*) We have already had a statement, on the condition of the brook, forwarded to us by some of your tenants.

The witness withdrew.

(*The following statement was handed in.*)

"Handforth, Manchester.

"To S. J. Smith, Esq., Secretary to the Rivers Pollution Commission.

"SIR,

"IN accordance with the instructions in the advertisement in Macclesfield paper of Saturday, I write to inform you that I am much interested in the case of the Bollin pollution, tributary of the Mersey, commencing above Macclesfield and flowing into it near Lymin (near Warrington), also in the Dean Water, flowing into the Bollin near Wilmslow, coming from the hills near Lyme, both rivers are and have been frightfully polluted for many years. The one from madder and disgusting refuse from printworks at Handforth, the other from dye works, indigo refuse, and all the sewage of Macclesfield. The injury to the properties down these rivers is great. No cattle can drink, and all fish are killed. The Bollin used to be a clean pellucid stream, swarming with trout and fish, and was a cattle watering-place for all the rich pasture lands which lie down the Bollin valley. During the summer months in warm weather the smell or miasma from the river is bad, sometimes abominable. It is disgraceful that such things should be permitted. The whole of Macclesfield pours its sewage into this stream. This place is about eight miles from Macclesfield. The course of the stream would probably be more, say ten miles. In spite of this distance the water is generally utterly foul, and thick, slimy, and seething. I should be quite willing to go up if required to give any information. I have a large cotton mill here. It was built the latter end of last century, and until about 1830 the water was clear and abounded in fish."

I am, &c.

(Signed) ROBERT GREG & Co.

Adjourned till to-morrow at 11 o'clock at St. Helen's.

The Council Chamber, St. Helen's.

Tuesday, 11th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

MR. JOHN ROSS examined.

Mr. J. Ross. 11 May 1869.

1500. (*Dr. Frankland.*) Are you surveyor for the borough?—Yes.

1501. Is there not in St. Helen's a great quantity of alkali waste deposited?—Yes.

1502. Are buildings subsequently erected upon that ground?—No, there is not very much of it newly deposited within the Improvement Commissioners' boundary.

1503. Independently of boundary, can you tell us about the number of houses that are built upon the alkali waste?—I am not able to answer that question.

1504. Is there any objection to doing it, or is there any reason why they are not erecting buildings to a further extent?—The alkali waste is deposited in a solid form in very large heaps, and it is therefore unfitted for building purposes, and on that account very few houses are built even in the neighbourhood of the alkali deposits or heaps.

1505. Is it the fact that the greater part of St. Helen's is actually built upon alkali waste?—I believe so. There were some old layers near Westfield Street, and in several other parts of St. Helen's as found by excavations from time to time.

1506. Do the people who reside in those houses complain at all of the smell of the alkali waste?—I am not aware of it.

1507. Can you tell us the maximum number of persons living in any one house in the borough, or in any number of houses in the most crowded districts of the town?—Six persons are about the average number in the most crowded parts of the town.

1508. How many rooms are there in a house in the district referred to?—There are four rooms.

1509. In the lodging-houses how many persons do you think sleep in one room?—I cannot say. The superintendence of lodging-houses does not form any part of my duties.

1510. Is it part of your duty to take any note of the death-rate in St. Helen's?—No.

1511. Is there any officer in the borough who can furnish us with that information?—Not so far as the death-rate within the borough is concerned, but with regard to the four townships comprising the borough, the Registrar will be able to give you the particulars of the death-rate.

1512. Is the Registrar here?—No.

1513. What are the four townships to which you refer?—Eccleston, Windle, Sutton, and Parr.

1514. Are not the sewers ventilated?—No.

1515. Do you know whether the gases escape from the sewers into the dwelling houses?—Yes, they do.

1516. Are complaints made of it?—Yes, occasionally.

1517. Have you any plan in contemplation for the purpose of preventing that?—No.

1518. Is the water supply in St. Helen's quite satisfactory?—It is not.

1519. In what respects is it unsatisfactory?—It is deficient in quantity.

1520. Do you mean that the quality is not complained of?—Yes, the quality is very excellent.

1521. We have examined two kinds of water, one was from the gravitating reservoirs. Is that only used for trade purposes?—Yes.

1522. Is it never used for domestic purposes?—No.

1523. The other water, I believe, is pumped entirely from wells?—Yes, out of the red sandstone.

1524. Is it that kind of water which is deficient for domestic purposes?—Yes, for domestic purposes, and for trade.

1525. What was the date of the establishment of the first alkali works in St. Helen's?—I cannot say.

1526. To what extent was there a deficiency in the supply of water last summer?—To the extent of 60,000 gallons per day. The gravitation waterworks were run dry.

1527. That was a deficiency of the water for manufacturing purposes?—Yes.

1528. Was there any real distress felt in consequence of the shortness of the water supply for domestic purposes?—No.

1529. Are the gravitation reservoirs partly supplied by pumping from wells?—One, the service reservoir only as attached to Pumping Station, is so supplied from wells.

1530. Were you able last summer to supply water for trade purposes, from the domestic source?—We supplied water for trade purposes from that source last summer.

1531. Let me correctly understand you. Are not the reservoirs you call gravitating ones, partly supplied by pumping from wells?—No.

1532. (*Chairman.*) The queries sent to you on this subject were, "How is the town supplied with water, "for domestic purposes. From what source is the "water at present obtained." &c. And one of your answers is, "By gravitation from a service reservoir, "at the Eccleston Hill pumping station." Is that service reservoir filled by pumping from wells?—Yes, it adjoins the engines, and the water thence flows by gravitation to the town.

1533. Then it is pumped?—Yes.

1534. The answer to the other query is "the "other reservoir; is situated 150 feet above the "town; but the water from the wells only is used for "domestic purposes. The surface or gravitation water-"works were established in 1840, and the wells or "pumping waterworks in 1852; they belong to the cor-"poration." What we understand is, that the borough is partially supplied with water by gravitation and by water collected from the surface of the ground, but that you ran short of water last year. We want to know the proportion of the rainfall that flows off the 300 acres into your reservoir?—It is suggested to me that it is a mere trifle over a third.

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1535. (*Dr. Frankland.*) What volume of water per head of the population of St. Helen's is supplied?—Twenty gallons per head.

1536–8. If water-closets were used in St. Helen's instead of privies, how much more water per head do you consider would be required?—Forty gallons a head for all purposes per day would be necessary. In Penrith, the town with which I was connected, before I held my present appointment, that quantity of water per head was used, and there the water-closet system was adopted.

1539. Are you assuming that there would be one water-closet to each house?—Yes.

1540. Upon what data have you founded the opinion that each person uses twenty gallons of water per day for a water-closet?—A great proportion of the water would be necessarily wasted.

1541. For what reason would it be wasted?—Because people are careless in their use of water.

1542. I presume you have an inspector whose duty it should be to prevent waste?—In the town to which I have referred there was a very minute inspection, but still we could not reduce the quantity supplied of 40,000 gallons.

1543. Do you really think that each person uses twenty gallons of water per day, men, women, and children, for water-closets alone?—I do not believe that twenty gallons per day would be legitimately used for water-closets.

1544. At Penrith they have an ample supply of water, and there is no occasion probably to look after the waste, it is obtained from the river Eden?—The quantity is obtained by pumping, and on that account it is very desirable that they should reduce the waste to a minimum.

1545. (*Mr. Morton.*) I believe that your streets are all sewered?—Yes.

1546. Do the sewers all discharge into the Sankey Brook?—Yes.

1547. Through how many outlets does the sewage flow into the brook?—About 16 or 18 main sewers.

1548. Do the washings of the streets, and the rainfall flow into the sewers?—Yes, and the ordinary drainage from dwelling houses, chamber slops, and water-closets.

1549. Are the middens connected with the sewers?—Yes, all of them within the Improvement Commissioners' boundary.

1550. There is also the drainage from the privies, the liquid part I presume finds its way into the sewers?—Yes.

1551. Are the ash-pits in St. Helen's roofed?—No.

1552. Does the rainfall on the roofs of the privies fall into the ash-pits?—Yes.

1553. In addition to the liquid are there not also the washings of the solid parts of the excrements which go into the sewers?—Yes.

1554. At Parr they speak of the midden system as a nuisance, and they consider it injurious, while the people at Sutton consider that it is not injurious. Is there any difference between the two places to account for that difference of opinion?—No.

1555. It is in Parr that the middens are complained of?—Yes.

1556. I see that by your "Improvement Act" it is required that the space at the back of the house shall be at least one-third of the ground occupied by the house?—That is a mistake, it means one-half of the space that is built upon should be reserved for back yard.

1557. Is it the rule to build rows of houses back to back?—Or with a passage between each row, the opening to the middens being in the passage.

1558. Do the privies and ash-pits skirt upon another road or upon a back way, or how is the scavenging carried on?—With passages at the back.

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1559. Does the passage serve for two rows of privies or only one row?—It serves for two rows.

1560. Is the scavenging done by servants of the Corporation or only in the case of houses where the owners have neglected to do it?—It is only done by the Corporation within the Improvement Commissioners' boundary.

1561. Is the scavenging handed over to a contractor, and do you give him 300*l.* a year for the stuff that he takes away?—Yes.

1562. Is he bound to take the whole of it away?—Yes.

1563. Does he not separate it to see what is fit for manure?—I am not able to answer that question.

1564. Do you know what he obtains for that which is sold as manure?—No, but a great portion if not all of it is used for manure.

1565. Is it worth carting a long way? Does he supply people at some distance?—The farmers in the majority of cases send their carts in for the stuff.

1566. Are the men employed by the contractor merely those who empty the middens, and wheel it into the street?—Yes, but in some cases he carts away the manure beyond the limits of the borough to a depôt from which he supplies the farmers.

1567–9. Does he take any of it beyond the depôt to fill up hollows when there is not a sale for it?—No, he is not permitted to do so.

The witness withdrew.

MR. ROBERT MCNICOLL, F.R.C.S., examined.

Mr. R. McNicoll, F.R.C.S.

1570. (*Dr. Frankland.*) Are you a member of the Royal College of Surgeons in extensive practice in St. Helen's?—Yes, I have a fair practice.

1571. How long have you known St. Helen's?—I have been here for 20 years.

1572. Can you state what the death-rate has been in St. Helen's during any part of that time?—I only know in a general way that the death-rate has been an average one.

1573. Do you mean that the rate of mortality in the town has been an average one, as compared with other towns in the kingdom?—Yes.

1574. Was the epidemic of 1854 typhoid fever?—Yes.

1575 To what did you attribute it?—It was attributed to the emptying of the canal during the hot season. The débris was cast upon the banks and left to fester in the sun for a fortnight or more.

1576. Do you think that that was the cause of the outbreak?—I know that the outbreak followed immediately after that.

1577. Did it break out near to the place where the deposit had been?—Yes, it begun at the foot of the Liverpool Road, and raged chiefly about that place as the centre.

1578. Did the fever extend to other parts of the town to any considerable extent?—Yes, it did.

1579. Do you consider that typhoid fever is infectious. I mean in the sense of extending from house to house?—If the same cause operates upon number one house, I take it that it will operate upon house number two.

1580. But supposing that you are gradually removed from the cause, should you expect the fever to cease?—I think it would cease.

1581. But still you say that it did extend to places at a distance?—Yes, it did extend to other parts.

1582. Do you know how St. Helen's was supplied with water at that time?—In 1854 it was supplied from a double source; partly from surface water, and also from the deep wells which had recently been constructed.

1583. Was there not at that time a number of shallow wells, the water from which was used by the inhabitants?—Not in 1854.

1584. Do you recollect whether the present water supply was then in operation?—To the best of my belief it was.

1585. Did the shallow wells become disused at that time?—They were being disused.

1586. Were the people who were attacked with typhoid fever, in the habit of drinking water from the deep wells?—Yes.

1587. In your opinion is the alkali waste beneath the houses in St. Helen's a source of ill-health?—No, I have no reason to believe that it has operated appreciably so as to increase the illness or mortality of the people.

1588. What is your opinion as to the state of the health of persons in those parts of the town that are built near to the streams running through them?—I have not observed any unusual amount of illness about those parts.

1589. Are you of opinion that there is much difference between the mortality there, and elsewhere?—There have been more complaints as to the unpleasantness of the smell than of actual ill-health.

1590. Is it your opinion a source of discomfort, but not a source of ill-health?—I would not say that the bad smells are as wholesome as the normal state of the atmosphere.

1591. What do you assign as the cause or causes of zymotic diseases generally in St. Helen's?—Poverty, and overcrowding, in Green Bank especially, and in the lodging houses. I have more cases in proportion in the lodging houses.

1592. Do you attribute the prevalence of disease entirely to the overcrowding of the people in the lodging houses?—I think so.

1593. Do you think that the mode in which excrementitious matters are dealt with in St. Helen's has nothing to do with the health of the people?—In some cases it has, because in some cases the ash-pits are not drained, I think that ill-health has, in many cases arisen from the want of draining of the ash-pits. The Sanitary Committee of the Council have had to summon a good many people on that score.

1594. Were they offensive to the smell?—Yes, very offensive.

1595. Do you know of any cases in which the actual contents of the ash-pits have soaked into the walls of the houses?—Yes, I have met with cases during the last three months of that sort.

1596. Have you found that fever or sickness has resulted from that state of things?—Yes, there have been isolated cases which I think have had to do with that bad state of things, but they have been remedied as soon as the attention of the Sanitary Committee has been called to them.

1597. Do you consider it is desirable that the excrements of the population should be removed while they are still fresh and before putrefaction sets in?—Yes, I am of that opinion.

1598. So that if it could be conveniently done, you would in fact approve of any system by which that could be carried out in St. Helen's?—Yes.

1599. Are you aware of any dry system of dealing with the excrements that would answer that purpose?—I have had no personal experience of the dry earth system.

1600. You have spoken of the overcrowding in some parts of the town, are you able to state the number of people on the average that occupy a room of given dimensions?—There are in many cases two and sometimes three beds and from four to six in a room.

1601. In a room in a small house?—In an ordinary sized cottage there are two beds in a room where perhaps there ought to be only one, and, if the room happens to be a littler larger than usual, and they can put in a third bed, that is sometimes done.

1602. Do you mean in a room of about 12 feet square?—Yes, sometimes it is that sort of cottage bed room.

1603. What would the height of the room be, seven or eight feet?—Not any more than that.

1604. Have you known any cases of the gases escaping from the sewers into the houses?—Yes.

1605–6. Have you traced any case of disease to those causes?—I have in one or two instances, from the want of trapping the sinks.

1607. Were they cases of typhoid fever?—Yes.

1608. Was that owing in every case to the want of a trap?—Yes, and I have generally called the attention of the tenant to it, and asked him to get the landlord to put a trap to the sewer with a sink stone, and then it has been remedied. I have told them that they would all be taken ill if they did not attend to it.

1609. Have you ever noticed or heard of sewer gases getting into houses through the water in the trap, that is, by being forced through the water of the trap?—It has not been so strong as to create a nuisance.

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1610. Are there in St. Helen's any sleeping rooms over privies?—I do not remember any case of the kind.

1611. (*Mr. Morton.*) Is asthma at all a common complaint in this neighbourhood?—We have a fair amount of asthma here.

1612. Is there more here than in other localities?—Perhaps there is, but I think it may be traced to other causes. The colliers are subject to it, and it arises in their case, I think, from the coal dust.

The witness withdrew.

MR. JAMES CROSS examined.

Mr. J. Cross.

1613. (*Chairman.*) I understand that you have paid some attention to the amount of rainfall in the district, and the quantity of the discharge?—Yes.

1614. Will you state what the rainfall is in this district?—The average amount here is about 34 inches, it is very much larger a little to the north-east of the town, but it is less again to the south-west. I may state that the average is about 34 inches.

1615. Have you had any experience, or have you ever noted down the maximum amount of the rainfall?—I cannot at the present moment give you that, but it was a good deal above 40 inches.

1616. What inference have you drawn as to the proportion of the rainfall which goes to the outfall?—At one time I carried on some experiments as to the rainfall, near to the town, over an area of about 500 acres of gathering ground, and we found that we got as near as possible 12 inches.

The witness withdrew.

MR. THOMAS HADDOCK examined.

Mr. T. Haddock.

1617. (*Mr. Morton.*) I believe you are a clerk to the Burial Board?—Yes.

1618. Can you state to the Commission the number of deaths in St. Helen's, in a series of years?—Yes. For the years 1851, 52, 53, 54, and 55.

1619. Be good enough to read out the numbers?—In the year 1851 there were 741 deaths in the St. Helen's Registrar's District; and in the year 1852 there were 734 deaths. In 1853, 806 deaths, in 1854, 887 deaths, and in the year 1855, 726 deaths.

1620. Can you state the mortality in any other years?—I have not taken it since.

1621. Do you know what the population was during the years you have given?—The census was taken in in 1851, and in that district the population was 28,041.

1622. What was the population in 1861, in the same district?—41,345.

1623. Did the increase of population take place chiefly in the latter portion of the ten years?—No. I think it went on gradually throughout the ten years.

1624. There appears to have been an increase from 28,000 to 41,000, during the ten years?—Yes.

1625. And the death rate was diminished between 1851 and 1855?—Yes, that was so; in 1854 there was an epidemic of fever.

1626. 726 was the whole number of deaths in the year 1855?—Yes.

1627. Was that within the limits of your district?—It was within our Registrar's district, but that does not quite take in the whole of the township of Eccleston.

1628. Does the Registrar's district contain only the population you have named?—It is within 1,000 of those two figures.

The witness withdrew.

THOMAS ANDERSON, Esq., examined.

T. Anderson, Esq.

1629. (*Dr. Frankland.*) Are you professor of chemistry in the University of Glasgow?—Yes.

1630. Are you practically acquainted with the mode of recovering sulphur from alkali waste, known as Mond's process?—Yes.

1631. Is the process carried out on a large scale in Glasgow?—Yes; it is carried out at Messrs. Tennants' works.

1632. Does the paper which you have handed in give a complete account of the mode of carrying out the process?—Yes.

1633. In your opinion, is that process a success?—It is undoubtedly a success.

1634. Both financially, and as a means of preventing the pollution of the river Clyde?—Yes, I believe that, financially speaking, Messrs. Tennants are satisfied with the results although they have carried the process on under considerable disadvantages, and certainly of late there has been no pollution of the river Clyde by alkali works to my knowledge.

1635. Have Messrs. Tennants operated upon the whole of the drainage coming from those waste heaps?—I believe that they now use all the drainage from those waste heaps.

1636. So that none goes into the river?—None.

1637. Do you know the price per ton that they get for the sulphur?—No, I do not know the price, but it is very pure sulphur, that they get and they intend to sell a part of it in the shape of roll sulphur. They are about to put up an apparatus to cast it into sticks, and they intend so to sell it. It must be very pure to command a high price.

1638. Do they find a ready sale for the sulphur?—They use it all themselves at present; they only intend to sell it in the way I have described, and they expect to make a better profit on it by selling it than by using it themselves.

1639. Have you gone into the question of the effect that might be produced upon the sulphur market if all the sulphur were extracted from the alkali heaps to be found in this country?—I do not know that it would be very large, because at present they get so much of the sulphur from pyrites.

1640. Is it not a fact that we are at the present time but small customers for sulphur from Naples?—Comparatively small.

1641. That is to say the Neapolitan sulphur finds its way into many other markets?—Yes, a great many.

1642. Suppose that the English market was closed

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to the Neapolitan sulphur by the extraction of the sulphur from alkali waste, do you think it would have a material effect upon the price of Neapolitan sulphur?—I should think so.

1643. To what extent do you believe it would lower the price of Neapolitan sulphur?—I must confess my inability to answer that question.

1644. Would it not depend upon the fraction of sulphur that was brought into this country?—Yes.

1645. (*Mr. Morton.*) When the sulphur is taken out does there not remain a heap of insoluble stuff?—There does.

1646. Is that of any agricultural value?—Yes. Messrs. Tennant are getting rid of it now, at a nominal price however. The farmers have taken it in considerable quantities, and have used it in many ways, but it is merely a substitute for lime, and it is sent to some districts where lime is employed, and it is there used to a considerable extent.

1647. With regard to the liquid from which the sulphur is precipitated the remainder of the drainage of the heap, what becomes of that?—That is of course discharged into the river, but that is practically innocuous; it is substantially chloride of calcium.

1648. (*The Mayor, through the Chair.*) You say that this process has been a great success at Messrs. Tennants works at Glasgow?—Yes; I must say so.

1649. The process, I believe, is one for extracting sulphur from alkali waste?—It is.

1650. What proportion of the alkali waste that is made by Messrs. Tennant do they operate upon by this process?—I am not sure but a very large proportion of their waste is so worked upon and they produce at the present time 12 tons of sulphur per week.

1651. Do you know how much sulphur they send out as alkali waste?—I do not know how much they use.

1652. Do you know that it is more than 300 in a week?—I am not aware that it is, and I do not think it is so much as that.

(*Mr. Wilson.*) I think there is some misunderstanding upon that point, the witness is speaking of the quantity of sulphur that is recovered, but you, sir, are speaking of the total amount of alkali waste.

(*The witness.*) The process which is used does not recover the whole of the sulphur by any means.

1653. (*The Mayor, through the Chair.*) What proportion of the whole quantity of alkali waste is saturated to get at the 12 tons of sulphur?—I suspect that it is very difficult to make that out exactly, but I made an inquiry, upon one occasion, as to how many tons of alkali waste were required, to yield one ton of sulphur, and I was informed that from the way in which they worked they could not estimate that, using the liquor from the waste heap, which was pumped up on the oxydised waste, that Mond's process prevented them from forming any estimate of that kind.

1654. From my knowledge of the business I am able to say that Messrs. Tennant throw out 160 tons a week of sulphur, and you say that they make 12 tons?—I am not able to say how much of the alkali waste they pass through Mond's system, but I certainly did gather from the statement made to me, that it was a large proportion. At the present time, I am told that the daily production of the waste at St. Rollox is about 40 tons, but they produce much less weight now than they did a few years ago, because a great part of the salt cake, in place of being made into soda, is sent to Newcastle, and is worked there.

1655. What is the liquid result which is obtained from the refuse by this process of Mond's?—The liquid contains chloride of calcium.

1656. (*Mr. Alderman Evans, through the Chair.*) Is the acid which is obtained by the decomposition of a ton of salt, sufficient to enable you to get back all the sulphur from the waste resulting from the process of alkali making?—I should think that it ought to be.

1657. But is it a fact?—I am not prepared to answer that question.

1658. With regard to the refuse resulting from the washing of the waste which you have described, do you think that that liquid would be more acceptable to the country than the present condition of the brooks generally?—Certainly.

1659. It would not be clean water would it?—It would not be clean water in this sense, that it would contain chloride of calcium.

1660. As the Chief Commissioner has told us that we shall not be permitted to pollute the streams, would chloride of calcium be acceptable, do you think, to the country after we had produced it by this process?—Most certainly I should think so, because that is an innocuous substance.

1661. Do you think you would be able to recover as much as one-third of the quantity of sulphur that was originally used?—I do not think it would be more than one-third.

The witness withdrew.

MR. ALFRED E. FLETCHER examined.

Mr. A. E. Fletcher.

1662. (*Dr. Frankland.*) Are you one of the Inspectors of alkali works and for this district?—Yes.

1663. Bristol also I believe, is within your district?—Yes.

1664. Do you know the Netham Chemical Works at Bristol?—Yes.

1665. Do you know whether, at the present time, Mond's process for extracting sulphur from alkali waste is being used there?—Yes, it is.

1666. Is it being applied to the total quantity of waste that they produce?—Yes, they are now employing it upon the whole of it.

1667. Are they using the whole of the drainage from the old waste heaps?—I presume the whole of it.

1668. Do you consider that Mond's process is being successfully carried out there?—Mr. Worsley (one of the partners) is thoroughly satisfied with it.

1669. Do they not profess to be making a considerable profit by it?—Yes.

1670. Is it requisite for them to purchase any acid from other works to carry out the process?—They do not purchase any acid, they make it themselves.

1671. Do they make any acid especially for this process or not?—They have not altered the quantity of acid which they produce.

1672. Instead of selling so much of it they now use it themselves?—Yes.

1673. Or instead of turning it into the river?—Yes. I do not know as to what they sold before, there has been no material alteration in the quantity made.

1674. So that they can extract by this process the sulphur from the whole of their waste by the acid which they produce themselves?—Yes, but I understood you to ask whether they operated on the whole of their waste; I suppose that they may operate upon it, to a certain extent.

1675. Do they not now operate upon the whole of it?—Yes, but I was just doubting whether they operate fully upon the whole of it; they may give it one, or two, or three washings.

1676. Do you think that they do not quite complete the process?—They do complete the process as far as they intend to do it, and as far as the patentee proposes, but still some sulphur is left in.

1677. Is that sulphur which is left in recoverable?—They extract, at the present time, all that which it pays them to extract by that process.

1678. Does the residue or the drainage liquid give off an offensive smell after they have operated upon it in this way?—No.

1679. (*The Mayor, through the Chair.*) We have as yet had no description of this process, but I believe it consists of exposing the alkali waste to the air and then exposing it to the action of water, so as to dissolve the sulphur?—Yes.

1680. And sometimes the waste is again exposed to the air, and again to the action of the water?—Yes.

1681. So as to extract more sulphur?—Yes.

1682. And you may go on repeating that operation several times?—Yes, three times, I believe is the full number.

1683. Why do you say that three times is the full number?—Because that is what they propose to do.

1684. Three times is the number that is supposed to be the full number?—Yes.

1685. If you were to go on and expose the alkali waste again in the same way would you not get a liquid containing sulphur?—No doubt of it.

1686. Did you say that all the alkali waste that is made at the Netham Works is operated upon in this way?—Yes.

1687. Then I suppose that we must infer that the acid from a ton of salt is sufficient to treat in this way the waste from a ton of salt?—Unquestionably, they make bleaching powder too, they do not use all the acid in the process.

1688. You say that they are able to make bleaching powder and still that they have enough acid left from a ton of salt to treat all their waste by Mond's process?—Yes, it is so.

1689. Do you know how many times they treat the waste in that manner?—I believe three times; it may be however only twice.

1690. After treating it twice or three times, as I understand you, the waste is thrown out, and exposed to the air; and by repeating the process the sulphur again becomes soluble?—I do not know how much drains from it, but the oxidation goes on, and it becomes then innocuous. It is not quite so, when it goes out, but it is so, after lying for a short time.

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1691. (*Mr. Alderman Evans, through the Chair.*) I think you stated that, notwithstanding the three washings of the alkali waste in the process, when it was thrown out and exposed, there was still refuse liquor from it, much of the same character as that which flows from the old waste heaps, so that after all that is done the waste remains in much the same state?—A small quantity might drain out of it in a certain time, but after the exposure of it for a few days it becomes quite inert.

1692. Have you seen alkali waste which has been lying for any length of time, after having been treated by this new process, say after the lapse of a month, or two, or three months?—I have not.

1693. You are not then in a position to say that that waste is innocuous, and that there is no nuisance from it?—I have seen samples of the waste which have been treated in this way, and which did not give out any sulphuretted hydrogen, when acid was poured upon it.

1694. Have you visited any heaps of alkali waste, which were perfectly innocuous, and harmless, if rain fell upon them, so that no refuse would proceed from it?—No. I have not taken such samples myself.

1695. (*Mr. Morton.*) Is the effete matter by Mond's process, as carried out at Bristol, thrown on to the old heap?—Yes.

1696. And is the whole of the drainage from that heap treated along with the fresh matter which is thrown on the waste heap?—Yes.

1697. And the effluent water is spoiled only, to the extent of containing chloride of calcium?—Yes.

The witness withdrew.

Adjourned till to-morrow at 12 o'clock at Widnes.

At the Office of the Local Board of Health, Widnes (for Widnes and Runcorn).

Wednesday, 12th May 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

MR. LUDWIG MOND examined.

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1698. (*Dr. Frankland.*) You have, I understand, invented a process by which sulphur can be extracted from alkali waste?—I have a patent for extracting sulphur from alkali waste.

1699. What is the date of the patent?—The 8th of September 1863.

1700. When was the process first applied on a tolerably large scale?—In the autumn of 1864.

1701. Where is the process carried out at the present time?—At the works of Messrs. Smits and de-Wolff, Utrecht; Messrs. John Hutchinson & Co., and Messrs. James Muspratt & Sons, Widnes; Messrs. Charles Tennant & Co., Glasgow; the Netham Chemical Works, Bristol; the Tyne Chemical Company, South Shields; and a chemical works in France.

1702. How many tons of sulphur are extracted from the alkali waste at each of these works?—About two tons a week are extracted at the works of Messrs. Smits and de-Wolff, at Utrecht; about four tons a week at the works of Messrs. John Hutchinson & Co., in Widnes; about 12 tons a week at the works of Messrs. Charles Tennant & Co., in Glasgow; four tons a week at the works of Messrs. James Muspratt & Sons, in Widnes; about 10 tons a week at the Netham Chemical Company's Works, in Bristol. At the other places they have only applied the process for a short time, and I cannot state the quantity of sulphur they recover.

1703. Do they operate upon the whole of the waste in any of the works just referred to?—They operate upon the whole of the waste at the works in Holland, in Bristol, and also in South Shields.

1704. When alkali waste has been operated upon by your process and three extractions have been made, if it is afterwards exposed to the action of water, does any offensive liquid flow from it?—No offensive liquid flows from the waste.

1705. What is the effluent liquid that flows from the sulphur extracting process?—After the sulphur

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has been separated it is principally a solution of chloride of calcium, which contains only faint traces of free acid, of sulphur, and other sulphurous compounds.

1706. What is the per-centage of free acid that it contains?—One-tenth per cent. is about the average.

1707. Is there any difficulty in keeping it within that limit?—Not the least.

1708. As far as you are able to judge, is the process as carried out at the several works before referred to a commercial success?—As far as I have been able to see at all the works where the process has been carried out, a good amount of money has been realised by it.

1709. Does not one part of your process require the use of muriatic acid?—Yes.

1710. What proportion of the muriatic acid that is made in alkali works is necessary for this purpose?—If it is necessary to treat all the waste, one-fifth of the acid that is produced will be required for that purpose.

1711. Is a ready sale found for the sulphur?—Yes, there at present is a ready sale for it, and there is every probability that there will be for a great many years to come.

1712. To what purpose at the present time is the sulphur applied?—It is used to a great extent in refining, and also in the form of flour of sulphur to vines.

1713. Is any portion of it used for the manufacture of sulphuric acid?—Yes, in the manufacture of pure sulphuric acid.

1714. Is it found that the sulphuric acid is free from arsenic?—Yes, quite free. It is also used for the purpose of bleaching woollen and silk fabrics, the manufacture of gunpowder, also in the preparation of india-rubber, and for various other branches of industry.

1715. Do you know how much sulphur is used annually in this country?—I believe that about 50,000 tons are imported from Sicily to England every year.

1716. Supposing that all the alkali waste, produced in this country were treated by your process, what would be the amount of sulphur annually produced?—About 35,000 tons.

1717. It would still be necessary to import some thousands of tons?—Yes; about 15,000 tons. The total quantity of sulphur exported from Sicily amounts to about 300,000 tons a year.

1718. Is Europe supplied to any great extent with sulphur from any other country besides Sicily?—No; or only to a very small extent.

1719. Is sulphur brought from Iceland?—It was contemplated to bring it from Iceland, but I am not aware of any having been imported into this country. Sulphur is also made in Italy, but most of it is used there—it is also made in Austria, and a little from pyrites in Sweden, but the quantity is very trifling in comparison with that imported from Sicily.

1720. Are there any difficulties in dealing by your process with the liquid which flows from the old waste heaps?—No, or none that cannot be got over.

1721. Do you know of any places where it is entrapped and prevented from flowing into the river?—Yes; it is so treated at Messrs. Charles Tennant and Co.'s Works in Glasgow, and also at the Netham works in Bristol.

1722. Is that liquid kept entirely out of the river? Yes, in both places so far as I know.

1723. Do you know what per-centage of sulphur is got out of the liquid taken alone?—The liquid alone could not be made into sulphur, as it would only give out sulphuretted hydrogen by being treated with acid.

1724. But if it is mixed with the lixivium from the oxidized waste, does it not give out sulphur?—Then of course it does, all the sulphur in the liquid is then obtained. At the Netham works, Bristol, it has been found to be from $1\frac{1}{2}$ per cent. to $2\frac{1}{2}$ per cent.

1725. What quantity of sulphur is obtained from the liquid at the works of Messrs. Tennant and Co., Glasgow?—Four per cent. of sulphur.

1726. Do you see any difficulty in using your process in this district on account of the peculiar structure of the soil?—I see none where I have had an opportunity of examining, but I have had that opportunity only in a very few instances.

1727. Have you examined the waste heaps in St. Helens?—I have examined some of them, and I think it quite feasible to gather the liquid from them.

1728. Could you by an inexpensive operation prevent the flow of the liquid from those waste heaps into the Sankey Brook?—Whether it would be an operation that would be inexpensive is matter of opinion, but I think it would pay to do it.

1729. Have you formed an opinion of the quantity of sulphur which might annually be recovered, but which now goes into the Sankey Brook?—I have not.

1730. Have you made experiments upon the mud in the Sankey Brook?—I have not. If the Commissioners would desire to have a few more figures to show what has been done, and also the commercial features of the process, I will, of course, with the greatest pleasure, furnish them with such information.

1731. (*Chairman.*) If you will be kind enough to forward in writing such information as you think will be useful to the Commissioners they will be very much obliged to you.

The witness withdrew.

The witness subsequently transmitted to the Commissioners the following statement:—

On the probable effect of the general adoption in Great Britain of Mond's Process for the Recovery of Sulphur from Alkali Waste from a mercantile point of view.

"The latest published statements of the secretaries of the two branches of the Alkali Manufacturers' Association show that during the year 1866 the following quantities of salt were used in the manufacture of alkali:—

	Tons.
By the Lancashire branch -	194,000
„ Tyne branch - -	157,000
Total -	351,000

while the Alkali Inspector's Report gives 391,000 tons as the total quantity used in Great Britain during the same year.

"Allowing for salt used for reducing the strength of soda ash and caustic soda, the above-named quantities of salt will yield for the Lancashire branch about 212,000 tons, for the Tyne branch about 172,500 tons of salt cake or sulphate of soda.

"The first-named sold 32,000 tons, the last-named 2,400 tons of sulphate of soda to glass makers and others, who produce no waste from it, so that the quantities from which waste is produced amounted to 180,000 tons in Lancashire, and 170,000 tons in the Tyne district. These contain about 38,000 and 36,000 tons of sulphur respectively, and about 90 per cent. of this sulphur, or 34,200 and 32,400 tons remain in the waste. One half of this quantity can be recovered by the above-named process, the other half being converted into sulphate and sulphite of lime. The quantity of sulphur which could have been produced in 1866 thus amounts for Lancashire, to 17,000 tons, for the Tyne branch to 16,000 tons, giving a total of 33,000 tons.

"According to the Alkali Inspector's Report, the increase in the consumption of salt amounted in 1867 to 37,000 tons, or to 10 per cent. of the quantity used in 1866. Since then the plant of the alkali manufacturers has again been considerably increased, probably to no less than another 10 per cent., but the demand having not kept pace with the desire of the makers to supply, it is not probable that the quantity of salt actually decomposed, and of the products manufactured have considerably exceeded, or do now exceed those of 1867. Supposing that the salt cake obtained from the above-mentioned increase of 10 per cent. is used in the same proportion as the rest in alkali and glass making, the possible sulphur production from the waste would also increase by 10 per cent., and thus now amount to 36,300 tons a year. To this quantity ought to be added the sulphur obtainable from the liquor draining from old alkali waste heaps. It is at present almost impossible to form a correct opinion of the amount which might be so obtained. Judging from a few figures obtained at Glasgow and Bristol, I guess it to be between 4,000 and 8,000 tons a year, which would raise the whole amount of sulphur recoverable from waste in Great Britain to from 40,000 to 44,000 tons a year.

"This quantity might still be increased by breaking into the old waste heaps and subjecting them to a regular treatment, and the total production might thus easily be made equal to the consumption of sulphur in the form of brimstone in this country, which is rather more than 50,000 tons a year. As, however, this would involve additional expense and would not be necessary for the complete suppression of the nuisance arising from the waste, it had better be left out of consideration.

"Taking as the basis of our calculation a probable production of only 40,000 tons, we find, that at the price which has prevailed for the last six months, this country paid at the rate of 280,000*l.*, and at the average price of a good many years (viz., 6*l.* per ton) at the rate of 240,000*l.* a year to Sicily for the supply of this quantity of sulphur. The whole of this outlay would be saved to the country by the adoption of the above-named process, as all the materials required for the production of the sulphur, viz., waste, coal, and muriatic acid, are found or made in the country. It is very improbable that this saving will ever become lower than the last-named amount, as the consumption of brimstone increases so rapidly —from 46,000 tons in 1832 to 300,000 tons in 1866 —that Sicily has barely been able to keep up the supply. So that an additional production of 40,000 tons, which would come only gradually into the market, would in all probability have very little influence on the price. Moreover, if the price of brimstone should go below 6*l.* per ton in this country, several of the mines of Sicily, which are unfavourably situated, would have to stop work, at once checking the decline in price.

"In order to show the amount of capital required to effect this saving of 240,000*l.* a year, I enclose a detailed statement of the estimated cost of the plant now in course of erection at Messrs. John Hutchinson and Co.'s No. I. works and intended for the treatment of the waste obtained from 190 to 200 tons of salt cake per week. Exclusive of sheds and of roofs, which in this as in many other cases need not be put up anew, this amounts to 1,509*l.* and adding 10 per cent. for contingencies to 1,660*l.* Sheds and roofs to cover in the whole of this plant would cost about 320*l.*, thus raising the total cost in round numbers to 2000*l.*

"The total saltcake from which waste is obtained in Great Britain, amounting to 385,000 tons a year or 7400 tons a week, the total capital required would be 74,000*l.* to 80,000*l.* The amount of capital invested in the British alkali trade has last year been computed by Mr. R. Calvert Clapham to 5,000,000*l.*, so that an increase of only about $1\frac{1}{2}$ per cent of this capital is required for the treatment of all the waste produced.

"To get at the return which the manufacturers would obtain for this outlay, we have to deduct the cost of making the sulphur from the above mentioned value of 240,000*l.*

"Of all the works which now produce sulphur in this country I have only at my command the actual figures of expenditure incurred during the year 1868 at the works of Messrs. John Hutchinson & Co, who owing to several accidents, such as the fall of part of the plant during a high gale of wind in February, and to repeated partial and complete stoppages of the sulphur manufacture, one on account of the colliery strike and consequent short supply of fuel to the works, produced during that year only 138 tons of sulphur.

The expenses incurred in this production were:—

	£	s.	d.		£	s.	d.
For wages - -	114	19	7	or, per ton	0	16	8
„ coal - -	35	5	4	„	0	5	1
„ carriage of acid	115	6	7	„	0	16	9
„ Total - -	265	11	6	„	1	18	6

"Maintenance of plant and machinery, which during the first quarters was not clearly ascertained, amounted during the last two quarters to 4*s.* 9*d.* and 5*s.* per ton of sulphur made respectively, and adding to this a royalty of 25*s.* per ton of sulphur the actual cost amounted to about 3*l.* 10*s.* per ton. The expense of 16*s.* 9*d.* for carriage of acid is however a quite accidental one, which is completely avoided in all other works where the process has been adopted, and will very shortly be completely done away with in these works also, which will reduce the necessary expense for the production of one ton of sulphur exclusive of royalty to 1*l.* 6*s.* 9*d.*

"Considering the very small amount of sulphur produced during the year, which increases the comparative cost of wages and maintenance very largely, I believe myself to be quite justified in stating, that one ton of sulphur can be easily recovered at an expense of one pound where the process is carried out on any scale, and to be quite within the mark, if I take the cost inclusive of royalty, which has now been reduced to from 12*s.* to 15*s.* per ton according to the terms of the license, to be at the outside 2*l.* per ton.

"This would for the present give the total cost of manufacturing 40,000 tons of sulphur at 80,000*l.* yielding to the manufacturers a clear profit of 160,000*l.* a year for an outlay of only 80,000*l.* In a few years to come, after the expiration of the patent, these profits would still further be increased by the amount of the royalty.

"This calculation may be objected to, because the estimated cost of the sulphur does not include any value for the muriatic acid necessary for its production, which amounts for every ton of sulphur to one ton of dry hydrochloric acid, or to 3 to $3\frac{1}{3}$ tons of strong acid of commerce, or to the acid obtained from two tons of salt; and this has been estimated by different manufacturers to represent a value of from 5*s.* to 1*l.* per ton of strong acid, which would raise the cost of manufacturing sulphur by from 15*s.* to 3*l.* 6*s.* 8*d.* per ton, thus giving a total of 2*l.* 15*s.* to 5*l.* 6*s.* 8*d.* per ton."

"The quantity of muriatic acid which is still run to waste in Great Britain is however so enormous, so very much in excess of what would be required for the recovery of sulphur from the whole of the waste produced, that I cannot admit this product to have any value at present, except a negative one, as it is an inconvenience and will be a source of considerable expenditure to the manufacturer if he should have to neutralize it all before running it into the rivers. Nor do I see any prospect of this state of things being materially altered for many years to come, as the increase in the decomposition of salt and consequent production of acid apparently progresses quite in proportion to the increased demand for bleaching powder and other articles requiring this acid in their production. According to the state-

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ments of the secretaries of the two branches of the Alkali Manufacturers Association above referred to, the quantities of chemicals requiring muriatic acid in their manufacture, were in 1866:

	In the Lancashire district.	In the Tyne district.
	Tons.	Tons.
Bicarbonate of soda	6450	11,000
Bleaching powder	20,000	27,000
Muriatic acid for sale	13,800	700

while the quantity of salt decomposed amounted to, in Lancashire, 190,000 tons against 157,000 tons in the Tyne District.

"Theoretically 100 tons of bicarbonate of soda should require the acid from 70 tons of pure salt. Allowing for moisture, impurity, salt left undecomposed, and loss in condensation, it should require the acid from about 80 tons of common salt. Practically the amount used by several well conducted works amounts however to 150 tons, which is explained by loss of carbonic acid and incomplete neutralization of limestone by the muriatic acid used.

"Theoretically 100 tons of bleaching powder, made with pure peroxide of manganese, should require the acid from 117 tons of pure salt, but again allowing for impurities and moisture in the ordinary manganese and salt, for salt left undecomposed, and loss in condensation, they should require the acid from about 160 tons of salt.

"Practically some of the largest bleaching powder makers in Great Britain and on the continent produce 100 tons of bleaching powder with the acid from 250 tons of salt, and a considerable number with the acid from 300 tons, the majority however employ a very much larger quantity, sometimes more than twice as much.

"These discrepancies must be accounted for by a considerable and partly inevitable loss of chlorine and by free acid left in the waste still liquor, amounting in well conducted works to about 20 per cent. of the acid used, which both together raise the theoretical quantity of 160 tons of salt to 250 tons. The manufacturers who employ more simply add to the acid run into the rivers.

Theoretically 100 tons of strong muriatic acid for sale ought to be obtained, allowing for impurity of salt and salt left undecomposed, from 57 tons, practically they are obtained from 60 tons of common salt.

Now calculating from the proportion of salt actually used in a number of well conducted works, viz:—

150 tons to 100 tons of bicarbonate of soda.
300 „ 100 „ bleaching powder.
60 „ 100 „ strong muriatic acid.

we find that the above mentioned quantities of chemicals could be produced from the following quantities of salt:—

In the Lancashire district,—

6,450	tons of	bicarbonate of soda	from 9,675	tons of salt.
20,000	„	bleaching powder	„ 60,000	„
13,800	„	strong muriatic acid	„ 8,880	„
		Total	78,555	„

"To this ought to be added the acid used in the making of bleach liquor, of chlorate of potash, chloride of barium, &c., which are not mentioned above. All these articles are however made in small quantities, and certainly did not consume the acid from 16,000 tons of salt altogether, which would give us the acid from 95,000 tons of salt used as against 190,000 tons actually decomposed, thus leaving the acid from 95,000 tons of salt or 160,000 tons of strong acid, as run to waste in 1866.

"All the sulphur which could have been made in 1866 in this district, viz., 17,000 tons, would have required the acid from only 34,000 tons of salt,—or 18 per cent. of the total salt used,—thus leaving the acid from 61,000 tons of salt, or above 100,000 tons of strong acid at the disposal of the Lancashire manufacturers.

"In the Tyne district the production was:

11,000	tons of	bicarbonate of soda	= 16,500	tons of salt.
27,000	„	bleaching powder	= 81,000	„
700	„	muriatic acid for sale	= 420	„
		Total	97,920	„

"To this ought to be added a quantity used in the production of subchloride of lead, probably equal to 5,000 tons of salt, making a total of about 103,000 tons of salt, the acid from which was used, as against 157,000 tons actually decomposed, and leaving the acid from 54,000 tons of salt, or 90,000 tons of strong acid as run to waste in 1866. All the sulphur which could have been recovered in this district in 1866, viz., 16,000 tons, would have required the acid obtained from 32,000 tons of salt, or about 20 per cent. of the total salt decomposed, thus leaving the acid from 21,000 tons of salt equal to 35,000 tons of strong acid at the disposal of the Tyne manufacturers.

"As, however, the above statement includes the production of Messrs. Charles Tennant & Co., in Glasgow, who with a consumption of about 23,000 tons of salt produce about 9,000 tons of bleaching powder a year, we find, by deducting these figures, that on the Tyne proper only the acid from 80,000 tons of salt was used against 134,000 tons decomposed, thus showing a much larger proportion of wasted acid.

"The total amount of acid run to waste in 1866 in Great Britain thus, was equal to 250,000 tons of strong acid, and this quantity, though I have no accurate statistics to prove it, has since certainly not diminished, but rather increased. According to the estimate of some of the largest makers, the production of bleaching powder has since increased by about 10,000 tons a year, which could easily be made from 30,000 tons of salt, but the manufacture of bicarbonate of soda, has largely decreased in consequence of competition protected by high duties in America. The increase of salt decomposed was, however, in 1867 alone 37,000 tons, which very probably has still further increased a little during last year. Now I certainly do not mean to say, that these enormous quantities of acid are run to waste in proportion to their make by the different manufacturers. Some of these still run all their acid to waste, others a larger or smaller portion of it, while a few, but only* a few, use it as completely as can at present be done. But even these few leave in the waste liquor run from their chlorine stills 18 to 20 per cent. of their acid in a free state, which is quite sufficient to make the sulphur from their waste.

"This anomalous state of things, though it had lasted for a great many years, has, however, at last led to its natural consequences. The majority, after having through their indifference allowed a small number of manufacturers to reap enormous profits from making bleaching powder for many years, while they themselves where careless enough to run their acid to waste, at last demanded a fair share in these profits. The consequence was an increase in the make of bleaching powder of 10,000 tons a year, and though the demand for this article had in the same time risen faster than at any previous period through the rapid development of the manufacture of paper from Esparto grass, this fell very short of the increase of the production, and the price was consequently run down since 1865 from 15*l.* to 8*l.* per ton, which latter leaves scarcely any profit.

* It is certainly worthy of remark, that Messrs. Tennant, who have always been in the van as regards utilization of their acid, should have been the first to take up the recovery of sulphur on a large scale at a time when they realized a large profit from bleaching powder.

"The demand for the article being limited and but little influenced by its price, the large number of firms who have now taken up its manufacture being not at all likely to give it up again as long as they make interest on their outlay, and as there is still any amount of acid to spare to increase its production at will, it is very probable that the price will now remain at the lowest possible limit until the whole of the acid which is still run to waste has found a profitable use. And this period will in all probability be still further delayed by recent improvements is the manufacture of chlorine, which tend to diminish the quantity of acid used and would thus leave a still larger quantity at the disposal of the manufacturers.

The general introduction of the recovery of sulphur from waste, which disposes of a quantity of muriatic acid in a very profitable way, paying to the alkali trade 160,000*l.* a year or at the rate of 1*l.* 4*s.* to 1*l.* 6*s.* 8*d.* per ton of strong acid, would thus also be one of the most effectual means to raise the profits derived from bleaching powder and other articles requiring muriatic acid in their manufacture.

"Estimated cost of Plant required for the Adoption of Mond's Sulphur Recovery Process in Messrs. John Hutchinson & Co's., No. 1, Works at Widnes, decomposing 190 to 200 tons of sulphate of soda per week.

	£	s.	d.
12 wrought-iron vats 9′ × 11′ × 6′ 3″ fitted up complete with all the necessary pipes, taps, shoots, air pipes, false bottoms, &c.	416	10	0
Brick pillars to carry vats	31	0	0
3 liquor wells (sulphur) 6′ × 6′ × 5′ 6″	45	0	0
1 donkey engine 10″ cylinder	45	0	0
3 cast-iron ram pumps 7½″ diameter	22	0	0
1 air fan 22″ diameter	13	0	0
Bedstone, framing and gearing for machinery, and fixing of the same	83	10	0
3 old boilers for sulphur liquor settlers, 30′ long, 7½′ diameter, including brick pillars to carry them, cocks, connections, shoots, &c.	190	10	0
2 wooden vessels for precipitating sulphur 12′ × 6′	43	0	0
1 donkey engine for driving agitator and feeding boiler, foundations for same, gearing, &c.	47	0	0
1 second hand two-flued boiler, 30′ × 7′ 6″ with fittings complete, including setting of the same	185	10	0
6 wooden vessels for washing and draining sulphur, 12′ × 7′ × 3′ 6″	38	10	0
2 cast-iron sulphur melting pans 12′ × 8′ × 3′ 6″ with drying plates, &c., including setting of the same	249	10	0
Acid shoots, tools, &c.	18	0	0
Excavations and foundations for precipitating and washing vessels, &c.	81	0	0
	1509	0	0
Adding 10 per cent. for contingencies	151	0	0
Total	1660	0	0

(Signed) Ludwig Mond,
Widnes, Lancashire, 19th June 1869."

Mr. L. Mond.

12 May 1869.

Mr. Henry Brunner examined.

Mr. H. Brunner.

1732. (*Dr. Frankland.*) Are you the manager at Messrs. Hutchinson's Works, where the process of Mr. Ludwig Mond, for extracting sulphur from alkali waste is being carried out?—Yes.

1733. Have you had experience in the carrying out of this process on a tolerably large scale?—We have not carried it out on a very large scale, but during the whole time that it has been carried out I have had the superintendence of it.

1734. Do you consider that it works satisfactorily?—Yes.

1735. Is it commercially, as well as chemically successful?—Yes; and I expect that we shall ultimately be able to make it pay much better than it has hitherto done. I should mention that we have been under the necessity of carrying the acid which we use across the canal in bottles, and of course that has added very much to the cost of the carrying out the process.

1736. Do you make bleaching powder?—No.

1737. Had you previously used much of the muriatic acid produced at your works?—No; we used it only for making bicarbonate of soda.

1738. If you operated upon the whole of the alkali waste produced at your works would there be any risk of your running short of acid?—No.

1739. If you employed in the manufacture of bleaching powder all the muriatic acid you produce, and extracted the sulphur from all the alkali waste you produce, how much more acid would you require for both purposes?—About one-fifth more than we produce.

1740. You agree then with Mr. Mond?—Yes; but there is this to be said, that the waste still liquor contains generally quite sufficient acid to recover the sulphur.

1741. Do you know of any case in which the waste still liquor is used for these purposes?—No; we tried it on a small scale and found it perfectly successful. I was in the works of Messrs. Smits and de-Wolff at Utrecht in the autumn of 1866 and it was being tried there at that time.

1742. Do you know anything of Weldon's process of recovering manganese from the waste still liquor?—I do not.

1743. If that process was carried out in chemical works there would not be any waste liquor of that kind to use in Mond's process?—The still liquor might be used for the recovery of sulphur, and after it had been precipitated the manganese might be recovered from the liquor. Of course the liquor would be very much more diluted, and the operation would be more difficult, but it could be done.

1744. In that case there would be very little free acid to deal with, because they would work up nearly all of it?—Yes, that might be the case after working with recovered manganese.

The witness withdrew.

Mr. Arthur Field examined.

Mr. A. Field.

1745. (*Mr. Morton.*) Are you surveyor to the Local Board of Health of Widnes?—Yes.

1746. Is the district of Widnes sewered?—Only very partially; the greater part consists of open ditches.

1747. Are the ash-pits and middens drained?—Only to a certain extent.

1748. What is done with the contents of the ash-pits?—The farmers come and take it away.

1749. Is is all used by the farmers?—Yes.

1750. Is the dry portion separated from the rest?—Not at all.

1751. With regard to the value of the stuff: I see in the answers to queries you state that you dispose of 1,800 tons for 150*l.*?—Yes.

1752. It is also stated that the privies are cleaned out quarterly, is that so?—Yes, or whenever they are full.

1753. That is done at a cost of 385*l.*?—Yes, it was so, but that is altered now. We have three con-

Mr. A. Field.
12 May 1869.

tracts for each of the districts, and the farmers receive 2*s.* for each ash-pit.

1754. What quantity do they take out of the middens at a time?—The middens vary in size in this district; they are in some cases six feet deep.

1755. How is notice given to the contractor?—It is given through the authorized officer of the Board, and it is sent to the contractor every morning.

1756. Are the ash-pits covered over?—Only in very few cases.

1757. Do the roofs of the middens drain into the ash-pits?—There is no roof.

1758-9. Then, in fact, the stuff they get consists partially of the rain which drains in?—Yes.

The witness withdrew.

Mr. Michael Barker examined.

Mr. M. Barker.

1760. (*Mr. Morton.*) Does the sewage of Runcorn flow into the river through more than one outlet?—Yes, there are six or seven outlets.

1761. Is the town perfectly sewered?—Yes, as far as the sewerage is carried out.

1762. Does the sewer receive the rainfall off the streets and roofs, the chamber slops, and drainage from the middens and privies?—Yes, but the rain which falls on the roofs to a great extent is caught and utilized.

1763. Does the waste from tan yards flow into the sewers?—No, it goes direct into the canal and from thence into the river.

1764. In the answers to queries you state that the middens are cleaned out at a cost of 300*l.*?—That is so.

1765. The contractor taking the contents?—Yes.

1766. Does he get rid of it all?—Yes.

1767. Is there no solid part kept out?—No, he has to sort the rubbish, and take out the brick bats and stones.

1768. What becomes of that kind of rubbish?—The contractor uses it to repair the roads.

1769. Does he convey it to a tip?—No, he takes it wherever is most convenient, to an old quarry for instance.

1770. Are houses in any cases built upon the solid refuse which is removed from the middens and privies?—No.

The witness withdrew.

At the Council Chamber, Warrington.

Thursday, 13th May 1869.

PRESENT:

Major-General SIR WILLIAM DENISON, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

Mr. Robert Vawser examined.

Mr. R. Vawser.
13 May 1869.

1771. (*Mr. Morton.*) Are you the borough surveyor?—I am.

1772. Is the system of sewers in a complete state?—No.

1773. Is it complete on the north side of the Mersey?—It is not.

1774. Does the sewage of the town pour into the river at more than one outlet?—There are two outlets for it now.

1775. Are they below the high water mark?—Yes, both of them.

1776. Are they properly trapped?—There is a tide valve to each of them.

1777. Does a high tide force its way into the sewers?—It does to a certain extent.

1778. Does it ever do so to the extent of flooding the cellars?—I believe not.

1779. Are all the middens drained, and does the liquid part of the excrements find its way into the sewers?—The majority of them are, and the liquid drains into the sewers.

1780. Are the ash-pits roofed?—No.

1781. Is a separation made of the cinders, or of the stuff that is called cinders, and of the excrement?—Yes.

1782. Where is that separation made?—It is made in the ash-pit.

1783. Do you know to what use the cinders are applied?—For filling up holes; they are of no commercial value.

1784. Is there any of the so-called dry stuff taken out of the middens that is not carried to the land?—I think that all the stuff is used on the land in one form or the other.

1785. Have you any idea as to the extra quantity of water per head that would be required if water closets were to be substituted for privies?—I cannot answer that, because so much depends upon whether the water closets are properly constructed or not.

1786. Within what limit would the extra quantity be?—I could not form an estimate, but I know that there is frequently a great waste of water.

1787. With respect to the trough closet, how many people are in the habit of using it?—It is used 20 or 30 times a day.

1788. What is the size of the trough?—There are two trough double closets, in form like those in Liverpool in every respect, 5 feet 6 long, and 18 inches in width.

1789. How often are they emptied?—Every morning.

1790. That is to say, once in 24 hours?—Yes.

1791. With regard to the proposed irrigation, is that anything more than a mere idea at present, or is there any plan laid down for it?—I believe it is very little more than an idea at present, it is talked of.

1792. Would there be any difficulty in getting land for that purpose?—There is land, but probably the landowners would not be willing to part with it, if we wanted to take it for that purpose.

1793. (*Dr. Frankland.*) I believe the gas works in Warrington do not belong to the corporation?—No; they belong to a company.

1794. What is done with the refuse from the gas works?—It goes into the sewers.

1795. What is done with the gas tar?—It is sold.

1796. What is done with the ammoniacal liquor?—I do not know; anything of value the company will sell.

1797. Have you ever noticed anything coming out of the sewers that you would attribute to the gas works?—No.

1798. What agent is used for the purification of the gas?—Lime.

1799. What is done with that lime after it has been used?—It is carted away to be used as manure on grass land.

1800. Does none of it go into the river?—No.

1801. Are the sewers ventilated?—They are not at present, but are about (January 24th, 1870) to be ventilated by open grids, inserted in the surface of the streets.

1802. Do you know from your own knowledge that the gases from the sewers have gained access to the interior of houses from want of ventilation?—I have no doubt of it.

1803. (*Mr. Morton.*) Are the cesspools on the south side of the river drained?—There are only five cesspools in the town, and these are not drained.

1804. Are the middens and ashpits on the south side of the river drained?—Yes; into the surface drains, but there are very few drains on the south side of the river.

1805. (*Dr. Frankland.*) Is the water supply to Warrington now satisfactory?—No; it is very unsatisfactory indeed.

1806. Do you mean as to quality or quantity?—I believe as to both; the company are now laying out a considerable sum of money in sinking a new well and establishing new pumping stations.

Mr. R. Vawser.
13 May 1869.

1807. What quantity of water is supplied per head now?—There are about 400,000 gallons a day supplied to the town.

1808. What is the population of the town?—30,000.

1809. Are there any tanyards in or about Warrington?—There are ten tanyards within the borough and two immediately on the outside of the borough.

1810. Have you noticed any nuisance in the river caused by the tanyards?—I do not know how they affect the river, but they do affect the sewers very seriously.

1811. Does the Honey-pot brook receive the drainage from the alkali waste and is it about one of your worst tributaries to the Mersey?—Yes.

1812. Does it receive a portion of the sewage as well?—I do not think that much of the sewage flows into it inasmuch as there are few buildings in that neighbourhood.

1813. What do you consider to be the principal sources of the pollution of the river at Warrington?—The sewage of the town, refuse from tanyards, chemical works, soap factories, wire works, galvanizing works, and lead works.

The witness withdrew.

Dr. Robert Martin examined.

Dr. R. Martin.

1814. (*Dr. Frankland.*) Are you a physician practising in Warrington?—Yes.

1815. How long have you been in practice here?—For ten years.

1816. What do you consider to be the sanitary condition of Warrington at the present time?—With the exception of the state of the privies here the sanitary condition is very fair, but the privies are a standing source of disease in the town.

1817. What forms of disease have you been able to trace distinctly to the privies?—The most serious condition resulting is that of debility, hence when any special forms of disease occur, for instance bronchitis as the result of a cold, or if any epidemic form of disease arises, it generally assumes a very serious aspect.

1818. In your opinion do cases of typhoid fever arise from emanations from the privies?—I believe so.

1819. Are there many cases of typhoid fever in the town?—Not at present.

1820. Has typhoid fever prevailed to any great extent within the last two or three years?—We had a very serious epidemic of typhoid here about nine or twelve months ago.

1821. In what localities did the fever rage to the greatest extent?—In Percivals Fold, the Factory yard in Silver Street, and in the neighbouring streets. In all those places there are large open middens or privies. In Percivals Fold, if you should happen to visit it, you will probably find as fine a specimen of a Lancashire midden as is to be found anywhere in the town.

1822. To what do you specially attribute the outbreak of the epidemic of typhoid fever?—It was owing to the state of the water principally. About nine months ago we were very short of it, and there is no doubt that what we got was very much polluted.

1823. What is the nature of that pollution?—It seems to be of an animal character, evidently from the drainage of the land; that is one cause.

1824. Do you know the site of the gathering reservoirs?—I am not well acquainted with it; I have been there once.

1825. Do you know whether the ground is highly manured or not?—It is rather highly manured.

1826. Is any night soil put upon it?—Yes.

1827. Do you attribute the typhoid fever which you have mentioned to the nature of the manure put upon the land, or to the general organic impurity of the water?—I should attribute it rather to the quality of the manure placed upon the land, the night soil.

1828. Do you consider that if night soil is placed upon land, the drainage from which flows into the water supply of the community, danger is to be apprehended?—I do.

1829. Do you think that diseases such as typhoid fever and cholera are communicated by excrementitious matter gaining access to the water?—I have reason to believe that that is the case.

1830. Have you much diarrhœa in Warrington?—No.

1831. Had you much diarrhœa last autumn?—We had not a very large amount of diarrhœa last autumn, but in 1866 we had.

1832. I gather from the evidence you have already given that you do not approve of the privy system and the mode of removing the excrements of the population?—No, not of the present system.

1833. What would you propose instead?—I think keeping the privies perfectly dry, and mixing the excreta with ashes as far as possible.

1834. Then you would still retain the system but you would improve it?—Yes; but I would roof the privy over, and keep moisture away from the interior.

1835. Do you consider it is desirable to remove the excrements of the population as rapidly as possible, and before putrefaction sets in?—I think that is most important.

1836. Could you do that by a dry system?—I think so, and much more effectually than by a wet system.

1837. How often would you have them emptied?—I think they ought to be emptied weekly at the very furthest.

1838. In a dry condition do you consider that the excrementitious matter would not enter into putrefaction within that time?—I think that mixed with ashes, if the privy were so built that the excreta fell amongst the ashes, in that time there would as a rule be no putrefaction.

1839. Would you have the ashpits and the privies connected with the sewers, so as to drain off the liquid?—No.

1840. What would you do with the slops and the urine?—I would allow them to be turned into the sewers, there are no better means of disposing of them.

1841. Do you consider that urine itself is likely to enter into putrefaction and give off noxious gases?—Yes, it is.

1842. If, for instance, it was kept in a close place, and it was then allowed to pass into the rivers?—Yes,

Dr. R. Martin.

13 May 1869.

it would be more desirable if it could be obtained separately from the fæces and the ashes.

1843. Do you connect any of the unhealthiness of Warrington with the condition of the river flowing through it?—Yes, perhaps indirectly to some extent.

1844. Does the river stink during the cold season of winter, or only during the summer?—In summer it is extremely offensive, especially at the Old Quay, just before the water passes over the weir; the mud also ferments, and gases come bubbling up from the bottom, very often bringing up large pieces of the mud.

1845. For what length of time during the 12 months does this condition of things usually last?—From three to four months.

1846. When did cholera last visit Warrington?—Not in my time; we had rather a sharp epidemic of diarrhœa, but no cholera in 1866.

1847. I see that in the year 1864 there was great mortality in Warrington; to what do you attribute that?—Scarlatina.

1848. Was it not very fatal in that year?—Yes; I believe that the mortality was at the rate of 74 per 1,000 during one week in that year.

1849. Were they mostly children who died?—Nearly all children.

1850. Are there any parts of the town near the river specially unhealthy?—Not on this side of the Mersey.

1851. Do you attribute the ill health on the other side to the state of the river?—I can scarcely say that, because on the other side of the river there are chemical works, and you cannot separate the two causes, the effluvia from the river and the gases from the works.

1852. What is the nature of the gases from the chemical works?—Chiefly nitrous or nitric acid.

1853. Do you consider that these acids are specially unhealthy?—Yes, in the concentrated form in which they are sometimes found.

1854. Do you attribute any of the zymotic diseases to emanations from chemical works?—No.

1855. What are the most densely populated parts of Warrington, and how many persons inhabit a house?—School Brow, Town Hill, and Pinners Brow. There are from 10 to 14 in some of the houses in the latter district.

1856. Are there any cellar dwellings in Warrington?—They are exceedingly rare.

1857. Do you know that sewer gases sometimes escape into houses?—I have reason to believe so.

1858. Do they escape through the traps, or from want of traps?—Through the traps. When a house is closed at night, and the atmosphere within is warmer than that without, there is a pressure outside, and a partial vacuum formed within.

1859. Have you reason to believe that any cases of disease have resulted therefrom?—I have not been able to trace any direct case of disease, but a deterioration in the health of families I have very often observed.

1860. Do you know whether any shallow wells are used in Warrington for the supply of water?—There are a few such wells.

1861. Is the water in those wells very impure?—Yes, at times, but the quality seems to vary.

1862. Do you consider that those wells have had anything to do with the propagation of typhoid fever or of diarrhœa?—I have not been able directly to connect the two, but still I have had reason to believe so in a few cases.

1863. (*Mr. Morton.*) I observe that the mortality previously to 1864 was considerably less than the mortality has been since. Is there any explanation to be given for the increased mortality in the last few years?—There has been more crowding in dwelling houses since that time, that is one cause; increased intemperance is another.

1864. It appears from the return furnished by the corporation that the increase has been as much as 2 per 1,000?—My impression is that the mortality has been very high for some years.

1865. In 1864 it was about 24 per 1,000, but since that time it has averaged 26 per 1,000, if not more?—I have always considered the mortality very high for a semi-rural district.

The witness withdrew.

Adjourned till the 31st inst. at Liverpool.

St. George's Hall, Liverpool.

Tuesday, 1st June 1869.

PRESENT:

MAJOR-GENERAL SIR WILLIAM DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

DR. WILLIAM STEWART TRENCH examined.

Dr. W. S. Trench.

1 June 1869.

1866. (*Dr. Frankland.*) Are you the medical officer of health for the borough of Liverpool?—I am.

1867. How long have you held that appointment?—Since July 1863.

1868. What have been the chief epidemics in Liverpool during the last few years?—Typhus fever and diarrhœa.

1869. Has scarlatina prevailed?—Not within the last few years; but I am referring to the period since 1863.

1870. I presume you were well acquainted with the outbreak of cholera in Liverpool in 1866?—Yes.

1871. To what causes do you attribute it?—I attribute the first cause to the German emigrants, and the spread of it to the filthy habits and overcrowding of the people.

1872. Are you acquainted with the water supply of Liverpool?—I dare say I am sufficiently acquainted with it to be able to answer your questions.

1873. Do you know at what dates certain wells which I will enumerate were closed?—No; Mr. Duncanson will be better able to answer that question; but I fancy that your questions have reference to the water in the wells during the time of the cholera. This is a map of the Liverpool wells; showing the position of the wells (*handing in the same*) which were then in use. The facts that I mention in my report on the health of Liverpool are somewhat extraordinary, and I will put them now in evidence. "Our whole town is served more or less by water "from the Rivington lake, which is free from every "possible source of sewer contamination. There are, "besides this supply from a distance, four wells within "the borough, viz., the wells of Soho street, Hotham

"Street, Windsor, and Water Street; the two first are "only used occasionally, and not at all since 4th Septem- "ber 1866," (the cholera year); "the two latter supply "the healthiest districts of the town," that is, Windsor and Water Street. "The Soho Street well is situated "in William Henry Street, and the area which it occa- "sionally served during that summer is bounded on the "north by Collingwood Street; on the east by Great "Homer Street, Fox Street, Everton Crescent, and "Salisbury Street; on the south by Islington, Stafford "Street, and London Road; on the west by Commu- "tation Row, Christian Street, Richmond Row, and "Scotland Road to Collingwood Street. This comprises "a very poor and very crowded district, and there- "fore, as might have been expected, there was among "its inhabitants a considerable amount of cholera; "but compared with the streets on the low ground to "the west, where the Soho water did not reach, it "might be regarded as healthy." I must tell you that this was to me quite unexpected; for it was found that the well water in no way accounted, at all events to my own mind, for the spread of the cholera. "The "average yield of the Soho Street well during that "summer was 496,377 gallons per day." I sent to the Commission a cholera map which I published, and of which I have a copy here, and by a comparison with that, what I am reading will be made more clear. "The Hotham Street well supplied a part of the "drinking water for a completely built up area "bounded on the North by St. John's Lane, Lime "Street, Lord Nelson Street to Hotham Street; on "the east by Hotham Street, Blake Street, Harford "Street, Benson Street to Renshaw Street; on the "south by Renshaw Street, Ranelagh Street, and "Church Street; on the west by Whitechapel. This "district is on its eastern side not only crowded with "residents, but is also the resort of low and abandoned "characters; yet the deaths were not nearly so numer- "ous as in lower parts of the town, remote from the "wells. The average yield of Hotham Street well "during the summer was 286,449 gallons per day. "The Windsor well, whose average yield was 958,295 "gallons per day, supplies constantly the greater part "of the water consumed in North Toxteth, Rodney, "and Abercomby wards; this area was very free "from cholera," that was the most healthy district of town. "The Water Street well, whose daily average "yield was 313,086 gallons, supplied an area bounded "on the north by Upper Stanhope Street to Windsor "Street; on the east by Windsor Street in a line to "South Street; on the south by South Street and "Park Hill Road; on the west by Mill Street to "Northumberland Street. This area was almost free "from cholera." Now this was a curious circum- stance, because the physicians in London at that time were calling attention to the contaminating water by the sewage, as the Commissioners are no doubt aware, and to the effect of such contamination upon the spread of the cholera. I must confess that it was startling to me to find that water from wells in no way accounted for the spread of the cholera in Liverpool. In fact, if we were to look for the geographical position of the cholera, as in the case of typhus fever, it occurred in the low crowded parts of the town, situated on the boulder clay. Taking a line between Scotland Road on the one side, and the river on the other there is the boulder clay, and upon that we had typhus fever and cholera, but whether it is to be regarded as its proximate cause I do not know.

1874. Have you formed any opinion as to the mode in which cholera is propagated?—My impression is that in Liverpool it was spread as much from the dirt in the streets as by anything else.

1875. Do you consider that cholera can be propagated through the air?—Yes.

1876. Do you consider that the dryness or wetness of excrementitious matters has anything to do with the propagation of a disease like cholera?—As in India we believe it to be spread by the dust of the fæces, here the same cause may operate. I am of opinion that the privy system was a cause of cholera propagation, and that also cholera germs were floated in the atmosphere, probably by the ammonia which I believe is the moving power; that the fæces, as dust, coming in contact with a person, might convey the poison to him; that in many instances it was abso- lutely carried bodily by dirty persons into their mouths, in the same way as Dr. Farr believes it to be carried by water; in other cases I believe, it was carried by dust, that is to say, by people carelessly emptying chamber utensils containing cholera fæces on to the streets, where, drying, they became dust, and so carried the disease to others, also by particles necessarily left in the street during the removal of refuse from middens.

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1877. Was there anything peculiar in the privy system, as it existed in the district, that was most affected by cholera, or in other words, were the privies more inside the houses?—They were in courts, so that they were completely enclosed without ventila- tion, and immediately below the windows of the houses. The privy was here (*describing*) or at the entrance of the court, and the whole atmosphere of the court was the atmosphere of a privy.

1878. You are acquainted, no doubt, with the general privy arrangements in Manchester?—I have looked at them generally, and I consider them bad; they were very much like our own. I think upon the whole we did beat them, but it was a hard thing to do it.

1879. Are you of opinion that there is anything peculiar in the Liverpool privies which would make it more likely that they would distribute the cholera poison, as compared with the privies in Manchester?—No.

1880. Then how would you account for the cholera having been propagated in Liverpool and not in Manchester?—I cannot answer that any more than I could tell why cholera comes one year and not another. The question is so full of theory that I really cannot answer it; a viva voce examination would neither do justice to the subject nor do justice to my opinions.

1881. I understood you to say that the Soho district was rather strongly affected by cholera?—Yes.

1882. The Hotham Street district was not so much affected?—No.

1883. And the Windsor Street district scarcely at all?—No.

1884. And the Water Street district was affected very slightly?—Yes.

1885. Do you know the comparative degrees of purity or impurity of the water derived from those wells?—I do not.

1886. Are you aware that the Soho district well is by far the most impure of the wells you have named?—Yes.

1887. I believe the use of the water from that well has been entirely discontinued?—Yes, as it ought to have been. In reality it ceased in 1866.

(*The Town Clerk.*) The use of that water was permanently discontinued at that time, but there had been a temporary stoppage before that.

1888. But you took water from it during the drought of that season?—(*The witness.*) Yes.

1889. Has Water Street well not been abandoned?—That is a matter the Water Engineer will speak to.

(*Mr. Duncanson.*) It has been stopped this spring.

(*The witness.*) Notwithstanding the strange results to which I have referred I wish the Commissioners to understand that I am strongly against all wells being sunk in the red sandstone beneath the habitations of man. I have only mentioned the fact which I have just referred to as startling to myself, occurring as it did at the very time when in London cholera was traced to water as one of the prime causes; here it evidently had nothing to do with it.

1890–1. Have you had any experience of the dry earth system?—No; I am very glad to say that I have not; we do not require it here.

1892. What is your opinion as to the use of that system so far as you understand it; I mean with re-

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ference to the propagation of disease?—I do not think it would stop the propagation of disease.

1893. Do you think it would be a better plan than the privy system?—Yes; because the fæces of a cholera patient when first passed are innocuous; that is to say, the zymosis, or fermentation, does not begin until putrefaction commences; therefore the dry earth system, which removes the peccant humour at once, is better than that which retains it immediately beneath the house.

1894. But the dry earth system to which I allude does not involve any removal?—Then the dry earth system, without any removal, is simply the Lancashire midden.

1895. Should you be afraid of excrementitious matters if they remained for a week and then became dry?—Yes; I am referring to Mr. Moule's dry earth system which involves frequent removals. As for putting dry earth upon excrementitious matters as they do here, that is the Lancashire privy system.

1896. If I understand you rightly, you consider that the percolation of sewage into wells is likely to affect the health of the persons using the water of those wells?—Yes.

1897. Should you consider that that would be the case also if the percolation took place through a very considerable depth of soil?—No; I do not think it would.

1898. What depth would make it safe?—That would depend of course upon the kind of soil; that of mould, with plenty of clay, would not only purify the water, but render it innocuous.

1899. You are not able perhaps to fix any particular depth that would make it safe?—No; it is a subject upon which I have never seen any experiments made.

1900. If water has become polluted by any poison like that of cholera, do you know of anything that will remove the germ so as to make the water safe and fit to drink?—I think boiling will.

1901. Do you hold that opinion with reference to the general effect of heat?—Yes; with reference to the effect of heat in destroying all germs or organisms, I think that heat that will coagulate albumen and keep it so, will destroy germs such as the cholera germs.

1902. Has it not been stated that germs can withstand the heat of boiling water and up to about 248 degrees?—As I have stated before, my own impression is, that boiling will have the effect.

1903. Do you consider that the filtering of water, such as that obtained from Rivington Lake, is an important matter?—It is not an important matter, but for the water obtained from Rivington, it would be useful; mere filtration will have no effect in arresting the germs of disease; for instance, the poison of cholera.

1904. Is there any chance of the Rivington water conveying the germs of disease?—No; and therefore filtration would do good there, because it carries a certain quantity of peaty matter with it. I do not filter the water.

1905. You regard it only as a matter of taste?—Yes.

1906. Do you think it has no influence upon the health of the consumer?—I think not.

1907. Are you completely satisfied with the quality of water supplied to Liverpool?—Yes, I think it is very good. At one time I used to believe very much in the water supply, as both a cause of sickness and of health, until during the last five or six months, the publication of the Registrar General's weekly returns, which show that Glasgow is even worse than Liverpool, although it obtains its supply of water from Loch Katrine.

1908. You do not consider with some authorities that the impurity of the water is inimical to the health of the people?—Yes, but I am perfectly convinced that the water supplied to Liverpool is perfectly wholesome, although not so good as the water from Loch Katrine.

1909. Do you consider it of great importance to the health of a large town that the excrements of the people should be rapidly removed?—I consider it a most important thing.

1910. Do you know of any mode other than that of removal by water, which will effect that object with sufficient rapidity?—I know of none.

1911. Do you know the maximum density of the population in Liverpool as compared with that of Manchester?—The maximum density of Liverpool is 100 to an acre.

1912. That is in the parish, is it not?—No; in the whole borough. It is difficult to speak of population of districts, because we have no returns that we can depend upon after the census of 1861, but I may mention the borough engineer has given me a statement of the built-up area, including the streets of the borough in districts, and the Registrar General's return of the census of 1861 gives the population of the districts; the facts do not come from the same sources, and I will hand in this paper.

POPULATION in 1861 on BUILT-UP AREAS, including Streets, in the Borough of LIVERPOOL.

Districts.	Population.	Area, in Acres.	Population, per Acre.
Everton - - -	54,848	548	100
Kirkdale - - -	16,135	272	59·3
Scotland Ward - -	81,228	349	233
Vauxhall Ward - -	24,816	133	186·6
Dale Street District including Paul's and Exchange Wards.	29,078	122	238·3
Islington District, including St. Anne's and Lime Street Wards.	41,241	213	193·6
St. George District, including Castle and Peter's Wards.	16,827	131	128·3
St. Thomas District including Pitt and Great George Street Wards.	29,142	152	191·6
Mount Pleasant District, including Rodney and Abercromby Wards.	47,410	367	129·2
West Derby - -	36,527	443	82·4
Toxteth - - -	66,686	582	114·5
Parish - - -	269,742	1,467	183·8
Out Town - -	174,196	1,847	94·3
Borough - - -	443,938	3,314	133·9

1913. May we take it that Liverpool is the most densely populated town in England?—It is the most densely populated town in the kingdom.

1914. What is the density of the population in Manchester as compared with Liverpool?—In Manchester there are 90 people on an acre, in Liverpool the number is 96. That is not the built-up area, but the general area, and of course what I have handed in gives the population in 1861.

1915. Do you consider that the ventilation of the sewers in Liverpool is satisfactorily performed?—Yes; and I think that in that respect we might certainly teach even London a lesson. The sewers are ventilated by the mode which the borough engineer has described in the written answer to queries sent by the Commission.

1916. Do you find that the gases issuing from those pipes ever blow into the windows of the houses?—No; they are dispersed, and really one of the best uses of the archimedean screw, as it is called, is the dispersion of the gases. I am doubtful whether the use of charcoal, according to Stenhouse's plan, is good. I am of opinion it would be better to let the gases go freely up and let nothing interfere.

1917. Will not the charcoal prevent the stink?—Yes.

1918. Do you consider that when you have deprived the sewer gases of any odour by the use of charcoal you may therefore be sure that you have destroyed the noxious properties?—No, we have not done that altogether. The carbonic acid that passes is without smell. By the use of charcoal we deprive sulphuretted hydrogen of odour, and thus do good.

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1919. Do you consider that the really noxious constituents of sewer gases reside in pure chemical compounds, such as carbonic acid and sulphuretted hydrogen?—We know that sulphuretted hydrogen is injurious. Carbonic acid is in itself injurious, but a disease propagator or germ of infection I believe to be a matter sui generis, and floated by the ammonia.

1920. You consider that a matter that lies outside those gases altogether?—Yes, I consider it sui generis. I believe ammonia to be the bearer of the mischief maker.

1921. Then if the charcoal deprives the gases of the ammonia, would you consider that that would prevent other things being diffused?—I think that in the gas passing through charcoal you have still got the germ of infection; the use of the ammonia is to float it in the air; it does not add any force to it, it merely acts as a kind of engine of motion.

1922. Do the people of Liverpool prefer soft or hard water?—For washing they prefer soft water, and for drinking hard water. I may mention that in three districts where the water was examined the central supply was certainly the best, because it was not so hard as that in the south, and it had less nitrates in it than that in the north.

1923. Do you consider that the presence of nitrates in water throws suspicion upon it?—There is no doubt of it, other things being equal. I do not believe that all nitrates arise from sewer decomposition, or that they in any way indicate those decompositions which we call sewage decompositions.

1924. What do you consider to be the source of nitrates in well water?—I think it is excessively suspicious when they are found in well water.

1925. Should you have any doubt as to the source of those nitrates in the Soho Street well?—No. I perfectly admit, without generalizing, that where you always find nitrates there you must look for sewer causation.

1926. Of course solid manure might produce them equally well?—We should find nitrates in the water of Rivington Lake.

1927. There were none in it last summer?—When the Rivington scheme was propounded, an examination of the streams was made by Doctor Lyon Playfair and nitrates found. I forget the amount, but they were published at the time.

1928. To go to the opposite extreme of your wells, the Green Lane well is one of your best sources of well water. It contains nitrates, how do you account for them?—It may have a little communication with the West Derby people.

1929. What is your opinion as to the possibility of nitrates getting into water, independently of animal substances?—I think that you may find nitre itself in a sewer; it may be washed into the water.

1930. Where do you think it comes from?—Do you mean originally?

1931. Yes?—That I cannot say; it is found in certain nitrine districts.

1932. In a dry season, do you think nitrites are stirred up in that way?—Yes; wherever you have volcanic action, there you will have nitrates.

1933. Where do you suppose the water comes from in the Green Lane well originally?—From a great distance.

1934. Not from the surface immediately above the well?—No, certainly not.

1935. None of it?—No appreciable quantity. My idea of the red sandstone is, that the supply comes from a great distance, and that it percolates, according to the formation of the sandstone.

1936. Do you consider that the Green Lane well is supplied with water from a source totally different from that of the Soho well water?—That we cannot tell, because the passage of the water from a distance may be cut off.

1937. Have you any knowledge of any such thing?—No; except the geographical formation of the red sandstone.

1938. (*Chairman.*) You may find that there is a fault, and that will stop it?—Yes; there may be blocks of red sandstone perfectly isolated.

1939. (*Dr. Frankland.*) Considering that there is within this country, or within a moderate distance of Green Lane well a great quantity of cultivated land, is it not very probable that a large proportion of that water passes through manured soil?—When it is stated in the published returns of the Registrar-General that nitrates are the result of sewage contamination or indicating it, I go so far with you; but, in places not immediately communicating with the wells, and not immediately communicating with the habitations of man, even if you find nitrates, and those nitrates be distinctly due to vegetable and animal decomposition, I believe those nitrates to be perfectly innocuous, and in no way indicating danger.

1940. (*Mr. Morton.*) Will you be good enough to state whether in your opinion water-closets are a more wholesome arrangement than ash-pits and privies?—I do not hesitate to say that they are more wholesome. The action of the Health Committee has not been at all upon the abstract question of which is right, or which is the best or the worst; we have acted under a specific Act of Parliament, that a thing being from its position and construction injurious to health, it must be removed. We have no power, that I know of, to convert privies into water-closets, that is to say, not specifically in those words; in the first place we must prove that the thing is a nuisance.

1941. (*Chairman.*) You have acted upon that to a certain extent, have you not?—Yes; because a thing has been proved to be a nuisance, and it must be so in a case where 100 people are upon an acre.

1942. (*Mr. Morton.*) In this, as in other respects, people can only be kept clean by washing?—Quite so.

1943. However cleanly and regular the removal of the excrement may be under the privy system, it cannot be otherwise than offensive?—No; and especially in large overcrowded towns, which are becoming daily still more so.

1944. A mass of mixed ashes and ordure that has been lying for months together cannot be removed without gases being set free which are not only offensive but noxious?—No.

1945. The majority of the people being asleep at the time when the removal takes place, they are not aware of the nuisance?—No. I am not an out-and-out advocate for water-closets in inland towns; I think it not very creditable to the engineering talent of the country that nothing better could be brought forward, but I certainly would have given many months' consideration to the subject if I had been the medical officer of an inland town before I would have taken the same action that I have done here. I should have invited the opinions of scientific gentlemen and engineers to help me in the matter; but I have no doubt about which is the best plan to be adopted in Liverpool.

1946. Do you not think that however satisfactory the privy system may be for detached cottages in country places, it is unfit for and ill-suited to the circumstances of a town like Liverpool?—Yes.

1947. Are not people more liable to sustain injury from the noxious gases given off during the cleansing operations when they are asleep than when they are active and awake?—Yes; I think it is very possible.

The witness withdrew.

JOSEPH RAYNER, Esq., Town Clerk.

J. Rayner, Esq.

I wish to bring under the notice of the Commissioners that in a case before the Court of Queen's Bench, and which is reported, it appeared that the corporation had said they would be satisfied with nothing else but

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a conversion of the privies into water-closets, the Court held that the magistrates had no power, but that the council, acting under the advice of Dr. Trench, were entitled to be satisfied where a place was a nuisance, that it was to be abated in that way, and in no other.

The witness withdrew.

Mr. JAMES NEWLANDS, C.E. examined.

Mr. J. Newlands, C.E.

1948. (*Mr. Morton.*) Are you engineer of the borough of Liverpool?—I am.

1949. It appears from the answers to questions which you have furnished to the Commission that 5,210 acres represent the area of the borough, will you state how much of that area is built upon?—Nearly one-fifth is unbuilt upon, and about 4,000 acres are built upon. The unbuilt portion consists of 1,061 acres.

1950. Can you insist upon a certain area being left unoccupied?—We do so now.

1951. Can you insist upon privy accommodation being provided?—If the medical officer or the borough engineer thinks that a water-closet is better than a privy, then we insist upon a water-closet being made.

1952. Do you, as a matter of fact, insist upon it?—There has not been a privy constructed in Liverpool for many years, they are all water-closets.

1953. Are you converting all privies into water-closets?—Upwards of 13,000 have been so converted during the last five years.

1954. Are the privies attached to the houses?—The water-closet is generally placed in the yard, and is entirely out of the house.

1955. Is the water supply at all diminished in its course?—I believe not; but we have never tested the actual flow of the sewers at all hours.

1956. Do the sewers carry away and deliver into the river all the waste water from kitchens and wash tubs?—Yes; and from baths.

1957. Also the drainage of the privies?—Yes; and now the drainage from the water-closets.

1958. Are the ash-pits roofed?—The old ash-pits are not roofed, but the privies are roofed.

1959. Then the roof of the privy pours into the ash-pit what rain falls on it?—No; the privy and the ash-pit were detached, and one ash-pit generally came between two small privies. Before the ash-pits were roofed, all the rain from the privy roofs fell into the ash-pits.

1960. In that case the solid excrement was washed by the drainage?—No; very little. The ash-pits then were wet ash-pits, and of course they were most stinking places; the dry one does not smell very bad.

1961. Are the ash-pits drained?—Yes, all of them have been so for many years.

1962. What quantity of water do you think is used daily for these purposes?—Mr. Duncan, the late engineer, made some actual experiments, and when people were frightened about the quantity of water that would probably be used for water-closets, Mr. Duncan said if every house in Liverpool had a water-closet it would only require 2,000,000 gallons of water a day. That was the result at which he arrived from actual experiments, and that would represent a very small portion of our water supply.

(*The Town Clerk.*) The late Mr. Duncan, C.E., water engineer, in giving evidence before the former Commission, when sitting here on the 14th of January 1868, said, "Upon a very liberal estimate that 14,000 "privies remained still to be converted into water-"closets, they would not require more than three-"quarters of a million gallons of water per day."

1963. (*Mr. Morton to witness.*) Are you now supposing that every house was supplied with a water-closet?—Yes; 86,000.

1964. With regard to the tank and trough-closets, what are their dimensions?—They vary according to the number of seats in them; in schools, for instance, they are very long.

1965. Is the quantity of water required as much as four gallons a head per day?—The average would appear to be 3·91 gallons, or take it at four gallons a head.

1966. Is not that an extraordinarily large quantity?—No, not if you take the average population of Liverpool. Referring to the census of 1861, and taking out the number of the houses, it gives above seven.

1967. Assuming that a person would use a water-closet once a day, do you think that four gallons of water would be carried away?—I have no doubt that there is an enormous amount of waste, for at places where they have mere taps they allow them to run.

1968. Do you know of any reason why man should not be as serviceable a fertilizer of the ground as sheep?—I know of none.

1969. Nor why 500,000 men ought not to be able to do as much as if it were stocked with the same number of sheep?—I know of no reason. You are probably aware that our sewage scheme, which is an experimental one, is very nearly completed, and we shall be ready to pump in the sewage on to the farm in about three months.

1970. What area are you proposing to deal with?—We can command a very large area. It is market garden ground all along the way which the pipe travels, and it goes through rich loamy land.

1971. For what distance does it go?—The extreme length of the line is nine miles from Liverpool.

1972. What is the size of the pipe?—It is a nine-inch pipe, and it is intended to take the water of one sewer. Our object is to test absolutely how much water the land will take so as to purify the water.

1973. Will the authorities of the town share in the cost of this scheme?—

(*The Town Clerk.*) Yes, they will to the extent of 5,000*l.* under the general Act.

(*The witness.*) The works are very inexpensive in character.

1974. Do you propose to work by surface carriers?—We propose to work by hose and jet.

1975. Shall you deliver it into a tank at a high level?—No, we shall pump it over a stand pipe; it will be done by air pressure, the pipe being 125 feet high.

1976. (*Dr. Frankland.*) Will you be good enough to state the extent of the district that is drained by Gower Street sewer?—Yes, the Gower Street sewer drains an area of 3,511,000 square yards.

1977. What is the character of the district drained, is it a water-closet district or a privy district?—It is very much a water-closet district, but there are some manufactories in that district also.

1978. Are you quite correct with regard to the area you have given?—Yes, quite correct.

1979. (*Mr. Morton.*) Does the Gower Street sewer receive the sewage of other sewers above it?—Yes, it is merely the means of discharge for the other sewers, and there are many others; an immense quantity of water goes into it.

1980. (*Dr. Frankland.*) Do you consider that that fairly represents your water-closet sewage?—Not at all, because that is very much filled by drainage from manufactories of one kind and another.

1981. What manufactories are chiefly drained into it, or can you give a district that will more fairly represent the water-closet sewage?—I can; about 800 acres of the district coloured yellow upon that map may be considered as producing water-closet sewage.

The witness withdrew.

Mr. CHARLES S. NEWMAN examined.

Mr. C. S. Newman.

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1982. (*Mr. Morton.*) Do your men superintend and look after the trough closets?—Yes.

1983. Is there a special set of men employed to look after them?—Yes, and they are 57 in number.

1984. Will you be good enough to describe what their duties are?—They make their rounds regularly to open the valves and let off all the water and flush out the closets and cleanse down the seats. They let the water on either by means of a tap which is inside some of the closets or by a hose supplied from a hydrant.

1985. Is that done once or twice in a day?—Once a day.

1986. As a rule are they in a dirty state, or are they clean?—The seats and floors in the lower neighbourhoods as a rule are dirty. It is not at all an uncommon thing for the population to neglect to avail themselves of the accommodation provided for them.

1987. Are these places, generally speaking, in a cleaner condition than the common privies?—I have seen the same state of things with privies in the same circumstances; the people will refuse or neglect to use the privies in a proper manner, and that is also the case with the water-closets.

1988. Do you think the people are improving in their habits in that respect?—I think they are.

1989. Do you know how much the troughs hold on an average, or what is the size of a trough?—They vary very much in size; in some of them, where there are many seats, the tanks are very large.

1990. In some cases are there several troughs?—There are sometimes two or three; there are double and treble troughs.

1991. Is the trough a fixed thing, or does it oscillate?—It is fixed.

1992. Has it a sloping bottom?—Yes.

(*Mr. Duncanson, Water Engineer.*) We have them using from half a gallon of water per head to about four gallons per head.

1993. Four gallons being the maximum I presume?—Yes.

1994. (*Mr. Morton to the witness.*) Will four gallons of water include what is wanted for flushing and everything of that kind?—Yes; but there are some cases in which the trough itself will hold nearly four gallons per head.

1995. With regard to the 20,000 privies, how many men do you employ in scavenging them?—As to the privies, my night staff at the present time is 52 men.

1996. How many privies do they clean out in a night?—During the year 1868 the average number of middens emptied nightly was 120.

1997. Taking the whole of them throughout the borough, how many times would that be in a year?—I should say on the average about twice a year.

1999. I see that there are 138,000 tons of stuff which are spoken of as being sold; does that all come out of the ashpits?—In the year 1867 138,777 tons came from the middens and ashpits.

2000. Does none of it consist of street sweepings?—No. In 1868 the contents of the middens and ash-pits removed were 109,668 tons, and the street sweepings 94,250, making a total of 203,918 tons.

2001. How much of that was sold as manure?—Of the contents of the middens 93,654 tons were manure, and from the scavenging there were 72,800 tons of manure, making a total of 166,454 tons of manure.

2002. What became of the remainder?—The other part was carried away to whatever places we found convenient. There are several old delphs or quarries which we fill up, and we deposit the ashes there.

2003. Wherever there is a privy do the whole of the contents of the privy and ashpit go to the wharf?—Entirely so; and they are all emptied at night, and the contents carted into the boats at the wharf, and it is all removed within 24 hours.

2004. In the case of ashpits which are connected with privies, is there not a lot of stuff which is not serviceable as manure, such as brickbats and other kinds of rubbish?—Yes, and we pick all that out.

2005. What do you do with it?—That is all removed and deposited in waste places, in the delphs.

2006. Then there is a certain portion of stuff from the ashpits, in cases where privies are connected with them, which is removed in that way?—No; it is only the rubbish, not the ashes; the other is mixed up.

2007. Where is the separation made between that which is useful as manure and that which is not?—It is all tipped into the boats together, and then the rubbish is picked out.

2008. Are some of the ashpits at times wet; that is to say, is the grid sometimes choked up?—Very frequently.

2009. What happens then; what are the kind of tools with which you provide your men?—They have scoops and shovels and forks.

2010. Is the scoop one that will hold water?—Yes.

2011. So that they are able to ladle out this liquid filth?—Yes; and in many cases men are put on specially for that purpose. For instance, when a midden is more than ordinarily wet, extra men are employed to ladle the water off.

2012. Do you receive notices from the parties, or do your own inspectors ascertain when a privy is full and requires to be emptied?—We receive about three-fourths on the average of notices.

2013. Is that matter left entirely to the people?—Not entirely.

2014. As I understand, you have a certain number of inspectors?—Yes.

2015. Is it your practice to cleanse a whole row of privies at the same time?—Not ordinarily so, that was my idea of what we should have done, but the conversion of privies into water-closets which took place made the work lie so much further apart than I expected, and therefore it is not economical to do it so, but we find it better to take them just as the notices are sent.

2016. Do you wash down the gangway after the emptying has taken place?—Yes, the staff of men is partly under the borough engineer, and partly under the water engineer, whose duty it is to follow these men, and wash down all the places which have been emptied. The Corporation have to pay for the labour about 500*l.* a year, besides the water that is required, for which no charge is made.

2017. Is the stuff taken out wheeled along the gangway, put into a cart, and taken away at once?—Yes; it is taken away at once to a barge. There is only one exception to that rule which is this, that I occasionally get an order from a farmer living in an outlying district who has land to manure, and I then make an arrangement with him so that the carts take it out to him and tip it on to his land, or tip it into waggons for despatch by railway.

2018. What do you charge in a case like that for cartage?—That depends upon the distance, it is so much per cubic yard.

2019. What do you get for it at the barge?—I think that the average price now is about 1*s.* 6*d.* a ton, and a ton will average less than a load, or one load will be a ton and a third, that is about 2*s.* a load.

2020. Is the stuff taken to be put on arable land?—It is put partly on arable land, and partly on grass.

2021. What is the ordinary dressing?—That I do not know.

2022. (*Chairman.*) I find that there are 27,000 houses in Liverpool without either privies or water-closets?—But they possibly have access to privies.

Mr. C. S. Newman.

1 June 1869.

2023. How many houses should you say have the use of one privy, or are there privies and water-closets which are common to a certain number of houses, a dozen?—No, not so many as a dozen houses.

2024. What I want to know is how many families, on the average, use the same privy or water-closet?—(*The Town Clerk.*) I think it is necessary to draw a distinction, and take out the troughs, the trough is used for a court.

(*Dr. Trench.*) In the courts in Liverpool there are from four to five houses to one privy.

(*Mr. Newlands.*) I think I may state that there are 18,000 people in Liverpool who have to use the privies in common.

The witness withdrew.

Mr. Edward Muspratt examined.

Mr. E. Muspratt.

2025. (*Dr. Frankland.*) Are you an alkali manufacturer?—Yes.

2026. Are you applying Mr. Mond's process for recovering sulphur from alkali waste?—Yes; we have carried on the process for about six months at Widnes. For the last five or six years I have had my attention directed to recovering sulphur from alkali waste, and have considered most of the processes brought out for the purpose, among them Schaffner's; but that process was, on account of the great cost of labour too expensive for English manufacturers, whereas, in Mond's process, the cost of labour was not very excessive, and therefore it might be remunerative to an alkali manufacturer, as well as enabling him to get rid of, to a certain extent, a nuisance. Professor Anderson, I believe, stated at Widnes that the cost of recovery of the sulphur was 2*l.* per ton, he is not a manufacturer.

2027. Professor Anderson spoke with reference to the application of the process to the liquid drainage from the alkali waste, which is rather a different matter from the application of the process to which you have referred?—It is certainly rather a different matter, and it seems to have come about in this way: At Glasgow there were great complaints of the drainage from the heaps of alkali waste in the works of Messrs. Tennant, and they took up Mr. Mond's process for the purpose of getting rid of the nuisance. But the process could not be carried out except by an alkali manufacturer who had fresh waste to act upon, because Mond's process depends, or rather the decomposition depends, upon a certain relation between the hyposulphites and the sulphides of calcium.

2028. Will you be good enough to give us your experience of the process?—I am of opinion that it is a practicable process, but the great cost in working it is the amount of muriatic acid it consumes, and in those works where the whole of the muriatic acid, produced from the decomposition of salt, is not used, of course the process is commercially applicable.

2029. What proportion of the total amount of the muriatic acid derived from the salt which is decomposed, do you consider will be used in order to carry out Mond's process?—About one-fifth. I think that Mr. Mond's calculation is a right one: that there is a sufficient quantity of acid now run away to make it possible to carry out his process in the whole, or nearly the whole, of the alkali works in England. But there are alkali works in many parts of the kingdom where they do not produce muriatic acid (and others where all the acid is used), and they will have to buy it if obliged to carry out Mond's process.

2030. Supposing that the muriatic acid is abstracted by the process of making bleaching powder, do you consider that a smaller amount of profit will be made by expending the acid which is so abstracted for the purpose of obtaining sulphur?—That depends upon the price of sulphur. At the present time the price of bleaching powder is about 7*l.* or 8*l.* a ton. It will pay alkali manufacturers to apply the muriatic acid produced to the extraction of sulphur from alkali waste; but when bleaching powder is 14*l.* to 18*l.* a ton, and manufacturers can make a profit of 5*l.* to 8*l.* a ton by the sale of bleaching powder, it is not likely that they will extract sulphur which will only bring them a profit of 2*l.* a ton.

2031. Can you tell me when bleaching powder was last sold at 16*l.* a ton?—About two or three years ago; but since that time the price has gradually gone down. Bleaching powder 10 years ago was very low in price; there was more produced than there saw a demand for; but owing to the application of chemicals and bleaching powder in the manufacture of paper from esparto grass, the demand for bleaching powder rose to the very high price I have quoted.

2032. What per ton has the extracting of sulphur from the alkali waste by Mond's process cost you?—About 4*l.* a ton.

2033. Do you extract sulphur from the whole of the alkali waste produced at your works?—Not yet; but we intend to do so.

2034. It has been stated to us that the Netham Chemical Company at Bristol extract the sulphur from the whole of the waste produced at their works?—I have heard that they now apply the process to the whole of the waste, and I hope to have it applied to the whole of the waste at our works at Widnes.

2035. If it be applied to the whole of the waste, would not the effect be to diminish the cost of the process?—Yes, about 5*s.* a ton. The more sulphur you can produce the less per ton does the labour cost.

2036. Do you consider that it would be a hardship even in the most extreme case that you have mentioned, if alkali manufacturers were compelled to extract the sulphur from the alkali waste?—Decidedly, I do not think that a manufacturer should be compelled to extract sulphur from the alkali waste. He ought not to be allowed to deposit waste which was likely to produce a nuisance. But in my opinion waste can be so laid down as not to cause a nuisance.

2037. How would you propose to do it?—It requires both water and air to decompose it and produce a nuisance, but if the waste is put in a heap, patted down very closely and covered over so that no water can percolate through it no nuisance will arise from it.

2038. Do you mean that you would put it under a shed?—No, it is quite practicable to cover it with earth, if necessary.

2039. (*Chairman.*) You admit that if there is a mode of dealing with the material which has been referred to, by which it can be prevented from becoming a nuisance, it would be perfectly justifiable to say that no alkali manufacturers should use the waste as they do now, and thereby create a nuisance?—Of course generally every person admits, in the interest of the community, that certain restrictions must be put upon certain trades; but it must at the same time be remembered that any interference with trades is generally opposed to the interest of the community, and also that unless the process of recovering the sulphur from alkali waste is very carefully carried out, as great a nuisance will be caused as that which arises from the drainage of the waste heaps, because in the process sulphuretted hydrogen is always given off.

2040. But that does not go into the river?—No, but it is nevertheless a nuisance.

2041. (*Dr. Frankland.*) If you should get sulphuretted hydrogen in any large quantity, would it not be a proof that you were carrying out the process in an unskilful manner?—Of course there is no doubt that if the process be very nicely carried out, there is hardly any sulphuretted hydrogen given out.

2042. If you test the liquors and properly mix them in the proportions as recommended by Mr. Mond, I suppose there will be very little sulphuretted hydrogen given out?—There is very little, but sometimes there is, even with the greatest care, a disengagement of sulphuretted hydrogen.

2043. Is there a ready sale at the present time for the sulphur that is extracted?—There is a ready sale for it, but many consumers of sulphur object to it on account of the arsenic which it contains.

2044. Is not that objection to a considerable extent wearing away?—I do not think so.

2045. Are you aware whether in the manufacture of sulphurous acid from the sulphur thus obtained the arsenic passes into the sulphurous acid chamber and impregnates the acid that is made?—It does so.

Mr. E. Muspratt.

1 June 1869.

2046. Do you not think that by a modification of the trunks which lead the sulphurous acid into the chamber, that arsenic might be avoided?—I think that possibly it might be avoided, and could be avoided; but I speak of it as it is at present.

2047. You think that it is very likely the process can be so arranged as to prevent arsenic getting into the acid?—Yes, but at an extra cost.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock.

St. George's Hall, Liverpool.

Wednesday, 2nd June 1869.

PRESENT:

Major-General SIR W. DENISON, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

2 June 1869.

(*Chairman.*) Gentlemen, we attend here to day to receive any evidence you may wish to tender, or complaint to make, respecting the alleged nuisance caused by the sewage of Liverpool, on the shore of the estuary at Seaforth and Waterloo, and to state that we shall be glad to visit those places, if necessary.

(*Mr. Thomas Etty.*) I appear for gentlemen residents of Waterloo, who are also present; two of them reside immediately on the shore, and I reside close to it, and we all say that we suffer very considerably from the nauseous stink, whether it be simply from the sewage from Waterloo, or not. Although Waterloo may disgorge its sewers there, *non constat* that more should go there, or that this should not be stopped if it can be stopped.

I put in the following copy of letter addressed—

"To the ratepayers and inhabitants of Waterloo.

"Gentlemen, Waterloo, May 31, 1869.

"It appears from a memorial now at the Waterloo railway station someone has discovered that the effect of the inquiry held at West Derby a fortnight since by Mr. Taylor may have a detrimental effect upon our health and lives. It is to be regretted this discovery was not made sooner. That the sanitary condition of Waterloo is bad, I believe no one doubts, and it is perhaps worth a passing thought to consider why so many houses are now empty. Is it to be attributed to fever? Why have so many people lately left our neighbourhood? Are there any cases of fever now? What have been the average number per month of fever cases in Waterloo during the last two years, and how many people during the same period have died of fever? I fear it is very little use addressing memorials and getting numbers of people to subscribe to a document which says "they will ever "pray," &c. I think more energetic means should be taken by the ratepayers and the inhabitants, and that they should look after the health of their wives and families, instead of leaving the matter in the hands of the *owners of property*, who, if any sewerage has to be done, will be the persons to pay for the work, and not the inhabitants, and therein, I think, lies the cause of the bad drainage. Who is to blame for the supine conduct of the Waterloo local board at the inquiry held at West Derby a fortnight since? The ratepayers of West Derby were unanimous in the desire that their sewage should be taken to our shore, and those who opposed the question of the sea outlet would have joined the Waterloo board in the expense of procuring evidence as to pollution of the sea shore. It is said our board declined their aid, and as a consequence the only evidence produced by the West Derby ratepayers related to the question of economy of irrigation, troubling themselves nothing upon the all important question to us as to the pollution of our shore. Did our local board produce any scientific evidence to rebut what the borough engineer of Liverpool stated with regard to the fact of the pouring of the sewage of Liverpool into the river? I have failed to discover that anything of the kind was done, on the contrary nothing whatever seems to have been done to meet that assertion, and but for the fortuitious circumstance of Mr. Nicholson and Mr. Thacker appearing at the last moment, our board would have been without any evidence at all except Dr. Callon and the local surveyor.

"Now it has been known for months that an inquiry would be held at West Derby to investigate the merits of a scheme for utilizing the sewage by irrigation on land in Kirby, and the Waterloo Board actually presented a memorial to the Secretary of State praying for this inquiry, but our Board allowed the time to slip by without getting up any case whatever. The evidence of Mr. James Newland, C.E., Borough Engineer of Liverpool, is that if the sewage of Liverpool is discharged in the tide-way of the river below low water mark, the effect of the current is to wash it out as far as the Isle of Man before any decomposition takes place. This is very strong evidence, and from Mr. Newland's position must have great weight. If the theory be true, we have nothing to fear from the West Derby, the Liverpool, or any other sewage. But is this theory true? The Rivers Pollution Commissioners sit in Liverpool to-morrow. Is our Board prepared with any evidence to go before that Commission as to the state of the Mersey? The sewage of Waterloo is discharged on our shore, and that, I understand, was originally done on Mr. Newland's advice; but would the Waterloo people with their present experience, if they had to do the thing over again, construct their sewers as they now exist? I am informed that about three months ago three gentlemen residing at Waterloo met, by appointment, the Chairman and Messrs. Nicholson and Schofield (two of the

2 June 1869.

members of the Local Board), and Mr. Roberts (the Engineer to the Board), to examine and consider the state of the sewer abutting from Harbord Street on to the shore. It was then agreed that the services of an inspector from London should be obtained, and that he should investigate the state of the sewerage at Waterloo. That in lieu of the present dilapidated brickwork (as the sewage was constantly percolating through it) a new iron pipe drain should be fixed; and it was arranged that Mr. Blythe and Mr. Wigg should leave their houses (*pro tem.*) during the present month of May, for the purpose of this being done. About 14 days afterwards Mr. Blythe got a letter from the Board inquiring what steps *he had taken and when the inspector would come from London.* He was very much surprised at such extraordinary conduct, and declined to have anything more to do with the matter. He wrote the Board, and told them he should hold them responsible for any ill effects that might arise from the defective drainage. In reply the Board's Clerk (*inter alia*) wrote—'They notice your protest, which shall have all the attention it deserves'!!! Mr. Wigg, the owner of one of the largest houses in Waterloo, intends to remove from the neighbourhood in consequence of the bad condition of the sewerage and the stinks with which he is assailed. The value of the house is 200*l.* a year or upwards. Another gentleman, who pays 180*l.* a year for his house, intends to leave Waterloo for the same reason, and Mr. Parr, who lives near, and who pays 130*l.* a year, also intends to leave. How many persons intend to do the same thing for the same reasons? Nay more, a piece of land was about to be sold for the building of several large houses, but the purchaser holds off until he sees whether the sewage of West Derby is to be emptied on the shore, and if that happens, he will not purchase the land. Is this true? Something should be done to save Waterloo.

"I have, &c.

"(Signed) THOMAS ETTY."

If the Commissioners should pay a visit to the place I will point out to them that just below Mr. Muspratt's house is a place where they are making a new dock, and immediately at the mouth of that dock there is a large sewer which discharges itself.

2048. (*Chairman.*) Where does the sewage come from?—(*Mr. Etty.*) It comes from Seaforth; and it will make that large dock a receptacle for everything that is bad.

2049–50. (*Dr. Frankland.*) Does the sewer go into the dock itself?—(*Mr. Etty.*) It does now; how far they will carry the wall I cannot say, but it empties itself now close to the dock.

(*Chairman.*) With regard to what you have said and the other gentlemen who are present who have an interest in the locality from which you come, we shall be glad if they will submit to us any statement they may wish to make in writing. We want facts with regard to the actual state of things; as to the nuisances that are created and the effects of the stinks, if any, and you can trace them upon the health or the comfort of the population. Recollect, however, that you must not try to throw blame upon others when you are open to complaint yourselves, if the sewers from your district discharge on the shore at low water mark they may be the cause of most unpleasant stinks.

The witness withdrew.

MR. ALEXANDER DUNCANSON, Water Engineer, examined.

Mr. A. Duncanson.

2051. (*Chairman.*) I believe you have some papers to hand in?—Yes, the first is with regard to the percentage of the impounded water on the Rivington watershed (*handing in a paper*). The second is with regard to the experimental tests that were made in different districts of the town (*handing in the same*).

2052. (*Dr. Frankland.*) Does the second paper refer to the consumption of water in the different districts?—Yes; also contains the result of experimental tests of the consumption of water in the trough water-closets in use in institutions, schools, workhouses, baths, and washhouses. We have meters upon all of them.

2053. (*Chairman.*) I see it is stated in column headed "Left for town or run to waste," "In 1865 "six millions of gallons;" but you had actually delivered into the town 9,000,000 gallons?—Yes; but we took that from stock.

2054. There was still a balance in hand?—Yes; still a balance in hand. We began with the reservoir full.

TOTAL YIELD OF DISTRICT.

Proportion to Rainfall, Quantities sent to Liverpool, given for Compensation, and run to Waste.

Year.	Rainfall as per Daily Gauge.	Quantity delivered in Liverpool, Run to Waste, and Compensation Water.		Equal to Proportion of Rainfall.		Quantity given as Compensation to Mills and Streams.		Left for Town, or run to Waste.		Quantity actually delivered to the Town.	
	Inches.	Gallons per Annum.	Gallons per Day.	Per cent.	Inches.	Gallons per Annum.	Gallons per Day.	Gallons per annum.	Gallons per Day.	Gallons per Annum.	Gallons per Day.
1861	46·38	8,093,325,037	22,173,493	77·13	35·77	3,029,500,000	8,300,000	5,063,825,037	13,873,493	3,797,393,993	10,403,818
1862	43·51	9,068,278,068	24,844,597	82·63	40·08	3,029,500,000	8,300,000	6,038,778,068	16,544,597	3,038,501,423	10,790,414
1863	51·01	9,213,696,276	25,243,003	79·84	40·72	3,029,500,000	8,300,000	6,184,196,276	16,943,003	4,060,640,184	11,125,041
1864	39·035	6,250,773,246	17,125,406	71·37	27·85	3,029,500,000	8,300,000	3,221,273,246	8,825,406	4,031,913,758	11,046,339
1865	34·80	5,284,059,293	14,476,865	67·12	23·35	3,029,500,000	8,300,000	2,254,556,293	6,176,865	3,414,556,293	9,354,948
1866	54·61	8,947,705,531	24,514,262	72·42	39·55	3,029,500,000	8,300,000	5,918,205,531	16,214,261	2,752,956,631	7,542,347
1867	42·44	6,650,643,307	18,220,954	69·27	29·40	2,860,630,000	for 273 days 8,300,000 for 92 days 6,465,000 average 7,837,479	3,789,968,307	10,383,475	3,716,707,117 for adjustment of year, 6 days of 1866= 60,219,238 has been deducted from quantity, as per engine duty book.	10,182,760
1868, 36 days	46·72	6,565,201,166	17,937,708	62·12	29·02	2,366,190,000	6,465,000	4,199,011,166	11,472,703	3,256,922,203 including ⅔ths of quantity, for week ending 5th Jan. 1869.	8,898,694

SUMMARY of EXPERIMENTAL TESTS by METERS applied to CONSUMPTION of WATER at places under mentioned, showing comparative results for Periods to 11th March 1868, from 11th March to 29th December 1868, and for whole period of Tests to 29th December 1868.

Name and Situation of Place tested.	Average Number of Consumers.			Period of Test.			Average Consumption per Day.			Total Consumption during each Period of Test.			Average per Head per Day.			Duration of Supply per Day in Hours.		
	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.	To 11 March.	From 11 Mar. to 29 Dec.	Whole Period to 29 Dec.
TROUGH WATERCLOSETS:	Persons.	Persons.	Persons.	Days.	Days.	Days.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Average.		
Darnley Street	82	70	76	583	293	876	127	222	159	74,300	65,200	139,500	1·536	2·92	2·27	15	11	13
Portland Street	23	—	—	574	—	—	27	—	—	15,380	—	—	1·164	—	—	..	..	..
Grosvenor Street	34	38	36	421	291	712	14	18	15	5,750	5,270	11,020	·4056	·5	·41	..	..	..
Wolfe Street	5	5	5	371	292	663	19	24	21	7,220	6,980	14,200	3·912	4·8	4·28	..	..	..
Prudhoe Street	120	112	116	296	293	589	631	602	616	186,900	176,400	363,300	5·256	5·2	5·5	..	..	..
Female Orphan Asylum	187	187	187	490	258	748	168	116	150	82,500	29,900	112,400	·9	·62	·8	..	..	..
Great Homer Street	14	14	14	889	277	1,166	78	65	74	69,416	18,000	87,416	5·592	4·64	5·29	..	..	..
INSTITUTIONS & SCHOOLS:																		
Hindley's	470	425	462	435	228	663	240	271	250	104,430	61,930	166,360	·511	·64	·54	..	..	..
Sutton's	575	624	580	453	230	683	374	136	293	169,280	31,210	200,490	·65	·214	·51	..	..	..
Lomas's	299	341	309	477	190	667	591	336	518	281,700	64,040	345,740	1·975	·98	1·67	..	..	..
Callaghan's	631	686	644	460	244	704	162	414	250	74,700	101,530	176,230	·257	·6	·39	..	..	..
Leather's	370	356	362	443	230	673	105	152	140	57,180	37,040	94,220	·284	·42	·39	..	..	..
Liverpool Institute	1,000	1,000	1,000	453	181	634	487	1,087	500	220,750	196,760	317,510	·487	1·08	·5	..	..	..
National Schools	196	122	178	475	216	691	161	173	164	76,300	37,300	113,600	·819	1·42	·92	..	..	..
Soc. of Friends Ins.	682	683	682	269	223	492	1,221	1,016	1,128	328,570	226,660	555,230	1·791	1·49	1·65	..	..	..
WORKHOUSES:																		
Liverpool Workhouse	3,711	2,918	3,500	468	272	740	106,676	100,309	104,462	50,018,000	27,284,000	77,302,000	28·8	34·37	29·84	Constant.		
West Derby Workhouse	349	578	428	478	279	757	21,456	12,251	18,063	10,256,000	3,418,000	13,674,000	61·48	21·19	42·2	do.		
Toxteth Park Workhouse	692	659	681	472	292	764	14,098	15,790	14,744	6,654,219	4,610,500	11,264,719	20·373	23·96	21·65	do.		
BATHS AND WASHHOUSES:																		
Cornwallis St. Baths	387	521	436	474	286	760	76,639	80,423	80,321	36,327,000	24,717,000	61,044,000	193·033	165·88	184·22	do.		
George's Baths	151	272	202	478	293	771	6,762	9,699	7,879	3,232,500	2,841,900	6,074,400	41·781	35·62	39·	do.		
Paul St. do. and Washhouses	—	—	—	477	279	756	23,591	28,914	25,555	11,253,000	8,067,000	19,320,000	—	—	—	do.		
Frederick St. ditto	60	50	56	485	278	763	11,951	10,461	11,408	5,796,300	2,908,200	8,704,500	199·18	209·	203·62	do.		
Margaret St. Baths	—	95	95	—	126	126	—	16,944	16,944	—	2,135,000	2,135,000	—	178·34	178·34	do.		
ADELPHI HOTEL:																		
Whole Establishment	—	—	—	238	294	532	12,730	12,018	12,336	3,029,700	3,533,300	6,563,000	—	—	—	—		
Hotel and Stables only	—	—	—	—	—	—	10,651	9,516	10,023	2,534,900	2,797,200	5,332,100	—	—	—	—		
Laundry only	—	—	—	—	—	—	2,079	2,502	2,314	494,800	736,100	1,230,900	—	—	—	—		

The witness withdrew.

MR. THOS. MELLARD READE, Architect and Civil Engineer, Liverpool, handed in the following statement:—

Mr. T. M. Reade.

2 June 1869.

I AM a native and have lived all my life in Liverpool. Have practised there as an architect and civil engineer for 10 years. Have observed a deterioration in the shores of the Mersey gradually taking place for years. Some years ago there used to be bright sand by the dock walls from which boys bathed. Now a good deal of the shore is like the sample taken near the outlet at the south end of Albert Dock (produced). Have lately inspected the outlet sewer by the Clarence Dock, and finds that at times it emits an abominable odour; tar and chemical refuse comes down (two samples of the sewer water produced). The tar floats on the surface. The Clarence grid basin contains many hundred of cube yards similar to sample produced. No sewer discharges into the basin, it is merely the deposit produced by subsidence in still water of the dilute sewage that backs into the basin. Have inspected the outlet sewer south side of Albert Dock at low water; it is very offensive, creates a lake of inky water extending out as far as the flats at anchor and the length of the Albert Dock warehouses. This is the effect of all the outlets in a greater or less degree at low water. At half tide the black sewer water is distinctly visible boiling up through the sea water, but the nuisance of the sewage is most distinctly palpable at low water. I produce specimen of the mud from the "delta" of the sewer. I am well acquainted with the Waterloo, Seaforth, and Bootle shore. When a boy have bathed at Bootle, the shore being then as fine as it is now at Blundell sands. The shore has been gradually deteriorating, and now near Bootle is simply one mass of impassable mud. Examined the whole of the shore last year and also this year, and find it noticeably worse now. This mud I believe to be a mixture of all sorts of filth thrown into the river from Liverpool and other places with the natural silt swept in with the current. The annual bulk of the sewage of Liverpool dry weather flow, estimating the water supply and subsoil water at 35 gallons per head, and the population at 500,000, will be 37,851,851 cube yards, or equal to a lake 13½ miles long, the average width of the river between New Brighton and Rock Ferry and one yard deep. Taking the proportion of solid to liquid in sewage at $\frac{1}{1000}$, this will give 141,685 cubic yards of solid matter delivered into the river annually. All this filth is gradually accumulating in the bed of the Mersey, and is stirred up with every successive tide, to be deposited where the current is slack. The current at Waterloo is slack from the flatness of the shore and the projection of the dock works. If the proposed west Derby outlet sewer to the sea is constructed (whether the sewage of Liverpool is hurtful or not to the Seaforth shore) it is certain to create a great local nuisance. The culvert is 6 ft. × 4 ft. larger than any Liverpool outlet; drains an area larger than the borough of Liverpool with a present population of over 30,000, which may

Mr. T. M. Reade. 2 June 1869.

expand indefinitely. As this proposed culvert will discharge at the extreme northern termination of the dock works, it will form a case analogous to the Clarence Dock outlet and the Clarence graving basin, and the effect of that is shewn by the specimen already produced. A local deposit of sewage will form on the shore to the north of the dock works, and will grow worse every year, in fact it will ruin Waterloo and Seaforth as bathing places. I am of opinion that no more sewage where it can possibly be helped ought to be turned into the river; but to disgorge sewage close to a watering place in a huge volume would be a monstrous injustice and injury, and that the tide does not sweep everything away is proved by the local deposits and the samples from the Liverpool outlets. The tidal action is one of oscillation only; what is taken up the river by the flood is brought back again and subsides as the water loses motion. The same effect follows seaward in the opposite direction. The Liverpool outlets having been removed from under our noses do not attract the attention they deserve. The tide covers the filth, but it is nevertheless there.

Adjourned till to-morrow, at Birkenhead, at 11 o'clock.

The Town Hall, Birkenhead.

Thursday, 3rd June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

DR. CHARLES OLIVES BAYLIS examined.

Dr. C. O. Baylis. 3 June 1869.

2055. (*Dr. Frankland.*) Are you Medical Officer of Health for the town of Birkenhead?—I am.

2056. I believe you are desirous of making a statement to the Commissioners on the condition of the foreshore of the river?—Yes. I have submitted samples of the river mud from the shore and at low water mark from the following places to chemical examination, viz., Birkenhead, samples of mud taken under Luggage bridge at low water mark lost 10·5 per cent. by ignition; Liverpool, taken under No. 3 Bridge, Prince's Landing Stage, lost 6·3 per cent. by ignition; Tranmere, taken from Tranmere Pool at about the centre, lost 9·5 per cent. by ignition; from Tranmere beach, equidistant between the Tranmere and Rock ferries, lost 5 per cent. by ignition (at low water mark); Rock Ferry and Waterloo, the mud at each of these places, gives 2·5 per cent. by ignition; New Ferry, taken from shore, half way between New Ferry and Bromborough Pool, 4 per cent. lost by ignition; and Hoylake, which gives 5 per cent. loss by ignition. I have thus found them to be contaminated with organic matter, mostly sewage, to an exent varying from 4 to 10½ per cent. All stank offensively when warmed, and gave evidence both of ammonia and sulphuretted hydrogen. In one case examined for phosphates, the presence of them was freely ascertained. These facts would seem to warrant the inference that the shores of the river would materially affect the salubrity of the adjacent atmosphere, and doubtless this would be markedly so were it not for the enormous influx and efflux of sea water which takes place with such undeviating constancy in its lower course. In this portion of the Mersey the tidal water by its solvent, covering, and antiseptic properties, does under very favourable circumstances prevent contamination, but when the protecting tide leaves the mud exposed during the summer heats or to a hot sun, offensive and injurious gases arise to vitiate the atmosphere, and these have been complained of by various people. A pollution of the river water itself is very evident to those who remember its comparatively clear influx some 30 years ago, or to others who are accustomed to the natural clearness of the sea water in other places less affected by the drainage and sewage of a populous neighbourhood. It is a very popular idea that the enormous quantity of sea water which passes backwards and forwards before Liverpool entirely liberates us in Birkenhead from the effects of their sewage, but my experience and investigations have proved that such is not the case, and that in fact there is an enormous amount of refuse deposited on this and the opposite shores of the river. The popular notion that the mouth of the river is at New Brighton is erroneous. The river there has yet to reach the sea through sand banks. In reality the mouth lies at a distance of 10 miles seaward from thence, and from that point the tidal water flows through channels, to the lake formed by the widening of the river above Birkenhead and Liverpool, and it is returned through the same channels between the sand banks to the mouth above indicated at the Victoria Bar. Now it results from these facts that during the first three hours when the tide begins to ebb, and the sewage is poured out at a point, say between South Birkenhead and Toxteth Park in Liverpool, at the usual rate of the current, about four miles an hour, it will take three hours to carry the sewage down to the mouth of the river and pass it into the sea. During the next or remaining three hours of ebb tide the sewage has not time to reach the Victoria Bar before it is intercepted by the flood tide, which carries it back again into the upper estuary or lake of the Mersey. The result of this state of things is that only during three hours of the twelve, or six out of the twenty-four, can the sewage of Birkenhead and Liverpool find its way into the sea.

2057. (*Chairman.*) Are not the sewers backwatered for several hours during high water?—Yes, in the low parts of the town it is stored in the sewers for some hours. In Liverpool, in some parts of the town, it is the same, but they both have flood gates to prevent the tide going in; the pressure of the water, however in the upper parts of the town, causes a pressure in some of the sewers, which forces the sewage out against the pressure of the lower tide. The point between Seacombe and Princes Dock is the narrowest part of the Mersey, and it is called very aptly the neck of the bottle; here the rocks are worn bare, and neither sand, nor silt, nor sewage matters are deposited there; but both above Seacombe, at Birkenhead, and also at Liverpool this silt and sand and suspended matter are freely deposited. The insoluble parts of the sewage of Liverpool and Birkenhead, which form a very large proportion of the whole of such deposits, amount to 60,000 pounds a day. The main current is at the rate of from four to five miles an hour, but on the sides of the shores it is not more than three or four miles an hour, and there the sand, silt, and sewage are deposited. The rivers Irwell, Tame, Goyt, Bollin, Weaver, and the Mersey itself all bring sewage and deposit manufacturing refuse, which

mix with the sewage of Birkenhead and of Liverpool, and are deposited on the shores. I have calculated the estuary of the Mersey as about 16 miles long, and roughly estimate the average shore to be about one-fourth of a mile wide, consequently there is at low tide an area of four square miles of shore exposed at low tide, and the deposit upon this when acted upon by the sun in hot weather causes an offensive smell. The salt water doubtless modifies this state of things. I analysed a specimen of mud obtained from Waterloo, and I found that it contained 2½ per cent. of organic matter, and this led me to look into the state of the sewage mud on this side of the river. I have analysed specimens taken from New Ferry, Rock Ferry, Tranmere, Bromborough, and from Birkenhead, on the Cheshire side, and on the Lancashire side from Bootle, Liverpool, Aigburth, and Garston. I found all these specimens contained a large amount of sewage matter in them; the highest was 10½ per cent., and the lowest was 2½ per cent.

2058. (*Dr. Frankland.*) Can you state the rate of mortality from 1861 to 1868?—Yes; the first year that a medical officer was appointed, and for which they have kept the returns, was 1864; the death rate was 24·37; in 1865, 21·37; in 1866, 22·44; in 1867, 20·84, and in 1868 it was 20·56. The number of deaths from typhus and other fevers in 1864 was 74; in 1865, 63; in 1866, 48; in 1867 it had decreased to 44, and in the last year (1868), it was as low as 20, showing a decrease in the fever cases, which is perhaps as good a test of improvement with regard to zymotic diseases as I could select.

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2059. To what do you attribute that decrease?—I believe it is partly owing to the better management of the town; but this year it arises in a great measure from the loss of our poorer population, for the very poorest class are getting dispersed in consequence of the cessation of dock and other works; the most miserable class of houses are now without tenants.

2060. (*Chairman.*) Otherwise you might say that as you have more sewage in the river it was to be expected that Birkenhead would be more unhealthy?—I may say that the sewage has been deposited for years.

2061. (*Dr. Frankland.*) Have you tried any experiments upon any samples of mud taken from a perfectly clean part of the shore?—No.

2062. (*Chairman.*) Have you made experiments upon the water?—I have made a variety of experiments and analyses of the water, there is now a very large quantity of suspended matter in it.

2063. (*Dr. Frankland.*) Do you find, as a general rule, that the finer the particles of the mud are the greater is the proportion of sewage?—Yes; next to silt and the finest sand, sewage is deposited.

2064. Would you not expect that the organic matter, being lighter than mineral sand and mud, it would deposit less readily?—Yes; but I have found it in the silt which is of the very finest description.

The witness withdrew.

MR. THOMAS CHARLES THORBURN, C.E., examined.

Mr. T. C. Thorburn, C.E.

2065. (*Mr. Morton.*) Are you the town surveyor of Birkenhead?—I am.

2066. It appears that you have 1,684 acres within your boundary, how much of that is built upon?—The area of the land built upon or laid out for building, inclusive of the dock estate, is 1,164 acres altogether.

2067. But even that is not all built upon?—I cannot answer the question precisely because the buildings are scattered over the entire area. The average population per acre within the district is estimated at 36·8.

2068. What number of houses were there in 1868?—There were 7,761 houses, including 22 in course of erection, 452 warehouses and workshops, total 8,213, exclusive of stables and other out buildings.

2069. Then with regard to the population, which is given as 37,796, was that for 1861 or 1868?—For 1861; in 1868 the population was estimated at about 54,000.

2070. Were the trough closets substituted for common privies?—Yes.

2071. Is that an improvement and a cleaner arrangement?—It is an arrangement that has been found to answer better for the class of property (cottages) to which they have been attached than the ordinary syphon or pan closet would have been.

2072. In your opinion is it a more wholesome arrangement?—It is found to require fewer repairs and less attention than the syphon or pan closets.

2073. As a matter of fact is it a cleaner arrangement as compared with the ordinary privy?—The tumbler closet for sanitary purposes is undoubtedly the better of the two.

2074. In which the water carries the excrement away?—Yes.

2075. What quantity of water do you think is used at each emptying of the closet?—That depends entirely upon the number of houses that are attached to them, and the size of the tank fixed.

2076. What is the average quantity of water that is used?—For a tumbler closet one and a half gallons, and for the ordinary syphon or pan closet two gallons a head per 24 hours. This does not include waste, which is very considerable.

2077. (*Chairman.*) What volume of water is necessary for trough closets?—One and a half gallons a head per day.

2078. (*Mr. Morton.*) Is the tumbler closet self-acting?—Yes.

2079. Does it act well?—When it is properly fitted up. There are however cases in the town where such closets have been improperly fitted up, and have consequently acted badly.

2080. Are all the trough closets cleaned out by your men?—No, because they are self-acting; in the upper end of a tunnel or conduit pipe the tumbler or tank is placed which, when full of water, falls over and flushes the excreta deposited in the trough into the sewer; the quantity of water is regulated according to the number of closets requiring to be flushed.

2081. Is the flushing operation performed by your men?—No; it is entirely self-acting, and is in a separate compartment, which is locked, and entirely beyond the control of the occupier.

2082. Are the privies connected with the ash-pits?—Where there are middens, the privies are invariably connected with the middens or ashpits.

2083. Does the contractor take the contents of the ash-pits away?—He is bound to do so under notice.

2084. It appears that you pay him 1,400*l.* a year for performing that task?—I think it is now 1,500*l.* a year. The contract is for three years, commencing 1st April 1868; it was 1,400*l.* a year for the first year, 1,500*l.* for the second year, and 1,650*l.* for the third year.

2085. What does he get for the stuff he takes away?—I do not know, as by the contract it is the contractor's property.

2086. I see that it has cost 8*s.* a privy, and that it is now more?—Yes; that is about the average cost if you exclude in the calculation the ashpits attached to 3,900 houses provided with waterclosets, by including these you will find the average cost per annum about 3*s.* 10*d.*

2087. At Tranmere it is said that it costs only 3*s.* or 3*s.* 6*d.*?—Yes; but the case of Tranmere and of Wallasey is rather different, because there they are surrounded by an agricultural district.

2088. And there the contractor finds an immediate sale for the refuse?—Yes; and here he is bound to

Mr. T. C. Thorburn, C.E.

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remove it to a distance of two miles from the Town Hall.

2089. Does he take away the whole contents of the ash-pits?—Yes, whatever they may contain.

2090. Whether the whole contents is available for manure or not?—Yes; he is bound to remove all refuse.

2091. Are the ashpits connected with the sewers?—The ashpits or the middens attached to privies are connected by overflow drains with the sewers, and in some instances where the ashpits are not connected with the privies they are drained.

2092. Does the sewer take away the liquid parts of the excrements?—Yes, by means of the overflow drains.

2093. Are the middens roofed over?—They are all open, except some few that have been constructed recently and which are covered over.

2094. Does the ash-pit receive the rain-fall on the roof of the privy?—Yes.

2095. Then a certain portion of the solid parts of the excrements are washed into the sewer as well as the liquid parts?—Yes; the best plan is to cover over and ventilate the middens or ashpits, and prevent rain or slops going in, and exclude the sun's rays therefrom.

2096. Do you think that the ashes would soak up all the wet?—I do not; but I think that the ashes would deodorize and prevent evil effects arising from the excrements; and, if all the yards were provided with a sink, there would be no occasion to throw slops into the ash-pits.

2097. Does the drainage of the north district flow through your sewers?—Yes; the drainage of the north district. In this map (*handing in the same*) you will see it comprises the area of the larger part of Birkenhead. The number of houses that drain from Birkenhead is 5,857, and the area so drained consists of 973 acres, laid out in streets for building, exclusive of 305 acres, the extent of the Dock estate. The south district comprises 126 acres of Birkenhead, and 480 of Tranmere, 180 of the latter being laid out for building purposes.

2098. I see in the north district 1,219 acres?—Yes, that is with Dock estate as well.

2099. There appears to be a considerable country area that is drained into the sewers of Birkenhead?—Yes, there is. This tracing (*handing in the same*), shows the watershed of the whole district.

2100. The drainage area is 21½ square miles?—Yes, the whole of which formerly drained into the head of Wallasey Pool, and was diverted into its present channel on the formation of the Birkenhead docks.

2101. What arrangement have you for escape of storm water in flood times when the main sewers are full, and their outlets backwatered by the tide?—We have no storm outlets, and in the low parts of the district, when the sewer outlets are tide locked, the cellars under the high water level are frequently flooded.

2102. Does the sewage ever flow from the sewers through the gullies into the streets?—No, although there is a portion of Birkenhead where the street is lower than the high-water mark at spring tides; but we get over that by a system of tidal flaps fixed at the outlets through the river wall.

2103. Is the main sewer made of larger capacity to serve as a kind of reservoir when the outlet is tide-locked?—Yes; the sewer for the south district is to be reconstructed, and made larger than it is now for the express purpose of providing for the pent up water, and serve as the storage reservoir for the sewage during high water in the Mersey.

The witness withdrew.

2104. (*Chairman.*) If there are any gentlemen from Tranmere or Wallasey desirous of tendering any evidence, we shall be glad to receive it.—(*Mr. Leigh.*) We have nothing to add, sir, from Tranmere.

Adjourned till Monday, June 7, at 11 o'clock, at Preston.

The Town Hall, Preston.

Monday, 7th June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

MR. JAMES ARMYTAGE, C.E., examined.

Mr. J. Armytage, C.E.

7 June 1869.

2105. (*Dr. Frankland.*) Are you engineer for the borough of Preston?—I am.

2106. Can you hand in plans showing the density of the population in various parts of the borough?—Yes (*handing in the same*). The square lines show the density per acre in each plan. The dots within the squares show the number of deaths. The density amounts to about 300 inhabitants per acre.

2107. Over what proportion of the borough do you consider that so dense a population exists?—I should say over about one-eighth.

2108. Are you quite sure of that, for it is a very great density?—That is in the densest parts, where the buildings are the most crowded together.

2109. How many acres are there in Preston with so dense a population?—I could not tell you without going through them—perhaps only about 20 acres.

2110. Can you give us the mortality in the densely-populated districts as distinguished from those which are less thickly populated?—I cannot do that.

2111–12. Are the dots intended for the entire year?—Yes.

2113. Are you prepared to put in a statement of the mortality at different ages, from the year 1860 inclusive?—Yes.

2114. And also one giving the mortality from all causes, and the per-centage from the different causes?—Yes (*handing in the same*).

2115. Is Preston a privy and ashpit town as contra-distinguished from a watercloset town?—Yes.

2116. Is the privy system, as carried out here, satisfactory?—Yes.

2117. Have you never had any complaints made with regard to the emptying of privies?—Very seldom.

2118. Have you had any experience as to the conversion of privies into waterclosets?—Yes.

2119. What, in your opinion, is the quantity of water per head of the population necessary for the service of a watercloset?—I should think about one and a half gallons a day.

2120. I believe that the quantity put down is about 10 per cent.?—Yes.

2121. Do you find in Preston that there is a great waste of water?—Yes; we find many taps carelessly turned on, and the water occasionally running to waste.

2122. Have you not vigilant inspection of the service fittings?—Yes; there is a very close inspection in Preston.

2123. At present are you not short of water?—Yes.

2124. And you are now, I believe, before Parliament seeking for power to increase the area of supply?—Yes.

2125. Can you subsequently furnish us with an analysis of the water you are going to obtain?—I will endeavour to do so,

2126. Do the people in Preston prefer hard or soft water?—They prefer soft water.

2127. Do they prefer it for all purposes?—I believe they do.

2128. Are there any surface wells, the water of which is used in Preston?—Very few.

2129. Did you not last year resort to them?—Yes, to some of them.

2130. Were many persons supplied with water entirely from wells?—No, not any.

2131. Do you think that any of those well waters were used for drinking purposes?—I think not.

2132. Do all persons make use of the water supplied to the town?—Yes.

2133. For what purpose do they use the water from the wells?—Some of it is used for domestic purposes, but very little. We examined the wells and found nearly all of them dry.

2134. There was but little water to be got from them?—Very little.

2135. Were there any cases of sickness observed when the well water was used?—I am not aware.

2136. How are your sewers ventilated?—By down spouts.

2137. Have you adopted the Archimedean screw principle as used to ventilate the sewers of Liverpool?—No.

2138. Do you merely leave the gases to their own course?—Yes; but one or two sewers are ventilated through charcoal.

2139. Do they answer?—Yes.

2140. Is there no unpleasant stink from them?—No.

2141. Is the arrangement for the charcoal in the man-holes and the gully-holes?—Yes, there are boxes made on purpose.

2142. Are they placed below the gully-holes?—They are attached to the sewer.

2143. Where the sewer communicates?—Yes.

2144. Have you had any complaints made of the down spouts in consequence of the gases finding their way in at the windows?—Not one.

2145. What kind of ventilation for a sewer do you consider is the best?—A shaft or chimney.

2146. Do you mean a chimney in which a fire should be kept burning?—Yes.

2147. Have you calculated the cost of ventilating the sewers of Preston in that way?—I have not.

2148. Do you know whether that mode is adopted in any other town?—I do not.

2149. Do you know any cases in which sewers are connected with factory chimneys?—Not in Preston, but in other towns.

2150. Do you know the effect upon the sewers in those cases, whether they are better ventilated than usual?—I do not.

2151. I believe you have not many cellar dwellings in Preston?—No.

2152. When the cellars are closed as dwellings, are they filled up with rubbish?—They are used for lumber rooms.

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2153. Are there drains from the cellars, and are these connected with the sewers?—Yes.

2154. When a cellar is closed, are the drains disconnected to prevent the gases coming back?—I believe not.

2155. Are there many persons who reside upon the river banks, near to and below your sewer outlets?—Very few indeed.

2156. Have you heard any complaints of the condition of the river?—No.

2157. Have you noticed offensive refuse upon the sand below the sewer outlets?—No.

2158. What disinfectants are used in Preston after the cleansing of middens?—Carbolic acid powder.

2159. Is that put into the privies before they are cleaned out?—No, it is used immediately after they are emptied.

2160. Is the carbolic acid powder mixed with the contents of the middens, or is it only sprinkled on that part of the street where the contents had been temporally deposited?—It is put on to the street and into the middens also.

2161. Does that, as a matter of fact, decrease the stink?—Yes, it does away with it altogether.

2162. What first led you to use those disinfectants?—The offensive stink arising not only from the midden when emptied, but also from the part of the street where the night soil had been shot out of the wheel-barrow to be afterwards thrown into a cart.

2163. Do the people who are near complain of this offensive stink?—No doubt of it.

2164. How long have you used these disinfectants?—For about 10 years. I had used them before I came to Preston; I have not been here long.

2165. (*Mr. Morton.*) By the return furnished to the Commission it appears that there are 2,300 houses having waterclosets, if you deduct that number from the total number of houses there remains 14,000 or 15,000 houses without water-closets?—Yes.

2166. There are also 8,000 privies—are they privies or middens?—Middens.

2167. Having a privy on each side of them?—Yes.

2168. So that there are 16,000 privies?—Yes.

2169. There are therefore more than one to a house?—It is almost so, some of the ashpits have four privies connected to them.

2170. In how many cases is there a privy to which the occupants of more than one house go?—158.

2171. Do the Corporation now insist upon a separate privy being provided for each new house?—Yes.

2172. (*Dr. Frankland.*) Do you know whether the gases occasionally escape from the sewers into the houses?—It is a very rare occurrence.

2173. Or into the cellars?—No.

2174. Does nuisance arise from steam and hot water being admitted into the sewers?—No.

2175. Is the condition of the river as it flows past Preston complained of as being a nuisance?—Yes.

2176. At all seasons of the year?—No.

2177. In the summer time?—Yes.

2178. Was it very offensive last summer?—Yes, during the hot weather and drought.

2179. Were there not last summer a great many fish poisoned by the polluted water of the river?—Yes, a large quantity of fish.

2180. What do you consider is the principal source of the pollution of the river Ribble?—The refuse from the manufactures is discharged into it.

2181. The Ribble or its tributaries?—Its tributaries principally.

2182. Which of the tributaries?—The Darwen, the Calder, and Pendle Brook.

2183. (*Mr. Morton.*) What quantity of liquid flows daily from the sewer outlet?—About two millions of gallons, or nearly two millions of gallons, per 24 hours.

2184. Has the quantity been gauged?—Yes.

The witness withdrew.

MR. HENRY MARRIOTT examined.

Mr. H. Marriott. 7 June 1869.

2185. (*Mr. Morton.*) Are you Inspector of Nuisances for the borough of Preston?—Yes.

2186. Do all the privies drain into the sewers?—Yes.

2187. Does the roof of the privy drain into the ashpit?—In most cases.

2188. Is the ashpit roofed?—Very few of the ashpits are roofed.

2189. Then the liquid excrement from the privy, and, to a certain extent, the washings by the rain of the solid contents of the privy, all drain into the sewer?—Yes.

2190. Where does the drainage go of the manufactories to which you supply 500,000 gallons of water per day flow to?—Into the sewers.

2191. The sewage, of which 2,000,000 gallons run to waste at your outfall, is the water supply to the town after it has been spoiled by use, is it not?—Yes.

2192. Consisting of the waste from the washing tub, the chamber slops, the kitchen waste, and the liquid excrements?—Yes, it all goes into the sewers.

2193. Does the rainfall with the street drainage also go into the sewers?—Yes.

2194. Are the privies in all cases detached from the houses?—Yes.

2195. Do you insist upon that arrangement in the case of new buildings being erected?—Yes, that is done.

2196. Do many of the privies and middens still abut upon the houses?—Very few, except in the older houses.

2197. It appears by the answer in reply to our questions received from the Corporation, that you clear away 25,000 or 30,000 tons of refuse, the contents of the middens, in a year?—I do not know the weight of it, but we clean out from 8,000 to 9,000 middens every year.

2198. Is the whole of the refuse sold as manure?—No, only about one-third is sold as manure.

2199. The contents of the ashpits connected with those houses which have waterclosets are not manure?—No.

2200. Is not some of the dry portion of the ashes taken from the middens?—Yes.

2201. Is the division made by the men at the time the midden is cleansed?—The refuse is first removed to the wharf and is assorted.

2202. What becomes of that which is called the dry part?—It is taken out of the town; none is tipped now within the borough boundary.

2203. How long has the tipping been discontinued?—About a month back.

2204. Is there any chance of houses being built upon that stuff?—No.

2205. It is carried out a long way?—I do not know where it is taken to.

(*The Town Clerk.*) I may say that it is tipped into boats direct.

2206. (*Mr. Morton to the witness.*) What staff is employed to clean out the 8,000 privies or middens per annum?—It takes about 10 horses to do the night soil work, and to each of these horses there are perhaps three men.

2207. Does the night soil include the contents of the dry ashpits?—Yes.

2208. Must the cleaning out of the privies be done during the night?—Yes, from 8 o'clock p.m. to 8 o'clock a.m.; some of the dry ashes are taken out in the daytime.

2209. As I understand you, that whatever ashes are mixed with excrement are taken out at night?—Yes.

2210. How often, on the average, are the privies cleaned out?—A cottage or a small house is cleaned out perhaps twice a year, but the middens vary in size.

2211. What is obtained for the manure when sold?—I do not know.

2212. Are there not in a few instances common privies?—158 are used in common.

2213. Taking a few of the worst cases that you know of, for how many houses is one privy used?—The worst place is called Singleton Row; there are 39 houses to one privy, there is a block of six privies.

2214. Is there a large cesspool behind those?—The midden is drained; it is a large ashpit about the size of one-sixth part of this room, and that is drained, so that it always stands dry.

2215. How often is that cleaned out?—Every three months.

2216. Is it not in a horridly dirty state sometimes;—No; not since it has been drained, the greatest mess is caused in cleansing the separate privies.

2217. How is that done?—Two men go about every week for that purpose.

2218. Are the privies slushed out with water?—They are swept out dry, and then they are disinfected.

2219. A supply of the disinfecting powder being given out to the men every morning?—Yes.

2220. Do they clear out the stuff and then sprinkle some of the disinfecting powder about inside?—Yes.

2221. (*The Town Clerk.*) Do your own men go and do that?—Yes.

2222. (*Mr. Morton.*) Are the men to whom you have referred as attending upon the 13 horses, the contractor's men?—Yes.

The witness withdrew.

MR. EDWARD GARLICK, C.E., examined.

Mr. E. Garlick, C.E.

2223. (*Dr. Frankland.*) Are you the borough treasurer and steward of Preston?—I am.

2224. How long have you been acquainted with the river Ribble?—For 25 years.

2225. Has it always been in the same condition as it is now?—No.

2226. Has it been improved of late years, or has it become deteriorated?—It has become considerably deteriorated.

2226*a*. To what cause do you attribute it?—To the sewage from towns and the refuse from manufactories.

2227. Are the tributaries equally polluted?—Yes, two of the principal tributaries,—the Darwen and Calder, and also the stream from Clitheroe.

2228. Those are the three principal sinners?—Yes.

2229. I believe the Darwen comes in just below Walton-le-Dale?—Yes, nearly opposite Presion.

2230. Where does the stream from Burnley flow in?—Just below Whalley.

2231. At Walton-le-Dale is the main stream considerably polluted?—Yes, it is very much polluted there.

2232. Does it ever stink there?—Yes.

2233. Is that before the junction with the Darwen?—Yes, you may smell it all the way down from Whalley.

2234. I suppose that it varies?—Yes, according to the state of the weather. When there is more water in the river it is better, and in dry weather it is the worst.

2235. Do you know whether the river, when it is in a bad state as it flows past Preston, is a source of discomfort to the inhabitants?—Yes.

2236. Have you known any mischief to be done through it?—Only to the fish, I have seen dead fish floating on the river. I believe that they lost a great quantity of fish last year.

2237. Do you know whether gases from the sewers frequently escape into the houses?—Not unless the traps are out of order; sometimes they are out of order, and then the gas escapes.

2238. Are the sewers sufficiently ventilated to prevent the escape of gas through the traps?—I think so.

2239. (*Mr. Morton.*) Have you gauged the volume of sewage flowing through the out-fall sewer?—Yes, on the 5th of May 1869 I gauged the sewage from the sewers, and on that day there were 10,000 tons or 2,240,678 gallons. (*See statement below and page* 82.)

2240. Had there been no rain previously?—Not of any consequence.

2241. Was that gauging carried on hourly for 24 hours consecutively?—Yes.

2242. Is there any water from land drainage that flows into the sewers independently of the water supply?—Not of any consequence in dry weather; In wet weather the surface drainage, and the rainfall off the roofs of the houses goes in, and a small shower makes a great difference in the volume of the sewage.

2243. Would samples taken to day, for example, be, in your opinion, trustworthy, as representing the sewage of the day?—Nearly so, there would be a little fresh water added to it perhaps; there should be four or five dry days before a sample is taken.

2244. Has anything yet been done to carry out the idea of irrigation?—No, it is only an idea.

2245. Are there any difficulties, that you know of, in the way of carrying it out?—No.

2246. Is there land to be found available for the purpose?—Yes.

2247. If a scheme of irrigation were carried out, how high would you have to pump the 10,000 tons a day?—Perhaps from 20 to 30 feet at the present outlet; but in all the towns above Preston there is quite a sufficient fall for irrigation purposes, without pumping.

2248. Do you think that you could, by intercepting sewers, carry away a good portion of your waste water without pumping?—Yes, I should think at least four-fifths at the present time.

2249. It all flows out at one exit, does it not?—Yes.

2250. Do you think it would be easier to carry it lower down from that point than to pump it on to the land?—Yes, I should think four-fifths of it would flow by gravitation, and the remainder must be pumped, but all the towns above Preston may irrigate the land without pumping, because they are at elevations varying from perhaps 500 feet above the sea down to 200 feet.

2251. Is any of the land lying below you poor or good land?—It is good land; it is worth from 2*l.* to 3*l.*, and garden land, 5*l.* an acre.

2252. Good soil suitable for irrigation?—Yes.

2253. (*Dr. Frankland.*) The land belongs to the Ribble Navigation Company, does it not?—Yes, a portion of the best land belongs to the Ribble Navigation Company.

Mr. E. Garlick, C.E. 7 June 1869.

2254. With regard to the gauging of the sewage, was that done at the time when the sample which has been sent to the Commission was taken?—Yes, on the same day.

2255. Did I understand you correctly to say that some of the surface water flowed into the sewers?—Yes, a little, but not to make any material difference.

2256. Then in your opinion it would fairly represent the average sewage of 24 hours in Preston?—Yes. I have prepared a statement of the heights of the different towns above Preston, showing that irrigation could be carried out without pumping by all the towns situated above Preston, as the land in the valley of the Ribble at Preston is only 25 feet above the level of the sea.

(*The following paper was handed in.*)

POPULATION of the PRINCIPAL TOWNS in the RIBBLE BASIN, and the ELEVATION above the sea at which the polluted water from each town may be diverted for irrigation purposes.

	Town.	Population.	Feet above the Sea.
	ABOVE PRESTON.		
DARWEN	Blackburn	66,418	300
	Witton	—	280
	Darwen, "Over"	16,492	425
	Darwen, "Lower"	3,301	350
CALDER	Church	12,452	350
	Accrington	17,688	400
	Rishton	1,198	270
	Clayton-le-Moors	4,682	200
	Harwood	4,070	250
	Burnley	37,984	325
	Padiham	5,911	230
	Trawden	2,087	500
	Colne	7,906	400
	Barrofword	2,880	375
	Sabden: Weswell	465	400
	Sabden: Heyhouses	128	
RIBBLE	Clitheroe	7,000	200
	Chatburn	803	275
	Barnoldswick	2,310	475
	Settle and Giggleswick	2,313	420
	Long Preston	536	450
	BELOW PRESTON.		
	Wigan	37,658	70
	Chorley	15,013	225
	Whittle	2,215	200
	Bamley Bridge and Walton	7,383	125
			25
	Kirkham	3,943	25
	Lytham	3,194	10
	Ormskirk	6,426	125
	Southport	14,661	10

The witness withdrew.

(*The witness subsequently forwarded the following communication.*)

VOLUME of SEWAGE flowing from the TOWN of PRESTON hourly during the third day of July 1869, and also the Quantity of Water supplied hourly to the town from the PRESTON WATER-WORKS on the same day.

A considerable number of the cotton manufactories in the town are not being worked, and generally trade is dull.

The weather being fine and dry at the time of the gauging of the sewage, the only supply of water to the sewers would be from the waterworks.

The population of the town is estimated at 94,000.

It will be seen on reference to the Table below, that during 24 hours there is only a small difference between the amount of water supplied to the town and that discharged from the sewers. The difference is a little less than a quarter of a gallon per head of the population.

The supply of water to the town from six o'clock at night to six o'clock in the morning is considerably more than the sewage discharged during the same time, but from six o'clock in the morning to six o'clock in the evening the reverse takes place, showing that during the night water is stored in the reservoirs connected with the manufactories, and used in the daytime.

The total amount of sewage discharged in 24 hours was 343,100 cubic feet, or $22\frac{3}{4}$ gallons per head of the population.

The greatest flow from the sewers was at 10 o'clock in the forenoon, when it was at the rate of $37\frac{3}{4}$ gallons per head of the population in 24 hours. The least flow was from 3 to 5 o'clock in the morning, when it was at the rate of $10\frac{1}{2}$ gallons per head of the population in 24 hours.

7 June 1869.

MEASUREMENT of the HOURLY DISCHARGE of SEWAGE from the TOWN of PRESTON, and the Supply of Water to the Town on the third day of July 1869.

Population 94,000.

One Hour from	Water supplied to the Town.	Sewage discharged from the Town.	One Hour from	Water supplied to the Town.	Sewage discharged from the Town.
	Cubic feet.	Cubic feet.		Cubic feet.	Cubic feet.
Midnight, 12 o'clock to 1	10,527	7,596	Noon, 12 o'clock to 1	17,898	20,304
1 „ 2	9,015	7,005	1 „ 2	15,503	16,482
2 „ 3	10,514	6,714	2 „ 3	19,356	17,862
3 „ 4	12,010	6,624	3 „ 4	17,852	21,378
4 „ 5	9,003	6,624	4 „ 5	18,728	21,414
5 „ 6	9,000	10,530	5 „ 6	17,820	21,302
6 „ 7	11,992	14,868	6 „ 7	14,838	16,152
7 „ 8	13,484	16,368	7 „ 8	16,309	10,284
8 „ 9	17,066	18,942	8 „ 9	14,815	9,213
9 „ 10	20,331	22,062	9 „ 10	11,844	8,817
10 „ 11	17,931	23,187	10 „ 11	11,836	8,661
11 „ 12	19,407	22,356	11 „ 12	9,466	8,355
			Total in 24 hours -	346,545	343,100

DR. HENRY ASHTON examined.

Dr. H. Ashton.

2257. (*Dr. Frankland.*) Are you in general practice in Walton-le-Dale?—Yes.

2258. How long have you known Walton-le-Dale?—For 20 years.

2259. In your experience has it generally during that time been a healthy place?—Yes, I consider that it is a very healthy place.

2260. When did it become unhealthy?—I have never known it to be unhealthy.

2261. Not last year?—No.

2262. Had you not rather a severe outbreak of fever at Walton-le-Dale last year?—No. I considered it to be of the nature of a modified sunstroke which took place. A number of people were taken ill in a mill through working under glass in a weaving shed. There were from 100 to nearly 200 taken ill, and there were sporadic cases afterwards. As soon as Messrs. Calvert whitewashed their glass and slates the seizures to a great extent ceased. A sample of water from a well in Walton-le-Dale was sent to London by Dr. Conway Evans, the water from which well had never been used for seven years, and this well had been converted into a tank to receive the sweepings of yards. I believe there were other samples taken. I mention this case in particular, because I suppose that it was actually the sweepings of yards were sent to London for examination.

2263. Is it your opinion that the disease was not typhoid fever?—Yes, that is my opinion.

2264. Had the condition of the river anything to do with the outbreak of disease?—I do not think it had. All the seizures, with very few exceptions, took place at Messrs. Calvert's mill, and in all the cases I saw the people were suffering from head symptoms, suffusion of the eyes, and congestion of the lungs.

2265. Was the disease confined exclusively to the hands at Messrs. Calvert's mill?—Yes, with very few exceptions. The inhabitants, generally speaking, were free from disease, that is to say, those who were not employed in the mills.

2266. Were there any cases among persons who were not employed in the mills?—Yes; one of the reporters who is present here to day was attacked.

2267. And it was a case of the same kind?—Yes.

2268. Do you consider that those cases which occurred in persons not employed in the mill were separately induced, and that they were also cases of direct sunstroke?—I think that several cases were; for instance, in the case of Mr. Aspden, he was seized with pain in the head at the beginning of his illness, having been very hard worked, and having made some over exertion during the hot weather.

2269. Will you be kind enough shortly to describe the main symptoms of this disease?—The majority of the persons attacked, coming under my observation, complained of a pain in the head and at the back of the neck, with suffusion of the eyes, and with symptoms of acute excitement. Of course, as regards the peculiar state of the constitution as being predisposed to its effects, some of them suffered severely, while others were able to go to their work again in two or three days.

2270. How long did the disease run before the patient recovered?—For several days before the acute symptoms were subdued, and in many cases several weeks elapsed before recovery.

2271. Do you think that the symptoms were well marked as being entirely different from those of typhoid fever?—Yes; and I did not treat them as cases of typhoid fever, the majority requiring a continued use of strong purgatives. With regard to one case I brought before Dr. Conway Evans, it was the case of a person whose symptoms were well marked. I invited him to see the case, and he said to me afterwards, "If I had had this case in London I should "at once have ordered the patient to the fever "hospital." That was on a Thursday, and on the Monday following the man was able to mow half an acre of hay grass.

2272. Do you consider that the river Darwen, as it flows through Walton-le-Dale, is a source of discomfort to the inhabitants?—It is complained of, but I do not consider it a source of ill-health. With regard to the wells in Walton-de-Dale village, I have a memorandum of the depths of some of them. The bottoms of the wells are at a higher level than the bottom of the river, and the water in them stands something like from two or three feet higher than the water in the river does during dry summer weather when the two rivers have little water in their channels.

2273. From what source were the operatives who were employed by Messrs. Calvert supplied with water?—They were supplied with water from a well on their premises.

2274. Has the source of their supply been altered since that time?—Yes.

2275. What was the object of doing that?—It was done at Dr. Conway Evans' suggestion. They would very gladly not have done it, because it has entailed an expense upon them of very many pounds per annum.

2276. Have there been any similar cases of illness since the change was made in the water supply?—No.

2277. Was the change in the water supply made in the hot weather?—It was after the seizures of illness had to a great extent ceased.

2278. Was that after the hot weather?—No; it was during the hot weather.

2279. Are there many privies in Walton-le-Dale?—Yes; but not so many privies in proportion to the number of the houses as in other places.

Dr. H. Ashton.

7 June 1869.

2280. Are there several houses, the occupants of which have to use one privy?—Yes.

2281. What is the character of the middens in Walton—are they wet or dry?—They drain into the soil, it being of a porous character.

2282. How deep do the middens go into the soil?—Not deep, as a rule.

2283. As much as four or five feet?—I cannot answer that positively.

2284. What is about the depth of the wells you spoke of as being used in Walton-le-Dale?—One well from the surface of the ground is 16 feet 3 inches deep, and it is 17 feet from the same level of surface to the bed of the river Darwen.

2285. What is the character of the soil in which these wells are sunk?—A porous character.

2286. Is it a gravelly soil?—Under the mould is a clay loam, retentive of water, then a stratum of gravel, then a condensed clay, and under it the red sandstone which crops out in Walton-le-Dale.

2287. Walton is rather densely populated, is it not?—Yes, in some parts of it.

2288. The houses have only small yards connected with them?—A number of the houses have none at all.

2289. Where are the wells situate, are they within the yards?—Not generally.

2290. How far are the wells situated from the privies?—About 10 feet; some are considerably more than that; there are one or two wells near to privies.

2291. You have stated that the ashpits are all dry?—Yes, as far as I know.

2292. Where does the liquid drain to?—Not into the wells I think.

2293. (*Chairman.*) Why not?—Because I think that if the level of Walton is taken you will find that the drainage will go into the river. The ashpits that are on the banks of the river drain into it.

2294. (*Dr. Frankland.*) If a privy is within 10 feet of a well, and the level of the water in the well is below the bottom of the privy, would not the liquid contents naturally drain into the well?—Dr. Conway Evans tells us that the night-soil brought from Preston, and spread as manure on garden land, has gradually percolated into these wells and produced illness, but against that there is this fact, that the land, which consists of gardens, is upon a lower level than that upon which the houses are built, and in which the wells are situated.

2295. Is it at a lower level than the water in the well?—I should think not.

2296. (*Mr. Morton.*) Is Walton-le-Dale sewered?—No, except surface drains.

2297. Are the privies drained?—

(*The Town Clerk.*) During last year an inspector of nuisances was appointed for Walton-le-Dale, and we requested Mr. Marriott to give him all the assistance that he could; he inspected all the privies, and will be able to tell you the state he found them in.

(*The witness.*) They were very full at that time, but I think that the soil would naturally drain the ashpits.

2298. Do you find that the level of the water in the wells is affected by the tide in the river Ribble?—There is a flow of water out of the wells into the river, but not from the river into the wells. The water in the wells remains at a pretty constant level, and as the wells are situated generally in a line with the river, if there was a flow of water from the river into the wells they would be contaminated by the polluted river.

2299. If there are a number of privies between the river and the wells, and their liquid contents soak into the ground, might not the river water drive the soakage of the privies before it into the wells?—I do not know. I may mention that our death rate in Walton is about 22½ per 1,000.

2300. What did the death rate rise to during the sickness that prevailed?—The death rate for the time, taking 5½ persons to a house, would be 24 per 1,000 for 12 months, from June 1867 to June 1868, and in that time eight deaths occurred from the prevailing epidemic; without these the death rate would have been 20 per 1,000 in the village.

The witness withdrew.

MR. HENRY MARRIOTT recalled.

Mr. H. Marriott.

2301. (*Dr. Frankland.*) We understand you were appointed to inspect Walton-le-Dale during the prevalence of the sickness there last year?—I was.

2302. What did you find to be the condition of the privies and wells at that time?—I examined every privy but not the wells, and in most cases water was running out of the middens, two or three of them being within a few feet of the wells that were the dryest.

2303. Where did the liquid drain to?—On to the land.

2304. Is it a porous soil?—Yes.

2305. Did it occur to you that there was a possibility of the liquid getting into the wells?—I am certain of it; it could not help it if the well was lower than the privy.

2306. Did you test the water?—No; the handles to nearly all the pumps were taken away.

(*Mr. Ashton.*) I should say that for every one taken away there were four or five left.

The witness withdrew.

MR. JAMES BIRCH examined.

Mr. J. Birch.

2307. (*Dr. Frankland.*) What are you?—I am the head water bailiff.

2308. Have you known the river Ribble for many years?—I have known it all my life.

2309. Is it a very celebrated salmon stream, and is it in as good a state now as it used to be?—The condition of the river is not so good, but there are more salmon in it now than we have had for years, owing principally to some of the tributaries in the upper part being better during spawning season.

2310. Has anything been done in the estuary to give the fresh sewage access to the higher parts of the river, or in the tideway?—No; but the pollution has yearly increased.

2311. Have you not abolished the fixed engines?—Yes.

2312. Has that had a marked influence upon the quantity of fish in the river?—Yes, but although they have abolished the fixed engines, they take them now with half nets, more so than they did with the balk nets.

2313. Did you, during last year, observe any deleterious influence upon the fish in the river near Preston?—Yes.

2314. When was that?—From the 8th to the 18th of July last year, we took out after each tide about two hundredweight of fish, which had been poisoned by the polluted river water.

2315. Did other people also take out fish so poisoned?—Yes.

2316. To what did you attribute the cause?—The sewage and filth from above.

2317. Do you attribute it to the Preston sewage?—Yes most of it.

2318. Do you think that the river Darwen had nothing to do with it?—It had something to do with it.

2319. Did you observe this destruction of fish at

Mr. J. Birch.
7 June 1869.

high water, or at low water?—At low water, but we could see them rolling about before that.

2320. Do you consider that this was the result of the sewage, or the result of some chemicals that had been put into the river?—I consider that it was owing to the sewage, because the fish seemed to be choked; their gills were filled with dirt.

2321. Did the river stink at that time?—Yes.

2322. Have you noticed that when the river decidedly stinks, the fish are very much affected by it?—I have observed at low water, at different times, below Preston, the fish go back when they have had to face the filth flowing down.

2323. Have you known the fish to be poisoned when the water in the river did not stink?—No, except when there have been chemicals thrown in above.

2324. Have you noticed it then?—Yes.

2325. Do you mean by chemicals, lime?—Yes.

2326. Do you consider that the liquid which comes from the manufacturing of Esparto grass into paper deleterious to fish?—Yes, and we have fined the owner of one of the paper-works at Clitheroe for polluting the river with that refuse.

2327. Did they kill the fish in the river?—Yes, a great quantity.

2328. Was that done by the use of chemicals?—Yes.

2329. How do you know that it was not done by the Esparto liquor?—It was chloride of lime.

2330. Have you had any case of fish being poisoned unmistakably by the yellow liquor that comes from the Spanish grass used in paper-making?—I have seen the fish killed when the chloride of lime went in, and the river smelt strong of it.

2331. Have any fish been poisoned by refuse from the gas-works?—Yes, from Settle; it destroyed nearly all the fish in the river from Settle to Clitheroe.

2332. The case you have referred to was a very bad one, was it not?—Yes.

The witness withdrew.

(*Chairman.*) If there are any riparian proprietors who wish to make any statement, we shall be very glad to hear them. As no one answers, we will now adjourn.

Adjourned till to-morrow at 11 o'clock at Chorley.

The Court House, Chorley.

Tuesday, 8th June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

MR. JAMES DERHAM examined.

Mr. J. Derham.
8 June 1869.

2334. (*Mr. Morton.*) Does the drainage of Chorley run from only one outlet into the river?—Yes, from the town proper.

2335. Does that outlet deliver the rain that falls upon the area of the local board of health district as well as the drainage of the houses?—Only that of the town proper and the lands immediately adjoining.

2336. What part of the area is built upon? How many acres?—The area of the Local Board of Health district is 3,613 acres, and buildings are scattered over about 1,000 of those acres.

2337. Are the figures 15,000 as the population, and 3,500 houses, for 1861 or 1868?—The number of houses is the present number, but the population is according to the census of 1861.

2338. What is the present population?—We estimate it at 19,000.

2339. Of the 3,500 houses in which those 19,000 people live, how many are connected with the sewers?—About 3,000.

2340. Are there at the present time 200 waterclosets?—Yes, about that number.

2341. How many privies are there?—There are 1,000 connected with the sewers.

2342. Upon the average there is one privy to every two and a half houses?—Yes.

2343. Is the privy an ashpit with which more than one privy is connected?—It is a privy with use of ashpit; there may be two or three privies connected with one ashpit.

2344. Virtually then there is double the number which you have given?—Yes; in some cases perhaps there is one ashpit to half a dozen privies.

2345. (*Chairman.*) As a general rule, is there a privy to each house?—No.

2346. (*Mr. Morton.*) Are there courts in which there are common privies?—There are some, but not in many cases.

2347. Are all the privies connected with the sewers?—In the town proper.

2348. Are the ashpits roofed?—No; they are open.

2349. Do the roofs of the privies drain into the ashpits?—Most of them.

2350. So that the rainfall, together with the liquid excrement, all goes into the sewers?—Yes.

2351. Does all the water which is supplied to the town flow into the sewers?—No; merely of the town proper.

2352. That is to say, 20 gallons a day distributed over 15,000 people—which would be 300,000 gallons a day—go into the sewers?—No; there are only about 13,000 people in the town proper.

2353. Then it would be 260,000 gallons a day which go into the sewers?—We estimate that it is 20 gallons per head.

2354. All that is spoiled by use goes into the sewer, does it not?—Yes.

2355. What amount of money was borrowed to carry out the necessary work for irrigation?—2,300*l.*

2356. Was that all that you needed?—That was all we need at present; perhaps we shall want more.

2357–8. Was that expended upon the laying out the land and for the iron conduit?—Yes; about 1,100*l.* was expended in laying down the iron pipes to convey the sewage to the farm, and the remainder

was expended in preparing the land to receive the sewage.

2359. At what distance is the farm from Chorley?—About three-quarters of a mile, and about 600 yards from the point where the sewage is diverted from the main sewer.

2360. What is the acreage of the farm?—The farm is 87 acres, but there are only 60 suitable for irrigation.

2361. Have those 60 acres been laid out?—We have laid out 41.

2362. Is the natural slope sufficient for the purpose?—Yes.

2363. Is the outlet upon the top of the land (*pointing to a plan*)?—Yes.

2364. So that you have the command of the whole of it?—Yes; the iron pipe is in the form of a syphon, running down hill, and then the sewage rises up again by pressure.

2365. Is the top of the land below the lowest privy in Chorley?—Yes.

2366. Are you irrigating in ridged lands or by contour lines?—Part of it will be contoured.

2367. When was the land taken?—About 15 months ago.

2368. Is the land in crop?—I have sown some of it.

2369. A green crop?—Yes.

2370. Is some of it in grass?—Part of it is; what I have in hand is not, but it is all in crop and under tillage.

2371. Is the sewage flowing on to-day?—Yes.

2372. Can we see the effluent water?—Yes.

2373. With regard to the cleansing of the privies, is that done in the night?—We do it both night and day.

2374. The dry pits are cleansed in the daytime?—We can cleanse them at any time, as we use McDougall's disinfecting powder, which takes away all stink.

2375. What proportion of the whole contents of a privy is useful as manure?—We sell the whole of it; but there are a great many ashes mixed with the excrement.

2376. Is there a division made of the dry from the wet contents?—No.

2377. Do you know what per ton is received for it?—It is 1*s.* a load, of from 25 to 28 hundredweight.

2378. What capital do you expect you will require to enable you to work the irrigation farm of 87 acres?—I do not know.

2379. Shall you stock it or sell the produce?—The Commissioners have not determined what to do.

2380. Is all the sewage of the town now discharged upon the farm?—The whole of it goes on to the farm.

2381. Is there any possible exit for the sewage except through the conduit pipe?—Yes.

2382. What happens when there is an unusual rainfall?—It goes direct into the Chor; we do not deal with that.

2383. What is the size of the conduit pipe?—Fifteen inches. *Mr. J. Derham.* 8 June 1869.

2384. What is the fall between the lowest point of it here (*pointing to the plan*) and the top of your land?—About 15 feet.

2385. In 600 yards?—Yes.

2386. Sufficient to carry the 2,500 tons of sewage a day?—Quite sufficient.

2387. Is there anything but the drainage from the waterclosets and privies that can get into the conduit pipe?—Yes, the refuse that comes from the mills; it is not a river; it is a stream; it is all taken up.

2388. (*Chairman.*) Can you swallow up the whole of the stream?—Yes, in ordinary weather.

2389. (*Mr. Morton.*) Is there any offensive matter from manufacturing processes that gets in?—Not particularly.

2390. Only the water that has been used for condensing purposes?—Yes, and some refuse water.

2391. (*Dr. Frankland.*) Have you converted any privies into waterclosets?—Very few.

2392. Have you turned your attention to the additional quantity of water that will be required per head when that is done?—No.

2393. Is the soil that you are irrigating an absorbent soil, or the contrary?—No. It is stiff clay. We drain the land, and some of the sewage goes into the drains, which I must stop.

2394. Would your arrangement with the Liverpool Corporation, with regard to the supply of water, justify you in taking the additional quantity of water which would be necessary in case you used waterclosets instead of privies?—Yes.

2395. (*Chairman.*) Is there a limit to the supply per head?—No, there is not.

2396. What is the actual condition of your bargain?

(*The Town Clerk.*) I will furnish you with a copy of the Act.

2397. (*Dr. Frankland to the witness.*) Are your sewers satisfactorily ventilated?—Yes.

2398. Do gases escape into houses?—Not now; from the old sewer there was escape into the houses.

2399. What is the condition of the cellars that are inhabited?—Some of them are bad and dirty.

2400. Have you not the power to close them?—Yes.

2401. Are those cellars connected with the sewers?—Yes.

2402. Are the slop stones carefully trapped?—Yes.

2403. (*Mr. Morton.*) Does the sewage received at the farm vary in quality from hour to hour during the day?—Not from hour to hour, but it does during the day; there is not much difference.

2404. It is the continual drainage of the privies which is different from the drainage from waterclosets?—Yes.

2405. In the case of a privy it comes on old and fœtid, but in the case of a watercloset it comes on within half an hour after it had passed?—Yes.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock at Wigan.

The Court House, Wigan.

Wednesday, 9th June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary*.

MR. JOHN LAW HUNTER, C.E., examined.

Mr. J. L. Hunter, C.E.

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2406. (*Dr. Frankland.*) Are you surveyor to the borough of Wigan?—I am.

2407. You were with us last year when we took a sample of the water supply?—Yes.

2408. It was taken from the Corporation Works?—Yes.

2409. Do you know of any cause which was in operation at that time which led to a slight pollution of the water?—I am not aware of any.

2410. What is the character of the gathering ground?—The whole of it is cultivated.

2411. With what is it manured?—Principally by farmyard manure.

2412. Is any privy stuff laid about it?—Very little.

2413. (*Mr. Morton.*) Is the land of the gathering ground ploughed land?—It is arable land and meadow land under general cultivation.

2414. (*Dr. Frankland.*) That would probably account for the evidence of pollution?—Yes.

2415. Have you now a sufficient supply of water?—We have.

2416. For all purposes?—Yes.

2417. Can you give us the volume which is supplied per head to the population each day?—We now deliver 17½ gallons per head to the population daily, taking the population at about 40,000.

2418. Is that quantity supplied to the whole of the town?—Yes; there are very few houses now that are not supplied.

2419. Is there not a considerable suburb of Wigan which obtains its supply from other sources?—Do you mean beyond our district?

2420. Yes, at the other side of the river Douglas?—No.

2421. Is there no extensive collection of houses that you do not supply with water?—No. There are some cottages that are not all supplied, but the service is being laid on, and connexion made with the mains.

2422. Is there any water used in the town at the present time which is obtained from wells or pumps?—Scarcely any. Several of the wells we have filled up.

2423. When did the waterworks come into full operation?—Last year.

2424. In 1866 was not a good deal of water obtained from the wells?—Yes.

2425. I believe the water obtained from those wells was analysed at that time?—Yes.

2426. Was it found to be much polluted?—Yes.

2427. Does the mode adopted in Wigan for ventilating the sewers by stack pipes perfectly answer?—Yes, and I have no fear whatever in going down any of the man-holes and along the main sewers.

2428. Have you had any complaints made of the gases from the stack pipes being blown into the windows of the houses?—No; special care is taken to avoid putting the stack pipes near windows.

2429. Are any of the ventilators on the Archimedean screw principle?—Not one.

2430. Is there any escape of sewer gases into the houses?—I do not know of a case.

2431. What is the condition, in the summer time, of the river which flows through Wigan?—The river varies in its condition very much. Some days it is comparatively clean and not offensive to the eye. At other times, when the works on the higher parts of the stream, such as the calico-print and dye works at Adlington, are in full operation, the river becomes very foul indeed.

2432. Is it only in the summer time that it is really offensive to the nose?—It is very offensive at times, both in the winter and in the summer.

2433. Do the people living near to it complain?—Some of the people complain.

2434. Does any of the sewage of the town pass into the river as it flows through Wigan?—No, it is all discharged at one point.

2435. Is that (*pointing to a bottle*) a fair sample of your sewage?—Yes.

2436. It is a very strong sewage?—Yes.

2437. Have you at all turned your attention to the effect of converting the privies into watercloset, and estimated the additional quantity of water that will be required?—No, because until last year we were not in a position to supply closets with water. In forming an opinion upon the quantity of water sufficient to supply closets a great deal depends upon the kind of watercloset that is used, and the precautions that are taken to prevent the waste of the water.

2438. Do you know the construction of tank closets?—Yes.

2439. Are you acquainted with those that are used in Liverpool?—Yes.

2440. The tumbler closets?—Yes.

2441. Supposing waterclosets to be introduced for cottage property, what in your opinion, is the best form of closet to adopt?—The tank closet lately introduced into Liverpool I believe is by far the best.

2442. Have you considered how far your water supply would enable you to furnish the quantity requisite for those closets?—If we had had a considerable number of those closets in use the latter part of last summer we should not have been able to supply them with water.

2443. If I understand your answers to queries rightly, you receive your supply in the upper reservoir; it then passes through filter beds, and is pumped from thence to the town for supply?—Yes.

2444. Is there nothing mixed with it there?—Nothing at all; it is pure filtered water.

2445. (*Mr. Morton.*) Has the number of the house which is stated in your answers to queries as 6,700 reference to the present date or 1861?—To the present date.

2446. Is the sewage from them drained to one outlet?—Yes.

2447. Does the Douglas goyt receive any of the drainage of Wigan?—No.

2448. In the answers to queries it is stated there are 1,500 privies. Are we to understand that there are 1,500 privies and 1,500 ashpits?—Yes, but in many cases there are two and in some cases three privies to one ashpit.

2449. That very materially affects the question of decency and comfort?—Yes, no doubt, I should mention that there is a class of property, consisting of very old cottages, where a few years ago there was perhaps only one privy to 10 or 15 or 20 cottages.

2450. Are there any such instances now?—There are.

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2451. Is not that a very filthy and uncomfortable arrangement?—Yes, it is.

2452. How often are the privies cleaned out?—As often as they are full.

2453. Are they cleaned out by men employed by the Corporation?—Yes; the Inspector of Nuisances give a written notice to the contractor when it is necessary to clean them out.

2454. Does he himself receive notice, or does he personally inspect the state of the privies?—He receives notice, and it is his duty to inspect them as well.

2455. Do you know how often the middens are cleaned out in a year?—Three or four times, and probably more. Some of the ashpits are very large and hold an immense quantity of stuff, and these are not cleaned out so often; but since buildings have been erected under the byelaws of the Corporation the ashpits have been made smaller, in order that they may be emptied more frequently.

2456. In the case of new buildings being erected, have the authorities insisted upon adequate accommodation being provided?—Yes.

2457. What is the regulation that you oblige parties to comply with?—We do not allow more than two houses to one privy.

2458. Have you fixed any limit as to the size of the privy?—Yes; a size is recommended which is very generally followed, but we have no power as to a particular size, or the arrangement of them.

2459. A portion, of course, of the contents of an ashpit is dry and a portion is wet?—Yes.

2460. Is there any division of the contents, or is the whole of it taken away as manure?—It all goes together.

2461. Do you know what is obtained for the stuff when it is sold?—I do not know.

2462. Does the contractor receive 800*l.* and the refuse for cleansing the privies and middens?—Yes.

2463. Has he anything to do with the street sweepings?—He has only to remove them.

2464. Are they taken away as manure?—Yes.

2465. Are the whole of the middens drained into the sewers?—As a rule they are all drained into sewers.

2466. Is the contents of the ashpit occasionally liquid filthy stuff?—Where the cesspools are not drained it is so.

2467. What means are taken to purify them, are disinfectants used?—In every case where the Inspector of Nuisances considers it necessary, or when we had a medical officer; whenever one or the other considered it was necessary then a disinfectant was used.

2468. Do you know the volume of sewage that flows from the sewer-outlet into the Douglas?—I have not gauged it.

2469. Does it amount to more than the water supply?—It cannot be very much more.

2470. Are there no land springs?—No.

2471. Is the whole of the surface area, comprising 2,170 acres, drained by your system of sewers?—No a great deal of it is agricultural land; the town portion is all arranged to be drained, and the works carried out according to the circumstances.

2472. Has irrigation been suggested as a possible means of dealing with the sewage of Wigan?—It has.

2473. Do you think there will be any difficulty in carrying it out?—I do not know.

2474. How many miles would you have to convey the sewage if you adopted that scheme?—About seven miles from Wigan, in the neighbourhood of Newburgh.

2475. If you were to pump the sewage could you obtain land, nearer to the town, upon which to apply it?—Yes; and land that is not likely to be required for building purposes.

2476. What is the level of the lowest part of Wigan?—The lowest part of our district is about eighty feet above Ordnance datum.

2477. Supposing that a plan of irrigation were adopted, have you any powers to enable you to carry it out?—We have power under the Sanitary Act to acquire land for sewage purposes.

2478. It appears that you have the sewage of 41,000 people, running out at one outlet?—Yes.

2479. Independently of what is taken away by the scavengers?—Yes; barring, of course, that there is a small part of the population who reside in the country districts, which is not included, but that is a very small part.

2480. That which runs out at the exit consists almost wholly of liquid excrements, and the washings of the solid excrements to some extent?—Yes.

2481. Are the ashpits roofed?—No.

2482. Do the privies drain into them?—Yes.

2483. Does that vary from day to day, as you say the river does, in quality?—I should think not.

2484. Does it vary from hour to hour?—I have not discovered any difference.

2485. Would a sample taken at noon be a fair sample of it?—Yes, I should say so.

2486. Does it dwindle down in quantity at night? Yes; there is less then because there is less consumption of water.

2487. (*Dr. Frankland.*) Do you suppose that the whole of the water supply, taking it at 17 gallons per head, passes off through that sewer?—Yes; no doubt it must do so.

2488. You stated just now that there were some outlying districts that were not yet sewered, and from which consequently the excrementitious matters would not come; are they to be considered unimportant?—They are provided for in the general sewerage scheme; it is a question merely of time. We took what we considered to be the worst districts. There are certain districts that are not much built upon, and there is one other upon the low level, at Poolstock, which is not yet connected with the main sewer; but they are all provided for in the general sewerage scheme, and no doubt they will in time be connected.

2489. How far does the sewerage system extend northward in the borough?—It extends up to that point (*describing on the map*).

2490. And, as I understand you, it will be continued further?—Yes, no doubt of it; it has been extended within the last 12 or 18 months, and it is only a question for the Town Council to say when it is to be carried further.

2491. Can you furnish us with the rate of mortality?—Not at the present moment, but I will get it for you.

2492. We should like to have it for several years past?—Yes.

The witness withdrew.

MR. THOMAS FISHER examined.

Mr. T. Fisher.

2493. (*Dr. Frankland.*) Are you a surgeon in practice in Wigan?—I am.

2493*a*. How long have you known Wigan?—I have known it for the last 50 years.

2494. What is your opinion about the healthiness or otherwise of Wigan?—I think that it ranks pretty high as compared with most other towns in salubrity.

2495. What are the principal epidemics that prevail in Wigan?—Scarlatina, typhus, and typhoid fever. Bronchitis is the most prevalent disease here, and it is on the increase.

2496. Have you been visited in Wigan by cholera?—Yes, we have had several visitations of cholera.

2497. The last I believe was in 1866?—Yes.

2498. It did considerable havoc in Wigan, did it not—many persons died?—Yes.

2499. To what do you attribute the outbreak on

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that occasion?—It might be from some contamination in the water the people were using in those days; they were not supplied with the town's water in those days so much as they are now.

2500. Whence did they obtain their water supply at that time?—Many of them obtained it from wells that have now been filled up.

2501. Are they all closed?—Yes.

2502. Were any of them situated near privies?—Many of them were.

2503. Are you aware whether the drainage from the privies got into the wells?—I believe it did into most of them, and it was well proved by analysis that they contained nitrates and nitrogenous matter.

2504. Did the water stink?—No; not that I am aware of. The people seemed to like it very well; it was sparkling and sharp.

2505. Do you remember previous visitations of cholera in Wigan?—Yes, in 1854 and 1859; but the outbreak of cholera in this district, that was most severe, was in 1832; not so much in the borough, but chiefly in the outlying places. At Marsh Green, which is lower down, it was very fatal.

2506. Is Marsh Green on the banks of the Douglas?—Yes; perhaps 200 or 300 yards from it.

2507. Where did the people get their water from then?—They got it chiefly from the wells in the village.

2508. Not from the river Douglas?—No.

2509. What do you think scarlatina arises from?—In a great measure from bad ventilation in houses, and from sewer gases.

2510. Do the gases from the sewers find their way into the dwellings of very poor people?—Yes. I have seen epidemics frequently arise in houses from defective traps, and from their not being kept cleansed.

2511. Are the privies in Wigan situate very near to the houses?—Yes, many of them are, but most of them are at some distance from the houses.

2512. Do they sometimes abut on the wall of a house?—Formerly they were so built, but they are now detached.

2513. Are the privies sometimes inside the houses?—No, I am not aware that there are any privies inside.

2514. Or any under sleeping rooms?—No, only waterclosets.

2515. In what part of the town does typhus, typhoid, and continued fever prevail?—Chiefly in the most filthy parts of the town,—in the low lying districts.

2516. Are those parts of the town near to the river, or away from it?—Barlows Yard, Scholes, Lime Street, and School Street are regular fever nests, and they are not far from the banks of the river.

2517. To what do you attribute this liability to fever in those districts?—From the low-lying situation of the place, and emanations from the river.

2518. Do you think that the river has a decided influence upon the health of the inhabitants living in those places?—I do not think that it has so much influence upon the health of the inhabitants of the borough, as it has upon the inhabitants lower down.

2519. That is to say, after the sewage of Wigan has been put into the river?—Yes, I think it operates more upon the inhabitants who live below us, and not so much upon the inhabitants of the borough.

2520. Have any complaints been made of ill-health arising from the state of the river below the sewer outlet?—Yes.

2521. Have you known cases of fever to arise from that cause?—Very fortunately it is not a very populous district. The river is dammed up below this town, whether rightly or wrongly, by the Canal Company, to be used occasionally as a feeder to the Canal, that is a great evil, and source of considerable discomfort to the inhabitants, who have repeatedly complained of it; the state of the river is very noxious all the year round, but more particularly in the autumn, after a long drought. At the weir below Wigan, which dams up the river, the mud and filth there held back is four or five feet deep.

2522. With regard to epidemic diseases in Wigan, you say that you think the river has but little to do with them, if so, to what other principal causes do you attribute them?—I think that they are attributable to over-crowding, to bad ventilation, and want of cleanliness in dwellings.

2523. Do you consider that the mode of removing excrementitious matters in Wigan is satisfactory?—I do not think it is.

2524. What would you propose in place of it?—I think that no fæcal matters ought to be turned into the sewers.

2525. What would you do with them?—I would have a better constructed class of privies and ashpits. In my opinion nothing but liquids or slops from the kitchen ought to go down the sewers.

2526. Then you would not drain a midden or a privy into the sewers?—They might be drained so that nothing but the liquid portion would go away. If the ashpits were covered over and the rain kept out it would not be necessary to drain them, as the dry ashes would absorb the urine.

2527. You would not even propose to put slops into middens?—Certainly not, I would let them go down the sewers.

2528. But those slops would contain all the night urine, would they not?—If chamber slops were thrown into the midden, it would make the contents more valuable, and I think it would be perfectly safe.

2529. They generally throw them down the next grid, do they not?—Yes.

2530. Are you not aware that urine very soon becomes offensive?—Yes, very soon; it decomposes.

2531. Especially in a dirty vessel, or in a dirty sewer?—Yes.

2532. Then should you not expect that sewage, which had the solid parts of the fæcal matter kept out of it, would still become very offensive?—Certainly urine soon decomposes, and after that process has begun, it must become offensive; but there are worse things than that which go into our sewers.

2533. Do you consider that the solid parts of the excrements are more deleterious than the liquid parts?—I am scarcely prepared to answer that question.

2534. (*Chairman.*) If I understood you rightly you said that there were worse things than urine in a decomposed state which went into the sewers, will you be kind enough to state what they are?—I meant the refuse of slaughter-houses.

2535. Does that pass into the sewers?—Yes. The blood and offal from the slaughter-houses goes down the sewers.

2536. As a matter of fact, you know that all that is thrown in?—I have myself seen much of this stuff thrown down the sewers.

2537. (*Dr. Frankland.*) What would you propose to do with the solid accumulations in the middens?—I would have properly constructed privies and ashpits, the deposits made each day should be covered over with dry ashes, to prevent noxious effluvia, and when full I would have it emptied as at present.

2538. Is it the fact that most of the middens are covered over so that the rain cannot get into them?—Some, I know, are not covered, but many of them are.

2539. Is not the emptying of the ashpits or middens rather a disagreeable operation?—Yes.

2540. May it not affect the health of the people living near?—Yes, but it is an operation that is generally performed in the night time, and the people do not perceive it so much then. Deodorizers and disinfectants are used, which may prevent any unpleasant effluvia. I believe that the ashes, if kept dry, are good deodorizers.

2541. Is it not generally the opinion of medical men that during sleep people are more liable to receive harm from anything of that kind than when they are awake?—Yes, and I have no doubt that persons are more susceptible to noxious effluvia during sleep than during the hours of wakefulness.

2542. Is diarrhœa prevalent in Wigan?—I do not think that we have so much in Wigan as in most other towns.

2543. Had you not, in the summer or autumn of last year, an epidemic of diarrhœa?—Yes. It was very slight.

2544. It was general throughout the country, was it it not?—Yes. We had not more than the average amount during last year.

2545. What do you consider was the cause of the comparative immunity of Wigan from diarrhœa last summer?—It was owing to the improved sewerage and the good water supply. The people seemed to appreciate very much the value of the good water supply last year.

2546. Had they not a good supply of water in Preston last year when they supplemented it by taking water from the Hodder?—I do not know.

2547. Still they suffered very much from diarrhœa there, did they not?—I believe so.

2548. And you think that the immunity from diarrhœa in Wigan arose from the good sanitary arrangements which were made?—Yes, I do.

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2549. (*Mr. Morton.*) I see that your sewerage works date from 1852?—Yes.

2550. Before that time was the river polluted by the drainage of Wigan as much as it is now?—No; I think not so much as it is now.

2551. The scavengers then removed what the sewers now take away?—Yes.

2552. Was the river cleaner 15 years ago than it is now?—Yes, I believe it was.

2553. In answer to a previous question, I understood you to state that the inhabitants in a village below Wigan suffered in health from the condition of the river?—Yes, at the village of Crook. It is there where the river is dammed up, and I believe that the inhabitants are suffering in health at the present time.

2554. Is their health worse or better than it was 10 years ago?—There is a good deal of fever generally prevailing about Crook.

2555. (*Dr. Frankland.*) Do you agree with the medical officer of the Privy Council that it is desirable to remove the excrements of a population while they are fresh?—Yes, if they are properly deodorized, and covered with dry ashes, that will prevent any decomposition or any noxious gases escaping.

The witness withdrew.

MR. JOHN LAW HUNTER recalled.

Mr. J. L. Hunter.

2556. (*Chairman.*) You wish, I believe, to give some explanation?—Yes; I wish to explain this fact, that before 1852 the river, as it passed through the town, was very much polluted, because the sewage was discharged direct into it by a score of outlets, and further than that, that a considerable portion of the sewage found its way by a goyt into the Leeds and Liverpool Canal. The fact was that the canal was nothing but a pool of sewage, that was before 1852.

2557. (*Mr. Part, through the Chair.*) I believe that before that time a very small portion of the area of the town was sewered?—It was not all sewered, but still the sewage of Scholes was discharged at Scholes Bridge, and that passed all the way down to Henhurst Bridge, and there was intercepted and taken into the lower pools of the Leeds and Liverpool Canal.

The witness withdrew.

MR. JAMES JOHNSON examined.

Mr. J. Johnson.

2558. (*Chairman.*) Are you a cotton-spinner?—Yes.

2559. I believe you have a statement to make of the condition of Charington brook?—Yes. The chief polluting materials are mineral water from the colliery; refuse from the gas works, the stink from which is sometimes most offensive; the refuse from chemical works, and town sewage of Ince. This is a specimen of the refuse from the chemical works (*handing in the same*). This (*producing the same*) is from steam boilers, showing the extent of the incrustation.

2560. (*Dr. Frankland.*) What length of time is necessary to form a crust like that?—About 18 months.

2561. (*Chairman.*) Do you obtain your supply of water direct from the river?—Yes. There is another polluting material thrown into the stream, it is mineral oil refuse from Messrs. Waddington's works, and the stink from which is sometimes almost unbearable. It is usually turned down during the night, but occasionally it comes down during the day.

2562. (*Dr. Frankland.*) Is what you refer to tarry matter?—Yes.

2563. Does it float on the surface?—Yes.

2564. What is the character of the refuse from the gas works that you have seen turned into the river?—It is like water and tar mixed.

2565. Do they throw the ammoniacal liquor into the river?—Only occasionally.

2566. To whom do the gas works belong?—To a company.

2567. (*Mr. Morton.*) Are these pollutions constant, or only occasional?—The mineral water from the colliery is constant.

2568. Are the others intermittent?—Yes, but the oil nuisance has now become pretty regular, and also the throwing in of the ashes.

The witness withdrew.

MR. WILLIAM TIPPING examined.

Mr. W. Tipping.

2569. (*Chairman*). Are you a cotton spinner?—Yes; my mill is one of the oldest on the banks of the river, and I remember the river when it was in a very different state compared to what it is now. I have generally to confirm what Mr. Johnson and Mr. Hunter have already said. Mr. Hunter stated, that the water was greatly polluted from Adlington, but I think he forgot to say that it is greatly polluted by some paper works. Many years ago there were fish in the river, but there are none now. I live near the river, and I can say that the stink from it is most unbearable at times.

2570. (*Mr. Morton.*) Do you mean the stench from the sewage?—No; besides what Mr. Johnson has said, there is also the washing of the coal slack in the canal, the refuse from the dye-house and gas works have also contributed greatly to the nuisance. If the pollution is to increase in this way, and nearly all the water is allowed to be impounded, we shall be completely stunk out.

2571. (*Dr. Frankland.*) Do you put anything into the river?—Nothing at all.

2572. No ashes?—No.

2573. Where do the excrements of your work-people go?—To my farm, and then used as manure.

2574. (*Mr. Morton.*) Do you occupy any land which lies below the town?—No: I farm a distance off the town, but I have land close too.

The witness withdrew.

Mr. William Kellett examined.

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2575. (*Mr. Morton.*) Are you a land surveyor?—Yes. I have been requested by Mr. Eccles, who is a cotton spinner, to make a statement on his behalf. He has a mill on the banks of the river, and he is also the owner of a considerable estate on the lower side of the town.

2576. (*Chairman.*) Are his works in the town?—His mill is in the town, but it has not been working for some considerable time. He wished me to state that there is nothing from his mill turned into the river, but what he complains of is, that he has so much filth and refuse to take out of the river.

2577. Does the water come to him in a polluted state?—Yes, he has to filter before he can use it.

2578. Does he use the water for steam power?—Yes.

2579. Do the valves of the boilers get choked?—Yes, and he has to clean them out. I am also to state that he is a riparian proprietor on the Douglas, and complains that since the sewage of the town has been drained into the Douglas, when a flood occurs and overflows his land, a stench is not only caused, but the damage done is very considerable. The cattle will not eat the grass after the water has been on.

2580. (*Mr. Morton.*) I suppose that there is then an uneven surface where it settles, or is there a coating of mud deposited in patches?—Yes, and to make it worse, there is a colliery tramroad which goes across his land; this acts as a sort of dam, and keeps the flood water longer than it would otherwise remain there; the land is very flat.

2581. Has there been any attempt made to irrigate with this water?—Not that I know of.

2582. Is any positive loss suffered by the farmers occupying land along the river from the cattle not having water to drink?—I have not heard of that.

2583. Will the cattle drink the water from the river?—Certainly not.

2584. What is the character of the river-side land below Wigan?—It is very variable.

2585. Is it good grass land?—Yes.

The witness withdrew.

Mr. Thomas Part examined.

Mr. T. Part.

2586. (*Chairman.*) I believe you wish to make a statement?—Yes. I should like just to supplement the statement made by Mr. Kellett. I wish to say that the mischief arising from the abnormal state of the river in Wigan is caused in the first place by the abstraction of the natural flow of the water from it, and next by the discharge of the sewage into its bed, which in time of drought is practically dry, and without any flow except the sewage itself. The Commissioners are probably aware that the Leeds and Liverpool Canal Company have powers under an old Act of Parliament to deal with the water of the Douglas in almost any way they like, and under those powers they have abstracted the water—that is the ordinary flow of the water—from the river almost entirely. Under that Act of Parliament there were 800,000 gallons of water that the Liverpool Corporation were to discharge into the valley of the Douglas as compensation, and the Leeds and Liverpool Canal Company are bound under another Act of Parliament to the Corporation of Wigan to throw that quantity of water over the weir at Scholes bridge, and so it flows on to the next weir at Henhurst bridge, still within the borough, but all that 800,000 gallons and also the water from Clarrington brook, which (I believe is the only feeder between the two) is again withdrawn from the river at Henhurst bridge.

2587. Do they throw over the 800,000 gallons?—I do not know. The quantity supplied by the Corporation of Liverpool is 6½ cubic feet per second, plus the 800,000 gallons, and altogether (with the compensation water that is thrown over by the Wigan Corporation) there are 800,000 gallons thrown over. That is the quantity of water that comes down, and I should say at Scholes bridge the Leeds and Liverpool Canal Company may abstract—and they do abstract—all except 800,000 gallons, which ought to be thrown over the weir at Scholes bridge. That water which is so thrown over at Scholes bridge into the reach between the two weirs and the Clarrington brook water is again arrested at Henhurst bridge, and there the whole of it is taken into the canal, leaving the river below practically void of water. The next supply on the course of the river is what is called Ince brook, and in dry weather there is scarcely any surplus, beyond the volume impounded, and used for condensing purposes. Practically that is not a feeder at that time. Then below Wigan, the sewerage works, which are well done, have effectually protected the town and the inhabitants from any annoyance from the sewage; but it is discharged into the dry bed of the river immediately below Wigan, from whence it flows polluting the air during the whole length, until it gets to Deane lock, where it culminates into a perfect nuisance. Deane lock is the point at which the Leeds and Liverpool Canal Company arrest the water of the Douglas which there consists only of this sewage. It is held in suspense, and the solid matter becomes deposited, and there are large mud banks which ferment and give off the most offensive and noxious gases which it is possible to imagine. That is a state of things which, I think, everyone must admit is very undesirable to be continued if it can be avoided by any means. The means of avoidance in this instance are obvious, I think. Within five or six miles of Wigan the canal falls 30 or 40 feet. In the line with the valley (and in this I must differ a little from Mr. Hunter, for) I think you will find that there are many hundred acres of flat land lying at the base of this valley which are available, and very convenient, for purposes of irrigation. But beyond that, when you get to Newburgh, which is between six and seven miles from Wigan, the country opens out into a wide flat district, and in that district, and immediately in connexion with it, I think I am quite warranted in saying that there are between 30,000 and 40,000 acres of land lying below the lowest level of the Leeds and Liverpool Canal, all of which would be conveniently available for irrigation purposes; but what I want particularly to impress upon the Commissioners is this, the serious evil of converting a river like the Douglas, flowing through an increasing population, into a common sewer, carrying the sewage of a population of 40,000 persons which is thrown into it, and not utilized.

The witness withdrew.

(*The Mayor.*) I wish to express my opinion, and a decided one, that the Corporation of the Borough of Wigan should have entire control given to them over the bed and banks of the river Douglas, not only within the borough, but before the river comes into the borough, so that they might be enabled to prevent any interference with it, or any trespass being committed upon its banks. There are trespasses committed, and no person seems to me to have a right to say to the trespassers, you shall not do this or that; persons have been known to erect a wall over one part of the river Douglas and the consequence of that has been to cause the water to run on to the other side of the river so as to take in a little more land. The wall is subsequently washed down, and then the owner erects a wall nearer to the bed of the river, and so in time turns the stream. I think that the river Douglas should be strictly under the control of the Wigan Corporation.

9 June 1869.

Adjourned till to-morrow at Blackburn at 11 o'clock.

The Town Hall, Blackburn.

Thursday, 10th June 1869.

PRESENT :

Major-General Sir W. Denison, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

Mr. Frederick Smith examined.

Mr. F. Smith. 10 June 1869.

2588. (*Mr. Morton.*) Are you the borough surveyor?—Yes.

2589. Does the whole of the sewage of the town pass into the river Blakewater at one outlet?—Yes.

2590. Is that at your sewage works?—Yes.

2591. Does any liquid refuse drain into the river from the works on its banks as it flows through the town?—No, except the hot water from the boilers and cylinders of the steam engines.

2592. Is it simply the domestic waste from the houses that passes into your sewers?—Yes; there are two or three exceptions; where mills have a connexion with the sewers and when the boilers require cleansing the water is let off into the sewers.

2593. Does the waste from slaughter-houses pass into the sewers?—Yes, that drains into it.

2594. What is the daily quantity of sewage, and how is that quantity ascertained?—It corresponds with about 20 gallons a head of the population, and is ascertained by measurement.

2595. Is it tested every hour?—Yes, I have tested it for several days together in the dry weather.

2596. Is it the quantity of the water supply that has been spoiled by use?—It includes the water of springs that were tapped during the execution of the drainage works, which rises through the inverts of the sewers. The quantity of subsoil water is about 300,000 gallons in twenty-four hours.

2597. Does the whole of the rain that falls upon the roads and streets go into the sewers?—Yes.

2598. Does the liquid part of that which goes into the privies also drain into the sewers?—Yes, from all of them that are drained; there are only a few that are not drained.

2599. Are the ashpits roofed?—No.

2600. Does the rainfall on to the privy roof fall into the ashpit?—Yes.

2601. So that the washings of the solid parts of the excrements also go into the sewers?—Yes.

2602. How many tons of stuff is removed from the depositing tanks at the sewage works per annum?—In the first 12 months ending 31st July 1868, 2,206 tons of semi-soiled matter were taken out of the tanks, which was equal to 42 tons 8 hundredweight per week, for the year through, but it is collected in seven or eight months. There are generally three or four months of the year with such a heavy fall of rain that the sewage flows right through the lands and into the river, carrying with it the matters in suspension; the quantity is too great to be dealt with.

2603. How much lime do you add to the sewage a day?—Six or seven hundredweight.

2604. With regard to the cleansing of the privies is that performed always during the night?—Yes.

2605. Is it illegal to do it in the daytime?—Yes.

2606. We saw this morning at the side of one of the roads a quantity of liquid excrement surrounded by a rim of earth. Was that a sample of the pure stuff which is carried away and sold at 4*s.* 6*d.* a ton, and is that the usual way of removing the contents of the privies?—Yes, it is put into a covered cart, removed, and sold for 4*s.* 6*d.* a ton.

2607. Is the earth with which the men form the rim and afterwards fill it with the excrement brought in the cart they make?—Yes; it is a water-tight box that carries the excrement away.

2608. In cleansing out the privies and middens is a division made between that which is dry and that which is wet?—Yes, there is a division made, and that which is clean and dry is tipped away.

2609. Is the division made at the meadow?—Yes.

2610. Is it done in the night time?—Yes.

2611. What becomes of the so-called dry stuff?—It is tipped into old quarries.

2612. Is that done within the borough?—In some cases it is within and in others it is out of the borough.

2613. Does it take place at a spot liable to be built upon?—Yes, at one tip, where we have deposited about 600 tons a week.

2614. For how many weeks has this been done?—It is done regularly.

2615. At one tip?—There are two or three tips, and the men go to the nearest one to the places they are emptying.

2616. Are all of these tips liable to be built upon?—Yes, and they are built upon in some places.

2617. How often are the ashpits cleaned out?—About twice a year.

2618. What becomes of the street sweepings?—They are sold to the farmers. We are at present mixing them with the sewage at the works, and we propose to sell it altogether as portable manure, we have only begun that this season.

2619. Would the cost of your scavenging be very much lessened if the privy stuff was kept out of the middens?—I do not think it would, because the ashes must be removed under any circumstances. I cannot state whether we should get more for it, if they were kept separate.

2620. Have many privies in Blackburn been converted into watercloset?—No, because the truth is, that the watercloset system is not much liked here.

2621. Is that because of the cost of water?—No, the people of Blackburn do not think that the ashpits, if drained and kept dry are injurious to health, no doubt the watercloset system increases the quantity of water that is necessary, and it increases the sewage, and I think that both are matters to be avoided.

2622. (*Dr. Frankland.*) How long has lime been applied to the sewage of Blackburn?—Every summer since the tanks were made.

Mr. F. Smith.

10 June 1869.

2623. What led you to use lime?—Because the stench was so great.

2624. Did you not also intend to precipitate the matters in suspension by the use of lime?—I think that lime assists precipitation.

2625. Were you not aware that for the success of the lime process, you require hard water, that is, water that is hardened by chalk and limestone?—No; Mr. R. Rawlinson, chief inspector under Local Government Act, said that I might mix the lime with the sewage, and this is done.

2626 Do you not know that unless the water is hard, you have nothing to precipitate the sewage and carry down the suspended organic matter. The water supplied to Blackburn has no temporary hardness?—I was not aware of that fact. I know the water supplied to Blackburn is very soft.

2627. Are there any wells still in use in Blackburn?—No.

2628. In your opinion, does any nuisance arise from the admission of steam and hot water into the sewers?—Not in Blackburn, there are only one or two mills, the steam from which is passed into the sewers.

2629. Are you aware that gases escape into the houses from the sewers in Blackburn?—There have been complaints of this kind when traps to the drains have been defective.

2630. Are your sewers well ventilated?—Yes.

2631. How does the mode of ventilating by means of factory chimneys answer?—It appears to answer very well, and affects the sewer for about 300 feet either way; all the subsidiary mains have a pipe for ventilation brought to the surface of the street, and there is no very great necessity for ventilating the principal main.

2632. Is the water supplied to Blackburn ample for all uses?—Yes, at present.

2633. Do you consider the quality of the water good; is it approved of by the people?—It is considered a fair sample of water.

2634. What is the supply of water per head of the population?—I cannot get that information.

2635. Do you know whether it is filtered before it is delivered?—No.

2636. It is very turbid when it is delivered in the town?—It is a little discoloured.

2637. Do you know the gathering ground upon which this water is collected?—I do slightly.

2638. Do the inhabitants of Blackburn like soft or hard water best?—Soft water is considered much better for washing purposes.

2639. For the purpose of drinking, which do they like best?—I never heard any opinion expressed about it.

2640. The water of the wells is rather hard, is it not?—The water of some of them is very hard.

2641. Have you heard the people say that they liked the well water better for drinking than the water supplied to the town?—No.

2642. (*Mr. Morton.*) What is the cost per annum of the sewage works?—About 317*l.* a year.

2643. Is that for labour merely?—That is for labour and lime.

2644. Not the interest upon capital?—No.

2645. Is anything obtained for the stuff?—We have given it away up to the present time.

The witness withdrew.

Mr. William Martland examined.

Mr. W. Martland.

2646. (*Dr. Frankland.*) Are you a member of the Royal College of Surgeons?—Yes.

2647. Have you been intimately acquainted with Blackburn for some years?—I have been acquainted with it all my life.

2648. What are the chief epidemics that prevail in Blackburn?—We have not had an epidemic in Blackburn since 1855, and we then had typhus and scarlet fever.

2649. What, in your judgment, did the typhus fever arise from?—In my opinion it arose from the uncleanliness of the people, and the defective drainage.

2650. Was there any escape of sewer gases into the houses?—I believe there was.

2651. How was the town supplied with water?—I believe it was very well supplied with water at that time.

2652. Was it obtained from the same sources as it is at present?—Yes.

2653. Waterworks, I believe, had already been established?—They had.

2654. Was there not a number of private wells used at that time?—Yes.

2655. Had you a good opinion of the quality of the water from the wells?—Yes, and I have every reason to know it, because a few years ago, when the supply to the town from the Waterworks ran short, all the wells had to be re-opened, and the water obtained from those wells is now considered to be better than that supplied from the Waterworks.

2656. What is the average depth of these wells?—I cannot tell you that; they are sunk into the mill stone grit.

2657. Are they deep or shallow wells?—They are deep wells, at least two of them that I know are deep wells.

2658. Are those wells situated near to the houses, the inhabitants of which use the water?—Yes, they are.

2659. Where are the privies situated belonging to those houses?—They are very near to the wells.

2660. Do you think that there is no possibility of drainage from the privies percolating into the wells?—I think that if it had been so we should have seen the effect of it.

2661. What effect do you think you would have seen?—I think there is no doubt that we should have had much typhoid fever.

2662. As a matter of fact, were the people who used the water from those wells not particularly affected by diseases of a typhoid kind?—No; they were not affected at all.

2663. Are those wells closed now?—The great majority of them are, but a few of them are open yet.

2664. To what cause do you attribute the high mortality in Blackburn in 1866; it was 29 per 1,000, which was considerably above the average?—I attribute it principally to consumption and chest diseases.

2665. What do you think those diseases are caused by?—A large majority of people in this neighbourhood die from that complaint; the cause is attributable to a very great extent to the manufactories. The children go into the factories when they are young, not properly clothed; but perhaps a greater cause than that is, that the mothers themselves go to their work very soon after the children are born, leaving them at home to be nursed by those who perhaps neglect them; they take cold; they are improperly fed, and perhaps they are attacked by bronchitis.

2666. Do these cases occur chiefly among young children?—About 55 per cent. of the deaths which occur in this neighbourhood are in children from 1 to 5 years old.

2667. Is there that proportion of consumptive cases?—I am taking them all, principally from bronchitis, consumption, and inflammation of the lungs.

2668. At the present time, what is the condition of the two rivers that flow through Blackburn, are they clean or foul?—The Darwen is very foul indeed, and very offensive.

2669. Is the river Blackewater comparatively clean?—Yes, except very near to one of the weirs, near to Whalley Banks Bridge, and there the river is very offensive.

2670. Do you find an exceptional amount of disease on the banks of either of the rivers?—No; I have tried to trace (but I have not been able to do so) disease to the banks of either of the rivers, so far as they are connected with the Parliamentary borough of Blackburn.

2671. Then you do not consider that the condition of the rivers has anything to do with the health of the community?—I do not think it has.

2672. What are the places which, in your opinion, are especially unhealthy in Blackburn?—Tontine Street; last year there was an outbreak of typhoid fever there.

2673. Is that street near to the river, or a distance away from it?—It is away from it.

2674. Was there any special cause, in your opinion, for the outbreak of typhoid fever?—I believe myself that it was caused by defective drainage in the houses, and that the middens were not properly drained; in fact, I believe, that the middens were draining through the walls where the ground was at a lower level.

2675. Do you consider that the mode of removing excrementitious matters at present practised in Blackburn is satisfactory, or otherwise, with reference to the health of the town?—I do not think that it affects the health of the town,—the way in which it is removed. I believe that the ashpits and the middens in Blackburn are, as a rule, well drained, and as long as they are kept well drained, in my opinion, they cannot affect the health of the town.

2676. Do you think that an accumulation of fœces, possibly in a state of putrefaction, immediately adjoining houses is not unhealthy?—From my experience I have not found it so; but I must say I much prefer the watercloset system, in which case the excrements are removed at once.

2677. In your opinion is it desirable that the excrementitious matters should be removed while they are fresh?—Yes.

Mr. W. Martland.

2678. You have spoken of Whalley Banks Bridge, when the river is pent up, is not that rather an unhealthy district?—Yes; there are two streets, one of them is called Back Leyland Street, and the other Back King Street, in the neighbourhood of Whalley Banks Bridge.

2679. Are there any other apparent causes to account for the unhealthiness in that neighbourhood?—Complaints in that district arise more from chest diseases, and more from bronchitis, pneumonia, and the uncleanliness of the inhabitants, rather than the overcrowding of the houses.

2680. Has Blackburn ever been visited with cholera?—I cannot say that it has been visited with cholera. I remember that two years ago there were two cases of cholera reported, but we have had no cholera here of any moment.

2681. Was there not cholera in 1866 in Blackburn?—No, not in 1866. There was no death from cholera in 1866; there were only two deaths from diarrhœa.

2682. In 1854 had you any cholera in Blackburn?—No. In 1854 there were no deaths either from cholera or from diarrhœa.

2683. Do you remember whether in the year 1849 you had cholera in Blackburn?—There was no death in 1849 from cholera.

2684. What is the state of the health of the people who live in the cellar dwellings in Blackburn?—I cannot say that I know much about the health of those people, or that there is anything particular to note about it.

2685. Do you think that the people living there are generally as healthy as other people?—Yes. The class of people who live in cellar dwellings do not take so much care of themselves as they ought to do.

(*Mr. Joseph Brierly, C.E., handed in a report.*)

(*Mr. Richard Radcliffe, C.E., handed in a report and two plans.*)

Mr. Frederick Smith, Borough Surveyor, further examined.

Mr. F. Smith.

2686. (*Mr. Morton.*) Will you be good enough to state whether or not the privies are detached from the houses?—As a rule they are detached.

2687. Are there any privies inside of houses?—There are not any.

2688. Are there many common privies in Blackburn?—Yes, a great many.

2689. What is the maximum number of houses to which there is only one privy attached?—I cannot say.

The witness withdrew.

Mr. Thomas Backhouse examined.

Mr. T. Backhouse.

2690. (*Dr. Frankland.*) Are there many fish in the Ribble and its tributaries?—There are occasionally fish in the Calder in a time of flood, but when the water is low no fish can live in it.

The witness withdrew.

Adjourned till to-morrow at 11 o'clock at Accrington.

The Town Hall, Accrington.

Friday, 11th June 1869.

PRESENT:

Major-General Sir W. Denison, K.C.B., F.R.S., in the Chair.

Dr. Edward Frankland, F.R.S. | Mr. John Chalmers Morton.

Mr. S. J. Smith, *Secretary.*

Mr. John Morris Gillespie examined.

Mr. J. M. Gillespie.

11 June 1869.

2691. (*Dr. Frankland.*) Are you a surgeon and in practice in Accrington?—I am M.D. of Glasgow, and L.R.C.S. of Edinburgh, and in general practice in Accrington.

2692. How long have you resided at Accrington?—For about 10 years.

2693. Has any effect been produced upon the health of the inhabitants by the sewage works?—Not any very marked improvement in the health of the inhabitants.

2694. In forming that opinion were you guided by the mortality returns?—Yes.

Mr. J. M. Gillespie.

11 June 1869.

2695. Do they not exhibit a considerable reduction in the mortality?—Yes, certainly; since the sewage works were commenced in 1863.

2696. In the year 1859 it was 40 per 1,000 per annum, in 1860 it was 36 per 1,000, in 1861 it was 36, and in 1862 it was 37?—Yes.

2697. You say that the sewage works were commenced in 1863?—Yes.

2698. And in that year the rate of mortality was reduced to 20 per 1,000?—Yes.

2699. In 1865 there is a sudden jump up to 31 per 1,000, from 22 in the previous year. Can you explain that?—At that time typhus fever was epidemic here. I think too it might be attributed partly to the cotton panic, because at that time the people were suffering a good deal from the want of the proper necessaries of life.

2700. You would think that probably a predisposing cause?—Yes. I think from good living the people of Accrington had been suddenly reduced to an inferior kind of living, and a deteriorating influence was produced on their constitutions, which predisposed them to disease.

2701. What other additional cause should you consider to have been active at that time?—There was at that time a large quantity of animal and vegetable decomposing matter, more especially vegetable, which had been thrown out, and in decomposing it produced malarious gases. The effluvia arising from the stream might have produced fever. Dr. Buchanan was sent down by the Privy Council to investigate the cause of the epidemic of typhus fever in Accrington, and we went through all parts of the town, and he attributed it a good deal to the want of proper surface drainage, and to the quantity of decomposing matters thrown into the stream.

2702. When you say the stream do you mean the river Hyndburn?—Yes.

2703. Was it in a very foul condition at that time?—Yes, it was; and is generally so in the summer time, when the water is nearly all absorbed.

2704. Did you notice that the cases of typhus and typhoid fever prevailed more extensively near the river than further away from it?—Yes; I think that the greatest number of cases were near to the river.

2705. Did the outbreak take place in the hot season or in the cool season of the year?—Principally in the hot season.

2706. Do you know what the mortality was in 1868?—I do not.

2707. Has cholera visited Accrington?—There have been a few cases of cholera.

2708. Were they cases of Asiatic cholera?—They very nearly approximated to it.

2709. Was that in 1866?—We have cases every year. I attended a case in 1866 that I called Asiatic cholera, and in 1865 I had several cases—deaths following very rapidly—with all the symptoms of Asiatic cholera.

2710. Were you in Accrington in 1854?—No.

2711. Do you know the quality of the water that is supplied to the inhabitants of Accrington?—Only from taking it.

2712. What is your opinion of it?—It is not always clear; after a heavy rain there is a good deal of muddy matter in the water.

2713. Do you know the gathering ground where the water is collected?—I do.

2714. What is the character of the soil?—A peaty soil.

2715. Is any of the gathering ground cultivated?—It is mostly moor land, and not much cultivated.

2716. Is it manured?—I think not.

2717. Is the water sometimes coloured by the peat?—Yes, after a heavy rain.

2718. Do the people object to the water on account of its appearance and taste?—Yes.

2719. Nevertheless, that is not an objectionable kind of matter?—No.

2720. Is it noxious?—No.

2721. Coming from a peaty district, I presume it is soft water?—Yes.

2722. Do you happen to know the degree of hardness?—No.

2723. Is the supply constant?—It has been very nearly so; we have had occasionally a stoppage.

2724. Is the supply sufficient in quantity for the wants of the people?—In a very dry season complaints are sometimes made of the shortness of supply.

2725. Is there any water obtained from wells in Accrington?—There are a few wells.

2726. Do you know anything of the quality of the water which comes from the wells?—I think it is hard; it contains both iron and lime.

2727. Are the wells you speak of shallow wells?—Two are surface wells.

2728. What is the character of the soil, is it porous, or is it millstone grit?—It is chiefly a clayey soil.

2729. Where does the water come from?—It filters through the hill.

2730. Is there any soakage into those wells from the surface?—Not much.

2731. Are none of the wells in the streets of the town, or in the back yards of houses?—There are very few in the streets; nearly the whole of the town is supplied with water from the waterworks.

2732. Have you noticed any cases of ill health from the use of the water from those wells?—Not that I could distinctly trace to the water.

2733. (*Mr. Morton.*) I see that the deaths during the five years before and including 1862 have averaged 35 per 1,000, and that the deaths during the five years before and including 1867 have averaged 25 per 1,000; are you able to give any explanation of that, there having been 10 in 1,000 less during the second period of five years?—I cannot give any explanation, unless it may have been that the sewerage may have improved the general health.

2734. Was the district from which the returns have been made the same in the second five years as it was in the first, or have the limits been extended?—The population has increased very considerably during that time.

2735. (*Dr. Frankland.*) Has the density of the population increased as well?—The population has increased, but not the density.

2736. (*Mr. Boothman.*) (*Through the Chair.*) Do you know that a portion of the water supply comes from Wood Nook coal-pit?—Yes, a portion of it comes from there, but, as far as I understand, that water is only used in cases of emergency, and not generally for the use of the public.

2737. But it is used, is it not, for the upper part of the town?—I believe it is occasionally, but not as a general rule. I should have mentioned to the Commissioners that that is another place from which water is obtained, the place to which Mr. Boothman is now referring, and that it is not considered very good.

2738. (*Chairman to the witness.*) Is that water pumped up from the bottom of the coal-pit, or is there an adit?—It runs out from the coal-pit.

2739. (*Dr. Frankland.*) Is the coal-pit at present worked?—Yes, they are at work now.

2740. Can you tell us whether you have noticed any ill effects arising from drinking the water obtained from the coal-pit?—I do not know that I have ever traced any distinct cases of sickness to the drinking of that water.

2741. I presume that you would not consider it desirable that water which is probably contaminated by the excrements of the miners should be used?—Certainly not. I have raised my voice against the use of that water before, and, as I have already said, I believe it is only resorted to in cases of emergency; but it is not right to use it.

The witness withdrew.

MR. ROBERT IDDON examined.

Mr. R. Iddon.

11 June 1869.

2742. (*Dr. Frankland.*) Are you secretary of the Accrington Gas and Water Company?—I am.

2743. How long has the present supply of water been furnished to the inhabitants of Accrington?—Since 1841.

2744. How frequently during that time has the water obtained from the Wood Nook coal-pit been supplied?—It was in 1861 or 1862 that the inhabitants first began to use that water.

2745. How do you prevent this water at other times from coming down the pipe?—By turning it into a brook; which is near the place where the water springs out of the ground.

2746. Did you use that water in 1865?—I am not sure of that.

2747. Is that water supplied to the whole of the town?—No, only to a part of it, for one or two hours a day; it will not supply more than that.

2748. Have you made an analysis of that water?—No.

2749. Are you acquainted with its degree of hardness?—No.

2750. What is the area of the gathering ground in the Burnley Road?—About 141 statute acres. Mitchell's is somewhere about 400 statute acres; then we have a spring besides that, which rises above the ground.

2751. Have you an analysis of that water or has an analysis been made?—Not that I am aware of.

2752. Do you know its degree of hardness?—No.

2753. Do you filter the water?—No.

2754. Does it often come down turbid?—Not at Burnley Road. From Mitchell's we have not commenced to supply it yet.

2755. What quantity of water per head do you supply to the population?—I have not made the calculation.

2756. As I understand you, it is only when you run short of water obtained from the gathering ground that you use the coal-pit water?—Only then.

2757. Do you know from what part of the coal-pit the water comes from?—Near Mitchell's house reservoir.

2758. Does it come from levels of the coal-pit where the men are actively engaged in getting coal?—It does.

2759. What becomes of the excrements of the men who are employed under ground?—I cannot say.

2760. Is the water filtered?—It percolates through earth; it may be considered filtered.

2761. Is it filtered after it comes out of the mine?—Yes. It springs up through the ground to the top.

2762. What thickness of earth or soil does it go through to reach the surface?—Some feet.

2763. Is the water always clear?—Very clear indeed.

2764. (*Mr. Morton.*) Are they working this coal-pit now?—Yes.

2765. Does the water stand in part of it?—Yes; it stands in the pit.

2766. Has any return been made of the charges you make for the supply of water?—Yes.

2767. Do you make any special charge for water for a watercloset?—There are charges made by Act of Parliament, from 4*s.* to 10*s.* each, according to the assessment.

The witness withdrew.

MR. SAMUEL SAMUELS examined.

Mr. S. Samuels.

2768. (*Mr. Morton.*) Are you the town surveyor?—Yes.

2769. I see that the area of the district is 3,425 acres, and the population 17,688,—is that for 1861 or the present time?—For 1861.

2770. What has the increase been since that time?—About 7,000. I believe it is now 25,000.

2771. The number of houses appears to be 4,400,—is that for 1861?—Yes.

2772. It is stated that you have 2,000 privies; are those middens or privies?—They are middens.

2773. Is there a privy on each side of a midden?—In some cases.

2774. What number of middens have a distinct privy attached to them?—About 3,600.

2775. Do the middens in all cases drain into the sewers?—Yes.

2776. I see that you speak of liquid manure being used for agricultural purposes?—Yes.

2777. Where is that obtained?—There are tanks belonging to the mills, and at some places where they have no proper accommodation they have boxes at the feet under the seat.

2778. Then what you call the liquid manure is simply the whole of the excrements?—Yes.

2779. Are no ashes mixed with the excrement?—None.

2780. What becomes of the contents of the middens?—It is taken away, and sometimes put into depôts where there are excavations.

2781. Is it taken to a tip?—Yes.

2782. The whole of it?—Yes; or at least there is some little fetched by the farmers.

2783. Who divides the matter into two lots, one which is fit to take to the tip, and another which is fit to be used by the farmers?—We have a foreman of the night-soil men, who attends to that matter.

2784. Are the privies cleaned out by your men?—Yes.

2785. At a cost of 300*l.*—Yes, or thereabouts.

2786. What do you get for the manure when you sell it?—We sell very little of it.

2787. What do you get for it per ton when you sell it?—From 1*s.* to 1*s.* 6*d.* for a cartload.

2788. Does the farmer send carts for it, or do you take it to a depôt?—Sometimes the farmers send carts for the excremental part, and we are glad to get them to take it. As to that which they do not take, we pick out the best of the dry ashes and use them in paving. The rough portion is taken to a tip.

2789. Are those tips places which are liable to be built upon?—Yes, in some cases they are.

2790. Is the division of the contents of the privies and middens made at night, and in the street?—It is done principally in the daytime.

2791. Are the privies cleansed out in the daytime?—Yes.

2792. Does the whole of the sewage of the town run into the river at one exit?—Yes, at one outlet.

2793. What quantity goes out there?—I have never made any calculation of the quantity.

2794. Was there much land water met with when the sewers were constructed?—No, very little.

2795. Then the quantity of sewage that flows out at the outlet is just the water supply spoiled?—Yes.

2796. That appears to be 270,000 gallons a day?—Yes, that is the calculation.

2797. Do factories drain into the sewers of the town?—I am not aware of any.

2798. Do slaughter houses or yards drain into the sewers?—Yes.

2799. Where is the 400 acres of land situate which it is considered might be used for the purpose of irrigation?—About two miles from here.

2800. Could the irrigation be carried out by gravitation, or would the sewage have to be pumped?—I think it could be done without pumping.

2801. As I understand you, the liquid portion of

Mr. S. Samuels.
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the excrements from the privies finds its way into the sewers?—Yes.

2802. Do the roofs of the privies drain into the middens?—Very few of them.

2803. Are the middens not roofed?—No.

2804. Then there must be a large amount of the washings of the solid parts which finds its way into the sewers?—Yes.

2805. Would the cost of removing the contents of the ashpits be much less, if you were to have an irrigation scheme in operation, and if the ashes were in a dry state and not wet?—That would not make much difference.

2806. Have you considered how much water would be required if waterclosets were substituted for privies?—I have not.

2807. Suppose that in the place of a privy, a watercloset was substituted, what quantity of water do you think would be required or be wasted every day, if the watercloset was used, say, by five persons in a family?—I should think six or seven gallons of water would be required for a house.

2808. (*Dr. Frankland.*) What induced you to treat the sewage by lime?—The example set by other towns where they had tried lime, and from recommendations that were made to us. It was also done to satisfy Mr. Steiner.

2809. You appear to use disinfecting fluid, and a certain quantity of lime; what becomes of the sewage afterwards?—It goes into the outfall sewer, and thence into the river.

2810. Have you subsiding reservoirs for the sewage to flow into after it is mixed with lime?—No.

2811. Who advised you to treat the sewage in that way?—The plan was just commenced when I first came here, about three years ago. I do not know who recommended it.

2812. Have you satisfied Mr. Steiner by what you have done?—No, he is not satisfied.

2813. If you were to inquire what is done in other towns, you would find that they have subsiding reservoirs?—I do not know myself how they do it.

2814. At all events you do not get any sludge from it?—No, we send it all together.

2815. (*Mr. Boothman.*) (*Through the Chair.*) What is the condition of the river Hyndburn, in the central part of the town, on a Saturday afternoon, when the lodges are cleaned out?—It is very bad indeed.

2816. Is there not a great stench?—Yes, there is.

2817. Have you had many complaints made?—Yes, many.

2818. Is not that the part that the doctor alluded to, as the place were fever prevailed?—Yes.

2819. (*Mr. Morton to the witness.*) What takes place on a Saturday afternoon to account for the great stench?—The whole of the lodges and the becks, as they are called, are then flushed out.

2820. (*Dr. Frankland.*) Is not a quantity of sludge the deposits of the week in those lodges then flushed out?—Yes.

2821. (*Mr. Morton.*) Is much of the sewage collected at the lodges?—No.

2822. Are not the lodges that are emptied out liable to be fouled by the sewage?—No; the works which greatly pollute the stream are above the town, and have small lodges of their own and becks.

2823. In flushing out the lodges does it stir up the mud in the river?—Yes, and the mud that comes from the works settles, as there is not a sufficient supply of water allowed to flow daily down the stream to keep the river channal clean.

2824. (*Mr. Boothman.*) (*Through the Chair.*) Is it spent madder that stinks so badly on the Saturday night?—Yes, and other things.

2825. Is not the water pure when it comes to the works at Broad Oak?—Yes.

2826. And after that is there not a considerable quantity of spent madder put into it?—Yes, and other mixtures.

2827. Is not the fluid refuse kept in the lodge till Saturday afternoon?—I do not know that, but the stench on a Saturday afternoon seems worse than at another time.

2828. Are there no complaints from the inhabitants of the town at other times except Saturday afternoon?—I have not heard of any, although the stench is bad enough at other times.

2829. (*Mr. Bell.*) (*Through the Chair.*) Is there not in the centre of the town a weir across the river which is the cause of considerable obstruction to the flow of the water and a great nuisance to it from the large quantity of mud that settles behind it, causing a most offensive stench in warm weather?—There is.

2830. For what purpose is the weir put there, is it to furnish power?—To keep up a head of water, and to furnish power to the adjacent mill.

The witness withdrew.

Adjourned till Monday next at 11 o'clock at Burnley.

The Town Hall, Burnley.

Monday, 14th June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary.*

DR. THOMAS DEAN examined.

Dr. T. Dean.
14 June 1869.

2831. (*Dr. Frankland.*) Are you in practice as a surgeon in Burnley?—Yes.

2832. How long have you known Burnley?—Twenty years.

2833. Do you consider the town, in a sanitary point of view, in a satisfactory condition?—Yes.

2834. Do you know what the present death-rate is?—It was 33 per 1,000 in the last year.

2835. Is not that an excessive rate?—Yes, very excessive.

2836. What was the character of the disease or diseases which prevailed in the districts when the death-rate was the highest?—Fever and English cholera.

2837. To what causes do you attribute those diseases?—To bad water, and a limited supply of it.

2838. Whence do the people derive their supply of water?—From reservoirs above the town, which belong to the Corporation.

2839. Do you consider that the water which is supplied by the Corporation is bad?—It is very good water.

2840. Was it deficient in quantity?—Yes, for some time last summer.

2841. If the people had plenty of the water do you think the use of it would cause disease?—No.

2842. Do they obtain any part of the water they consume from wells?—Very little.

2843. Do you know of any wells within or near the borough which are ever used?—Yes.

2844. Are they shallow or deep wells?—They are shallow.

2845. In what sort of strata are they sunk?—Through sand into clay.

2846. Are they at any considerable distance from privies?—There are wells closely adjacent to privies.

2847. Is it probable that the liquid contents of the privies percolates into the wells?—There is not much danger of that.

2848. How are the ashpits constructed, are they puddled or cemented inside?—They are not; they are very badly constructed, and as a rule porous.

2849. Does not the liquid portion of the contents sink into the soil underneath?—It does.

2850. Might it not get into the wells?—It might; but when I say that there are wells, do not understand me to say that there are many. An exceedingly small per-centage of the water used in Burnley comes from wells.

2851. Still there is, if I understand you rightly, at least the risk that those wells may be contaminated by the drainage from the privies?—Yes.

2852. Where does the water come from that supplies the wells?—From the hills, I suppose.

2853. Do you think that it does not sink into this porous stratum within the town itself?—I do not think so; certainly not.

2854. Nor from the sewers?—No.

2855. In your opinion is the river flowing through the town a source of ill-health?—Yes.

2856. Have you ever noticed any increase of disease on or near to the banks of the river?—Yes.

2857. What forms of diseases?—Fever and English cholera.

2858. Any typhoid fever?—Yes.

2859. Scarlatina?—Yes, and it rages in those parts of the town more than in any other.

2860. Is there much overcrowding in the houses in certain districts?—There is.

2861. What is the maximum density of the population in those places?—At the present time perhaps it is exceptional. The comparative famine from which the people are now suffering and their poverty have caused them to crowd together, and even to evade the vigilance of our officials. The average in good times is not more than five persons in a dwelling; but it certainly averaged more than that last year during the time to which the mortality of 33 per 1,000 refers.

2862. What at the present time is the maximum number of persons in a house?—About eight.

2863. Five, I believe, is the usual number?—Yes. I do not give the number officially, it is only from my own observation.

2864. (*Chairman.*) Is this overcrowding caused by the practice of taking in lodgers?—Yes; and from families living together.

2865. (*Dr. Frankland.*) Does the river flowing past these houses stink offensively?—It does.

2866. At all times of the year?—Not at all times, but in hot and droughty weather, when the springs are dried up, and there is little water in the channel.

2867. Is not the river water used largely for condensing purposes in Burnley?—Yes.

2868. Is not the water returned again at a high temperature; last year we found it to be 108°?—Yes.

Dr. T. Dean.
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2869. That would rather promote the stench, would it not?—Yes, the river is offensive now.

2870. Do the inhabitants complain of the state of the river?—Those do who live close to it.

2871. Has cholera visited Burnley?—Not Asiatic cholera.

2872. Was there a visitation of cholera in 1849 and 1854?—There was one case in 1849, but none in 1854.

2873. Do you consider that the present mode of storage of excrementitious matters in ashpits conducive to or prejudicial to health, or that it is a matter of indifference; first, take the storage in ashpits, and secondly, the removal?—Our present system of storage I do think is not good.

2874. Is the mode of cleansing and removal satisfactory?—It is very bad.

2875. Is it desirable, supposing that it could be done without going to too great an expense, to remove the excrements, or a large proportion of them while they are still fresh?—Yes.

2876. Before putrefaction begins?—Yes.

2877. Do you think that there is more danger from excrementitious matters when they are in a state of putrefaction than when they are fresh?—Yes.

2878. Do you know of any mode of thus dealing with them besides the ordinary mode of removal by water?—No; but I believe that another plan could be practised.

2879. Do you mean that there might be some mode of emptying them independently of water?—Yes.

2880. How would you do that?—By emptying the ashpits more frequently, and by having small tanks or cisterns in which to receive and carry away the refuse.

2881. Do you mean both the solid and the liquid?—Yes.

2882. And also the slops from the houses?—Yes.

2883. Such a place would require to be of a good size, would it not?—Yes.

2884. Have you considered the difference which exists between the solid and the liquid excrements, and as to their effect in polluting the air and the water?—The liquid of course saturates the ground more easily.

2885. Does not the urine become very offensive and is it not liable to putrefy?—Yes, certainly.

2886. Would not a good deal of the urine necessarily escape if your plan of tanks or cisterns was adopted?—It must do so.

2887. Do you know the dry-earth system?—No.

2888. Do you know the gathering ground of the Corporation water works?—Not very well.

2889. Is there any cultivated land amongst it?—Not much.

2890. Is there any arable land?—Not much.

2891. What sort of manure is applied to it?—Ordinary farm-yard manure.

2892. Is any refuse from privies carried on to it?—I do not know.

2893. Had you not a great scarcity of water last summer?—Yes, a very great scarcity.

2894. Have you at all turned your attention to the question of what additional supply of water would be necessary if waterclosets were substituted for privies?—No, there are a good many waterclosets in Burnley, but, as a rule, the Corporation do not like them.

2895. What is the objection to them?—The excrements are sent direct into the sewers and thence into the river.

2896. Then the objection seems to be that the river is polluted worse than before?—Yes.

2897. (*Captain Starkie, through the Chair.*) Will you be good enough to state whether the sewage does not go into the canal before it reaches Burnley, and when there is a flood, does it not empty itself from the canal into the river?—The inspector of nuisances had better answer that question, it is scarcely one that I can answer.

Mr. W. H. Colbran examined.

Mr. W. H. Colbran.

14 June 1869.

2898. (*Captain Starkie, through the Chair.*) Are you aware whether any sewage comes into the canal at Brierfield and other places before it comes into Burnley town?—I am not aware of any place where it comes into the canal.

(*The Town Clerk.*) It is the fact, nevertheless, I know that it does.

2899. (*Chairman, to Captain Starkie.*) Do you mean that a portion of the sewage from Brierfield empties itself into the canal?—Yes, it flows through Burnley, and during a flood can run into the canal.

2900. (*Mr. Morton, to the witness.*) Are you Borough Surveyor? What is the present population of Burnley?—I am—the present population is about 30,000.

2901. The number of the houses appears to be 5,738, does that refer to 1861 or 1868?—To 1868.

2902. What are the 7,000 houses which are mentioned as being supplied by the waterworks?—That is a question the manager of the waterworks will be better able to answer.

2903. The number of the privies is given as 2500—are those ashpits with a privy on each side of them?—No, they are privies with ashpits, and the same number of each.

2904. Is the town of Burnley thoroughly sewered?—Yes.

2905. How many exits have the sewers into the river?—There are in the two rivers, Calder and the Brun, about 30.

2906. Through these exits the water supplied to the town passes after is has been used and spoiled in Burnley?—Yes.

2907. I understand that the quantity amounts to 800,000 gallons?—Yes.

2908. Were any land springs tapped in forming the sewers?—Very little.

2909. Does the drainage of the privies find its way into those sewers?—Yes.

2910. And also the drainage of the waterclosets?—Yes.

2911. Have all or nearly all the cesspools to the waterclosets an overflow into the sewers?—Yes.

2912. What is done with the contents of the cesspools?—It is carted away by the farmers.

2913. Is it a fact that some of the privies have no connexion with the sewers?—Very few.

2914. Are the slaughter-houses drained into the sewers?—Yes.

2915. Are the manufactures or mills drained into the sewers?—Very few.

2916. Do the tan-yards drain into the sewers?—No, they are generally on the banks of the river, and drain directly into it.

2917. With regard to the contemplated scheme of irrigation, is there plenty of land below the town available for receiving the sewage?—Yes, but that matter has not been duly considered yet.

2918. Do you think there will be any difficulty in obtaining land, that is to say, will the landowners object?—I cannot say.

2919. Do you think that those that have an interest in the use of the river water would object?—Possibly, as it would take so much water from the river.

2920. Are the 800,000 gallons a considerable portion of the volume of the river?—Yes, especially in droughty seasons.

2921. Is the supply of water sometimes short?—Yes, constantly so.

2922. Then probably 1,000 acres of gathering ground would not be sufficient for a dry season?—They have proved not to be so.

2923. Is there an ample area of gathering ground available in case of need?—I do not know the gathering ground, and cannot say.

2924. With regard to the cleansing of the privies, that I understand is done at night?—Yes, it is generally.

2925. Are the entire contents of the ashpit taken direct to the field?—No, there is a great deal of it put into hollow places.

2926. Is that done in the neighbourhood of Burnley?—Yes.

2927. To form land that will ultimately be built upon?—Yes, and it is used for filling up sites for building and other places, and there is very great difficulty in getting places on which to tip it.

2928. Where is the division made between the dry filth, and that portion that is wet, is that done at the mouth of the ashpit?—No, the cesspool is flagged over, and the ashes are kept separate and distinct from the night soil.

2929. Is there not a connexion between the seat of the privy and the ashpit?—No.

2930. Are the two places kept absolutely distinct by an impervious wall?—I do not say that it is impervious, but they are kept separate and distinct; there is no doubt that the liquid part percolates into the cesspool below.

2931. Is there not a good deal of vegetable matter thrown into the ashpit?—Only garbage.

2932. And that is all taken to the tip, is it not?—Yes.

2933. Then the sewage that the farmer takes away is simply excrement?—Yes.

2934. What does he give for it?—He gives nothing for it; he carts it away without charging anything for emptying the cesspool.

2935. Does he empty it?—His men empty it.

2936. Do the owners of the property send notice to the farmers to empty them?—Sometimes; but on receiving notice from the inspector of nuisances they have to cause them to be emptied.

2937. Then a body of scavengers is not employed by the Corporation to do the work, but only an inspector of nuisances, who gives directions when it is necessary to have the privies emptied?—Our scavengers do not cleanse the cesspools; it is done by the farmers in the district.

2938. Do the scavengers only attend to the street sweepings?—Yes.

2939. What becomes of the refuse?—It is carted to a yard and there sold to the farmers.

2940. What sum is obtained for it?—About 30*l.* per annum.

2941. Is it sold to one contractor?—Yes.

2942. Do the men employed by the Corporation remove the ashes?—No; the farmer takes away the ashes in consideration of having the night-soil from the cesspools.

2943. Do you not direct the farmers where to tip the ashes?—No; we merely tell them where they cannot tip them; they must find out a place where to tip them.

2944. Are there any tips near or on the banks of the river?—I am not aware that there are now, for the river is almost entirely built up to.

2945. I see that the cleansing is complained of in the day time?—Yes.

2946. I suppose the reason why it is not complained of at night is because the people being asleep do not smell it?—Yes.

2947. It is stated that the condition of the river is improved in consequence of the Corporation having taken proceedings against persons throwing solid refuse in. Has it been materially improved?—Yes, very considerably.

2948. Has that taken place within the last two or three years?—Yes; the river bed has not silted up during that time, but the condition of the stream has not improved.

2949. Is there a periodical cleansing of the lodges which causes the river to be particularly filthy?—I do not know.

2950. Are not the mill lodges flushed out on a Saturday afternoon?—I think that anything that comes down generally improves it.

2951. It has already been given in evidence before us that the water flushed out of the lodges into the river is black and turbid?—I think that that is an improvement, because it is better to allow it to flow away down the stream than to dam it up in the lodges.

Mr. W. H. Colbran.

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2952. Does not the river stink at those times?—Yes, because it stirs up a good deal of filthy matter.

2953. It cannot be very pleasant for your neighbours below?—No, it is not.

2954. Are there any deodorants used at the time when the privies are cleansed out?—No.

2955. Are there many instances in which there is but one common privy to a large number of cottages?—Not many; in all the new houses there is a privy to each house.

2956. I see that there are only 2,500 privies spoken of although there are 5,000 or 6,000 houses?—Yes, in the older parts of the town there are, no doubt, a great number of houses to one or two privies.

2957. Does the Inspector of nuisances take notice of the condition of those places?—Yes.

2958. (*Mr. R. Townley Parker, through the Chair.*) I understood you to say that the river was considerably improved in consequence of some steps which had been taken by the Corporation?—Yes, it has been improved in this respect, that formerly the outlets of the sewers were blocked up, by the bed of the river being raised.

2959. If the water contained in this bottle (*pointing to the same*) comes from the river, does that afford evidence of the improved state of the river?—I think I stated that the stream itself was not improved, but simply that the bed of the river being lowered improved the condition of the outlets of the sewers of the town, and not the stream itself.

Mr. R. Townley Parker stated that the bottle which he produced contained water from the river Brun, and his object in producing it was to show the Commissioners that the property which belonged to him, situate on the banks of or near to the river was materially diminished in value by the state of the water which was sent out of the sewers into the river.

2960. (*Chairman, to the witness.*) All you mean to say, as I understand you, is that the bed of the river is cleansed out and freed from ashes?—Yes.

2961. Have the Corporation cleansed it?—Yes.

2962. (*Mr. Morton.*) Is the condition of the river as offensive as ever?—Yes, there is no improvement in that respect.

2963. Has the Corporation any power which enables them to insist upon adequate privy accommodation being provided for the old houses?—Yes.

2964. Do they exercise that power?—Yes; and in some cases we have pulled down houses for the purpose of erecting privies for the accommodation of the remaining houses.

2965. Do the sewers drain the back yards and the slop stones of houses?—Yes, the drainage is complete.

2966. Are the cellar dwellings drained?—Yes.

2967. Are there any cellar dwellings that have been closed?—Yes, a few.

2968. They are not actually filled up with solid material?—No.

2969. The trap of the drain in that case becomes dry, and there being a direct connexion between the house and the sewer the gases must escape into the house unless care is taken to prevent it?—Yes, in most cases the cellar dwelling is generally added to the house, and it is used for a wash-house.

2970. (*Dr. Frankland.*) Are the sewers ventilated by down spouts?—Yes.

2971. Does that plan answer?—Yes, we have also a shaft brought up from the sewer to the surface of the street, fitted with bags filled with charcoal according to "Brooks's Patent," but the system is not yet complete.

2972. How do you provide for making a draught through the shaft; do you burn a fire?—No; it is merely a vertical pipe which is brought up to the surface of the street.

2973. Do the gases from the sewers escape through the down spouts into the windows of the houses?—No; there are so many outlets and a good current of air in the drains that the gases are soon expelled through them.

2974. (*Mr. Morton.*) Are there any instances in which cottages or dwelling houses are placed back to back?—Yes, but not very many.

2975. What provision is made for privy accommodation in those cases?—Sometimes a house has to be pulled down to obtain a site on which to erect privies. We insist upon the owners doing it, and if they fail we do the work, and charge them with the cost.

2976. In such a case as that, what amount of privy accommodation do you make for a block, say of 20 separate cottages?—From four to six houses to a privy.

The witness withdrew.

Mr. Eastwood Robinson examined.

Mr. E. Robinson.

2977. (*Dr. Frankland.*) What is your occupation?—I am a joiner, in the employ of Robert Townley Parker, Esq.

2978. Do you live on the bank of the river Calder?—Yes.

2979. Do you complain of the river as a nuisance?—Yes, and I have done so for years.

2980. Do you find that it frequently stinks offensively?—Yes, every day more or less.

2981. Is there a stench from it in the winter time?—Yes.

2982. Has your health been affected by the offensive state of the river?—My wife has often complained, and has thought if she had been in the middle of the town she would have had better health. Last summer, on account of the stink, we had to move out of the kitchen into the other place, and shut up the back door.

2983. (*Chairman.*) Do you live a little below the Calder Wheel mill?—Yes.

2984. (*Dr. Frankland.*) Do you work at home?—I do occasionally, but I am not always at home.

2985. Do you suffer in health at all?—Very little myself; not so much as the wife and the children do.

2986. Have you ever noticed cattle drinking the water of the stream?—Very rarely. Farmers have tried to coax their horses to drink the water, but they would not.

2987. Will sheep drink the water?—They will not drink the water.

2988. Do your children complain of the state of the river?—Yes, they have complained many times.

(*Mr. Deane.*) I can corroborate what the witness states of the effect of the polluted river on the health of his family, for I know that his children are often ill from that cause.

2989. (*Chairman.*) Did you obtain the water which has been produced near to your own house?—Yes; it ran into the bottle out of the stream, and on Saturday morning I noticed particularly a floating mass of scum on the top of the river, about 9 or 10 feet long and 5 feet in breadth.

2990. (*Dr. Frankland.*) Your experience is that cattle will not drink the water of the river?—Yes.

The witness withdrew.

Mr. George Adams examined.

Mr. G. Adams. 14 June 1869.

2991. (*Dr. Frankland.*) What is your occupation?—I am coachman to the Rev. Canon Parker.

2992. Where do you live?—At the Hall.

2993. How far is it from the river?—About 30 yards.

2994. What have you observed with respect to the river?—There is a great stench in dry weather, in the summer time. My bedroom faces the river; I cannot have the window open for weeks together during the dry weather in summer, on account of the stench, and neither can any of the windows on the same side of the Hall be opened for the same cause.

2995. Are you alluding to the river Burn?—No; the river Calder.

2996. Have you suffered in health from this state of things?—Yes, more or less, and the rest of the servants as well.

2997. Who has attended you when you have been ill?—I have not consulted a surgeon, but a chemist prescribed for and gave me medicine.

2998. Have you noticed whether cattle will drink the water of the stream or not?—No.

2999. Is there any mud on the bank of the river near to where you are?—A great deal collects on the sides, banks, and bed when the mills are stopped, and when a freshet of water comes down that stirs the mud up, and it smells very badly.

3000. When the mud is left and becomes dry, and is exposed to the sun, does it then give out any offensive stink?—Yes, very much.

3001. You complain of the state of the river after the mud has been washed down and stirred up?—Yes; but it stinks very much in dry weather.

3002. Do you attribute this condition of the river to any particular material that is put into it?—It arises from manufacturing refuse, and from the sewage of the town, and at times it is caused by the gas water from the gas works.

3003. What makes you think that there is any gas water in it?—Because you can see the gas tar, which is of an oily nature, on the top of the water, and smell the gas too.

3004. Do the gas works belong to the Corporation?—Yes.

The witness withdrew.

Captain Nicholas Le Gendre Starkie, J.P., of Huntroyde, examined.

Capt. N. Le Gendre Starkie, J.P.

3005. (*Chairman.*) You wish, I believe, to make some statement?—I appear on behalf of the chief landowners. I hold myself the whole of six miles of frontage on the river, with the exception of a small portion which is held by Sir James K. Shuttleworth, and one farm which is held by Colonel Townley. The whole of that stream (*pointing to a map*) is entirely destroyed, as far as the purity of the water is concerned.

3006. How far down are you?—Six miles by the river. I am with Sir James Shuttleworth proprietor of nearly the whole of a town called Paddiham, which has a population of 9,966 souls. About 10 years ago there was a great dearth of water, all the springs were nearly dried up, they are all dried up. There were three or four wells in the town, and there was a well about a mile out of the town, from which the people used to get water. They had to come in dry seasons for a mile and a half further to get their water; but we constructed waterworks for them, by which the town is now supplied with water. The river there, owing to the pollution of the brooks which come into it, instead of being a clear stream, which it was 35 years ago, has now a mixture of that water (samples of which I have collected in various bottles), and is in a very filthy state.

3007. Where did you obtain the water for the waterworks?—We obtained it from gathering grounds partly on my estate, and partly on the estate of Sir J. K. Shuttleworth. There is one spring from which we took the surplus, allowing so much to go away. Between Burnley and Paddiham no pure water goes into the Calder, except from a small brook at that place (*pointing to a map*), and another one just about half a mile above Paddiham. The water that comes from Burnley, being is such a filthy state, has destroyed all the pure water.

3008. Are the chemical works to which you refer those which may be seen from the railway near to Paddiham?—There are Riley's chemical works, and can be seen from the railway.

3009. Do they distil tar on their works?—Yes, they do, and this is a specimen of the water (*producing the same*), after they have polluted it. A tenant of mine lost two cows last year; drinking this water killed them.

3010. (*Mr. Morton.*) How are the cattle watered on those farms?—I have put up a trough, and have turned a spring into it, and it is so arranged that the cattle are now obliged to drink that water. The condition of the water in the river has very materially deteriorated the value of my property for building upon, and it also deprives me of a very useful source of water supply, and the stench from the river is also very offensive.

3011. Has the rental of the land that is not affected by the immediate neighbourhood of the town, been diminished by the injury done to the water?—No, I do not think it has been affected, but I can tell you how it has not improved. You cannot let sites for building on the river. The agricultural rent has not at all increased, but for the purpose of opening it out for building, the rent has certainly been materially affected for land near to the stream.

3012. Are you aware whether there would be any difficulty in the way of obtaining land for the purpose of cleansing the sewage below the town; whether the landowners would object to it?—I have not taken that question into consideration, neither has it ever been put before me.

3013. Of course, looking back to a period 35 years ago, when the water was clean, land has increased in value?—Yes, but I cannot tell you anything of the value of land then, for I was only six years of age.

3014. At present you say that the state of the river is a very great nuisance?—Yes; all that I can recollect is going to the river and seeing trout caught, and compared with that time there is not even a piece of moss on the stones now to be seen, or an insect; and in fact if fish were to spawn there, the spawn would be killed by the deleterious matter that comes down.

3015. Is the water so spoiled that it would not be good for irrigation, for example, would it kill plants as well as animals, or is there any instance that you know of in which it is used for irrigation purposes?—Not that I am aware of. In every farm of mine, I have provided clean water from other sources for the cattle to drink. I have been requested by the tenants to do so.

3016. You have been driven to do it, have you not, by the state of the river?—Yes, I have been requested to do it, and my father before me had to do so, where there was not a stream of pure water running down through a farm.

The witness withdrew.

Mr. James Emmet examined.

Mr. J. Emmet 14 June 1869.

3017. (*Dr. Frankland.*) Are you the manager of the waterworks?—Yes.

3018. How long has Burnley been supplied with water from the present source?—It has been supplied from the first source, Calf Hey spring, since 1819. From the other source it has been supplied with water since about 1848 or 1850.

3019. Are those waters mixed before they are supplied to the town?—They work in conjunction, one being in the north, and the other a little to the east of the town. One district receives more of the spring water from Calf Hey than from the other source.

3020. Is the water mixed in the mains?—Yes.

3021. In what proportion are those two waters supplied to Burnley?—The Calf Hey spring, as gauged in 1856, supplied about 68,400 gallons per day.

3022. The total supply to the town being about 800,000 gallons?—Yes; and the other supply is obtained from a gathering ground of 1,090 acres. On those gathering grounds there are a few springs.

3023. Have you any analyses of water supplied to the town?—I have not.

3024. Was there a deficiency in the supply of water last year?—That was a very exceptional year.

3025. What is the character of the gathering ground where you collect the larger proportion of this water?—All uncultivated land.

3026. Is there no arable land?—None whatever.

3027. When you say that it is uncultivated, I suppose that some of it is pasture land?—It is pastured by sheep.

3028. How is that land manured?—For the last dozen years it has not been manured.

3029. (*Mr. Morton.*) Is this enclosed land?—No, it is moor land; it was reclaimed from the common under the Inclosure Act, 20 years ago.

3030. (*Dr. Frankland.*) Do you consider that the water gathered there is quite unpolluted?—Yes; with the exception of what may arise from the sheep pasturing there.

3031. How long does the water remain in the reservoir before you supply it to the town?—It is constantly flowing to the town.

3032. Do you know the degree of hardness of that water?—I do not.

3033. Have you turned your attention to the increased supply of water that would be necessary if waterclosets were substituted for privies?—No; but it is a great source of waste in the town of Burnley.

3034. Do you mean the watercloset system?—Yes.

3035. It would appear that you have only about 500 waterclosets?—Yes; but they are a great source of waste, nevertheless.

3036. Have there been any instances where there has been a change from the privy system to that of waterclosets in which you have been able to judge, after the change has been made, what additional quantity of water is required for the waterclosets?—No, there is a good deal of guess work as to water supply and water consumption.

3037. Then your opinion that there is a good deal of water wasted in the use of waterclosets is not founded upon any reliable data?—Yes, it is founded upon this, that I go, and I have gone periodically round to inspect the waterclosets, and it has been very seldom that I have found them in order. I may state this fact that when a half inch pipe is allowed to run freely, it will run out seven gallons a minute with our pressure.

3038. (*Chairman.*) What is your pressure?—The high pressure is 200 lbs. and the low pressure about 65 lbs. upon the square inch.

3039. (*Mr. Morton.*) Is more water used per head by persons living in the better class or by those occupying the poorer class of houses?—I think that there is more water used by the people living in poor houses.

3040. Notwithstanding that waterclosets are used in the better class of houses?—Yes. There is a system in Burnley of putting a common sanitary closet in a house, which is supplied direct from the main without any intervention of a ball tap, consequently there is a continual supply of water to those closets and if the stop tap put is left open the water is running to waste. And this we have found to be the case.

3041. Are you able to state what the rainfall is upon your gathering ground?—In 1866 the rainfall was $58\frac{24}{100}$ in.; in 1867 it was $38\frac{30}{100}$ in.; and in 1868 it was $41\frac{89}{100}$ in.

3042. (*Chairman.*) Can you furnish us with any data as to the proportion of water that you get off the gathering ground per acre, that is to say, if you have 41 inches of rainfall, how much of that do you secure?—I cannot say, but I should take it in this light that all the water is the rainfall for the time being of the district. The land absorbs a certain proportion of it, and the other part flows off the ground, and between the two the whole of the rain is absorbed.

3043. That is true; but it varies in a very curious way, and our object is to ascertain the fair average proportion which you can depend upon. For instance, out of 58 inches, say roughly, that you may obtain two-thirds this year, next year the rainfall might only be 38 inches, but you would not then get two-thirds of those 38 inches?—It would very much depend upon the state of the atmosphere for the time being, and the evaporation. Here is a case in point: in the year 1868, which was a very exceptional year, from the 1st of April to the 31st of July, we lost in the shape of less rainfall compared with the previous year, which was not an exceptional one, but only an average one, $9\frac{31}{100}$ in. of rainfall. Then we lost $6\frac{21}{100}$ in. by evaporation. I find that the two together come to $15\frac{52}{100}$ in., and that upon 1,090 acres makes 383,799,900 gallons; in other words, we have to give in round numbers, 1,262,857 gallons for the domestic use of the town, and for mill purposes. For mill purposes we give 462,857 gallons a day for compensation. We lost at least in those four months 303 days supply of water. The evaporation in those four months was $6\frac{21}{100}$ in. but the rainfall was only $4\frac{86}{100}$ in.

3044. (*Mr. Morton.*) Do you know the rainfall upon your gathering area every year?—Yes.

3045. Do you know what quantity leaves your reservoir?—No.

3046. Do you know what quantity is lost in the way of evaporation?—No; the experience as to evaporation here is, and I am now going by Mr. Curtis, and I am assuming that there is the same evaporation going on here, that it was $6\frac{21}{100}$ in. for four months in excess of any previous year. I have added that to the 9 inches that we had of less rainfall, and in that way I get at the $15\frac{52}{100}$ in.

The witness withdrew.

14 June 1869.

(*Captain Starkie.*) I wish to hand in some samples of water, only one of which is pure, which goes into the Calder.

(*Seven bottles containing samples of water and bearing the following lables were handed in.*)

"Water from the brook from Barrowford, taken above the junction with the Calder of the same Brook."

"Water from the Calder below the junction of the above river with the Barrowford Brook."

"Water from the Hantroyde Brook."

"Water from the brook running from Mr. Riley's Chemical Works before joining the river Calder."

"Water from the brook running from Lower House before joining the river Calder."

"Water from Hyndburn brook at Hyndburn bridge."

"Water from the river Calder at Cock Bridge near Whalley."

3047. (*Mr. R. Townley Parker, J.P.*) May I request that before the inquiry is closed the Town Clerk may be asked to state where the land is which is said to be available for the purposes of irrigation? Is it east, west, north, or south of the town?—(*The Town Clerk.*) It is north of the town.

3048. (*Mr. R. Townley Parker.*) I should like to know how far it is from the town, and how many acres there are?—(*The Town Clerk.*) That has not been gone into at all. It is simply the general opinion that land may be obtained.

(*The following Papers were handed in by Mr. R. Townley Parker, J.P.*)

Cuerdon Hall, Preston.

I beg to call the attention of the Commissioners to the polluted waters of the river Lostock, a stream of which I believe no representation has hitherto been laid before you.

The Lostock rises in the township of Withnell, in the parish of Leyland, whence by Wheelton it flows south-west to Whitt-le-Woods, turning north-west by Clayton-le-Woods and Cuerdon to Bamber Bridge, a very populous hamlet in the township of Walton-le-Dale, and flowing west to Lostock Bridge, in Farington; it turns again south by Leyland and Ulnes Malton, and again westerly until it joins the Yarrow, about a mile from Croston, the united streams subsequently falling into the Douglas.

Upon the course of the Lostock are the paper-works of Mr. Park at Withnell.—Printworks of Mr. Aitkin, called in the Ordnance Survey, "Durham Springs Printworks" in Wheelton.—Printworks of Mr. Aitkin, called in the Ordnance Survey, "Lower Mile Printworks," in Whittle-le-Woods.—Cotton-spinning mill of Mr. Ward at Whittle-le-Woods (at these mills severally it is believed that there are gas-works).—Printworks of Mr. Farrers, called "Kemp Mill," in Clayton-le-Woods.—Corn mill of Lord Skelmersdale, in Clayton-le-Woods.—Cotton mill of Messrs. Ward in Walton-le-Dale, called "Cuerdon Mill," with gasworks.—Corn mill in Farington, and bleaching works, called "Shruggs," in Leyland, with gasworks.

Within the last two years an action was brought, Farrer *v.* Parke, the former claiming damage from the pollution of the water by the paperworks at Withnell; a private arrangement was made between the parties, and the nuisance, as regards the plaintiff's printworks, I presume to have been abated, but the defilement still exists, and the foul effluvium from it has been experienced in this house (Cuerdon Hall), which is placed at very considerable elevation above and at the distance of 250 yards from the river.

The degree of pollution of course varies, but the water is never available for domestic purposes, but the deposit upon the bed and banks of the stream shows at all times the nature of a filthy deposit.

(Signed) R. Townley Parker.

Royle, Burnley.

As I shall unfortunately be absent from home when the Commissioners visit Burnley for the purpose of inquiring into the state of the rivers Calder and Brun, which when united flow close past my house, I think it necessary, as the river is such an intolerable nuisance to me and the other residents in my house, to convey to you some slight notion of the state of it during the summer months. My house, which is about one mile from the town, stands on the banks of the river, which before it reaches it has passed through the middle of Burnley, and received all the sewage of the town, and any other filth which it may have been considered desirable to have got rid of,—to say nothing of occasional very strong odours arising from some print and gas works. I can perhaps bear as strong testimony as any person not actually residing in the town as to the very foul state the river is in during the months of June, July, August, and September, except when a flush of water, arising from a storm of rain, partially cleanses it, the stench arising from the decomposed matter on its banks, and from the actual water itself, is most offensive, and renders it perfectly impossible with any comfort to walk along the banks, and I have no hesitation in saying that it is detrimental to health, as the family of the carpenter upon the estate, who resides close to the river, are nearly always ill. During the summer season, it is really unpleasant to open the windows in my house looking towards the river, and I prefer being stifled from heat, rather than being poisoned by the foul air. When the dew rises, without either door or window being opened, the stench from the river pervades the passages and rooms in the house, so that in summer, I do not consider it really safe to open any of the windows, during the night, of the rooms I occupy upstairs. In short, such is the nuisance I experience at this season of the year that I have very often thought that I should really be obliged to absent myself from home entirely during the summer months. I need hardly say that as my duties call me every day into Burnley I can bear strong evidence of the dreadful state of the river as it passes through the town; there are streets adjoining it which positively stink, and how the unfortunate residents in them exist I cannot conceive, as their case is, of course, much worse than mine. I trust a remedy may be discovered for a nuisance which is not of my own creation, and which is seriously injuring property upon which much outlay has been made.

(Signed) A. Townley Parker,
Rector of Burnley.

(*Mr. Joseph Brierley,* of Blackburn, Civil Engineer.) I wish to volunteer a statement to the Commissioners, founded on practical experience. I have had a very intimate and special acquaintance with the state of the rivers and streams in this district for 15 years past. In 1854 I was surveyor to the town of Burnley, and the condition of the streams at that time was such as to call for immediate interference. As surveyor to the Commissioners I made a minute inspection and report upon the various nuisances which existed upon the streams; I may say in brief that the greater part of those nuisances remain, to the present day, unabated. In order that the gentlemen present, who have a local knowledge of the district, may be aware of the facts, I beg to refer them to such places as Hammerton Street, Susan Street, Cow Lane, Calder Street, and Brown Street Bridge; all the ashes from the cottages are thrown into the bed of the stream from Brown Street Bridge, and indeed the river is the only receptacle for the ashes and other refuse from a great number of dwellings. There are a considerable number of privies which overhang the stream, the contents of which fall directly into its bed, and to-day may be seen large quantities of fæcal matter from those privies lying upon the bed of the stream; this is acted upon by the heated water which issues from the mills and factories, and the condition of the river is consequently most disgusting. I have had experience of these things for many years as a civil engineer, and I have never seen, even in the Bacup district, or anywhere else, anything more disgusting or more objectionable. The supply of clean water is not increased, and the consequence is, that the pollution is magnified most intensely. It might be expected of me to suggest some practical remedial measure, and what I should recommend is this: In the first place, that the Burnley Improvement Act of 1854 with respect to the prevention of solids being thrown into the rivers should be strictly enforced; it is not at the present time. The alteration or removal of the existing weirs, which was also reported upon by me, should receive immediate attention. There are 30 or 40 sewer outlets, which pour into the stream the whole contents of waterclosets and privies, and the contents of those sewers should be intercepted by means of a general intercepting sewer, which might be easily constructed along the bed of the stream, and the sewage be conveyed thoroughly out of the town. In the next place a compensation reservoir to supply the want that would be caused by taking the sewage out of the river, for in truth the manufacturers depend upon the sewage for working their mills, ought to be constructed so as to ensure an equable volume of water down the stream. The river Brun is already compensated. As to sewage irrigation that is a matter which, I think, could be very easily accomplished. There are lands in the neighbourhood of the town which, to my knowledge, are exceeding suitable and most eligible for this purpose, upon which the sewage might be turned by gravitation without any difficulty; I speak merely as an engineer, I do not know what objections the landowners might raise.

14 June 1869.

(*Mr. Morton.*) How much land do you think could be obtained?

(*Mr. Brierley.*) I dare say that by an inspection of the district one might select suitable areas, and I should think from 400 to 600 acres might be obtained.

(*The Town Clerk.*) In answer to the charge brought against the Corporation, that we do not put in force the Act of 1854 as to the weirs, I may say that we have tried to do so, and have failed, in the Court of Queen's Bench.

(*Chairman.*) You have done your best, and it would seem that the law is not strong enough to enable you to carry out your object.

(*Mr. Brierley.*) I may add this: that when I was an officer in the town I found the same difficulty which the town clerk has referred to, in obtaining convictions. I know that the Corporation has exerted itself to secure convictions, but they have failed from the want of unanimous action.

(*Chairman.*) Gentlemen, this being the termination of our inquiry in Lancashire, I may say that we have collected together a mass of valuable information, and, as you are the last body I shall have to address, I beg to return you the thanks of the Commissioners for the very kind manner in which you have received us, and for the very full information with which you have supplied us; and I trust that the recommendations we shall make in our Report to the Government may prove beneficial to you, and to the whole of the towns in Lancashire.

The Rivers Pollution Commission Office, No. 2, Victoria Street, Westminster.

Palace Chambers,
Abingdon Street, Westminster, S.W.,
31st May 1869.

Rivers Pollution Commission.

Sir,

At the annual general meeting of the Alkali Manufacturers Association held the other day, I was instructed to communicate, through you, to the Commissioners on the pollution of rivers, the desire of the Association that the Commissioners before deciding on their report would be good enough to receive a Deputation from the Association, as the Alkali Manufacturers believe they can, from their practical knowledge and experience, afford the Commissioners information and explanations which will be of great value to them in preparing their report, and without receiving which the interests of the trade might be seriously injured.

A Deputation will be happy to wait on the Commissioners at any time or place they may fix.

I am, &c.

(Signed) J. B. Simson.

The Secretary,
Rivers Pollution Commission,
2, Victoria Street, S.W.

Rivers Commission, Adelphi Hotel,
Liverpool, 2nd June 1869.

Gentlemen,

I acknowledge the receipt of your letter of the 31st ulto.; have brought it under the notice of Her Majesty's Commissioners, and am desired to inform you that they will be pleased to receive a Deputation from the Alkali Manufacturers Association at the office of the Commission, No. 2, Victoria Street, Westminster, on Tuesday, June 22nd.

The Commissioners will be engaged in Lancashire up to the 19th inst.

I am, &c.

(Signed) S. J. Smith, Secretary.

Messrs. Simson and Wakeford, Solicitors,
Palace Chambers, Abingdon Street,
Westminster.

22 June 1869.

At No. 2, Victoria Street, Tuesday, 22nd June 1869.

PRESENT:

MAJOR-GENERAL SIR W. DENISON, K.C.B., F.R.S., IN THE CHAIR.

DR. EDWARD FRANKLAND, F.R.S. | MR. JOHN CHALMERS MORTON.

MR. S. J. SMITH, *Secretary*.

Dr. R. ANGUS SMITH, F.R.S., Chief Inspector, and Mr. A. E. FLETCHER, Sub-inspector under the Alkali Act, } attended by invitation of the Commissioners.

A Deputation from the Alkali Manufacturers Association, — Mr. C. T. STEVENSON, M.P.; Mr. H. C. ALLHUSEN; Mr. H. C. ALLHUSEN, jun., and Mr. A. CROSSFIELD, Newcastle-upon-Tyne; Mr. H. GASKELL, and Mr. A. K. MUSPRATT, Widnes; Mr. C. THOMAS and Mr. P. A. WORSLEY, Bristol, —was introduced.

(*Mr. C. T. Stevenson, M.P.*, Newcastle-upon-Tyne.) We attend here as a Deputation from the Alkali Association, representing both branches of it, the Tyne branch and the Lancashire branch, understanding that the Commissioners are about to present a report to the Government. The object of the Deputation is to ascertain whether the Commissioners propose to recommend any compulsory legislation which will affect the proprietors of alkali works, and if so, that we should have an opportunity of making our representations to the Commissioners on the subject. The gentlemen engaged in the alkali trade feel very strongly that the circumstances connected with the different manufactures are so different that it would be quite impracticable to lay down any system of compulsory legislation, as to the disposal of the waste products, that would be applicable to them all. I represent, principally, the manufacturers on the river Tyne, and there we have peculiar facilities, being on a tidal river, for disposing both of our solid and of our liquid refuse. Nearly the whole of the manufacturers on the river Tyne now convey to the sea, and sink, in the deep water of the German Ocean, the alkali waste resulting from the process of alkali manufacture. Those who do not make use of muriatic acid for the manufacture of bleaching powder, or bicarbonate of soda, or other less important products of manufacture, have an opportunity of discharging into a tidal river where the dilution is so great, on account of the great volume of water which passes the works every tide, that no evil results from that discharge. I would take the opportunity of quoting to the Commissioners the seventh annual report of the inspectors of Salmon Fisheries in England and Wales. In Mr. Walpole's Report, at page 60, in speaking of the river Tyne, and of the great improvement that has taken place in the fisheries there, notwithstanding the great shipping trade, under the Act relating to commerce in the river, he makes use of these words "The "length of the Tyne, a river by nature admirably "adapted for the cultivation of salmon, is 73 miles; "its catchment basin is 1,053 square miles. The Tyne "is particularly interesting from proving, firstly, the "comparative unimportance of pollutions in tidal "rivers; secondly, that the active shipping trade does "not deter salmon from entering the river; thirdly, "that weirs have been the chief cause of the destruc"tion of our salmon rivers, whether the salt water "floats, without mixing with it, over the polluted "river water, or whether the tide flows first along "the sides of the river where the current is less "strong, and where it consequently meets with less "resistance, is a matter of comparatively small im"portance. The important point is that the fish "pass Newcastle,—the chief home of our chemical "factories, — and we may therefore infer that "pollutions in tidal waters are of less consequence "than those in non-tidal waters. The river at "Newcastle is crowded with shipping, so much so, "that my predecessors in their first Report thought "it necessary to dispose of the argument, that the "shipping had destroyed the salmon in the Tyne; "the improvement which has since taken place in "the river shows the correctness of their views, and "proves that we need not apprehend that the in"crease of trade will in any way affect the production "of a river." And he goes on to say how the value of the salmon fishery has increased in the river Tyne, notwithstanding the increase of chemical manufactories; the reason of the deterioration before having been a dam in the upper part of the river, which has now been removed. So that, in whatever way it may be looked at, we consider that in the river Tyne, whether as regards the salmon fishery or in any other respect, the dilution which takes place is so great as to prevent any real inconvenience, and the disposal of the waste at sea, which is now the plan adopted gets rid of that source of trouble and inconvenience which is found in some other places. I would also refer to the great variety of circumstances in the different alkali works. In some works they use all their muriatic acid, while in others they use none. Then as to the manufacture of bleaching powder, and the principal mode of applying it. The quantity varies with the circumstances of the trade It happens that the demand for bleaching powder is very slack, and the price is very low. The consequence is, that the manufacture of the bleaching powder on the Tyne is not now carried out. At the same time the alkali manufacture is going on. There is one large manufactory on the Tyne which represents in a striking way the great variety of the different manufactures. Messrs. Tennant & Co., of Glasgow, carry on a very large manufacture of bleaching powder. I understand so large that they decompose salt to make acid in order to make bleaching powder, and, if they wish to use muriatic acid they have to buy it. They send the resulting sulphate of soda to the Tyne, and there it is made into alkali. So that you have at Glasgow a manufactory producing acid and bleaching powder, but no soda waste, and the second stage of the process is carried on at Newcastle, were no muriatic acid is produced, but all soda waste. We feel strongly that any compulsory legislation is inapplicable and unnecessary in our case, and that we ought to be left to the operation of our own intelligence and self-interest, in carrying on this manufacture in the best manner and with the best results.

3049. (*Chairman.*) It appears that according to your statement you do not commit any nuisance in the Tyne, because you throw the waste into the sea. You have spoken only of the river Tyne?

(*Mr. Stevenson.*) No, there are other gentlemen present who will be able to speak of other places, but I am requested to say that the tidal range of the Mersey at Runcorn is so great that the same considerations apply.

3050. (*Chairman.*) Our business is to ascertain the substances that pollute the rivers and streams and produce offensive and injurious results. Our recommendations will only go so far as to deal with those nuisances. If you throw any refuse into the sea it is not of consequence whether the refuse is offensive or not; but if you turn it into a river, or, for instance, into the Sankey Brook, as it is done at St. Helen's, your neighbours lower down will be injured, and the stream will be made practically injurious. Our business is to see whether we cannot find out some remedy for such an evil which will not be injurious to a particular trade. However, I do not see that any man has a right, on the river above, to take the clean water of that river and turn in a quantity of sour stuff, so that nobody below can use it, if there are any modes by which he can alter its character or improve it.

(*Mr. Gaskell*, Widnes.) There are five or six rivers above us, the Goyt, the Etherow, the Tame, the Irwell, the Bollin, and the Weaver; they are all polluted, and united they form the Mersey, which flows past us at Widnes, and we say that what we add to it is beneficial rather than otherwise; simply perchlorides, and the effect is to deodorize and purify the river.

(*Chairman.*) That is a matter of opinion.

3051. (*Dr. Frankland.*) Our main object is, first, to make the stream in its higher branches pure, and in such a condition as shall make it usable by all those who are situated on or near to it. Those who are situated on tidal estuaries, must undoubtedly have an advantage, as regards the feasibility of turning the waste products into the sea water, they do not thereby render the water unusable for those purposes to which it may be applied in its own natural condition.

(*Mr. Gaskell.*) Then we say that all the waste liquors from St. Helen's and Widnes fall into the Mersey where it is a tidal river, and where it is diluted to such an enormous extent, that our small proportion of chemicals cannot possibly affect it. I took some specimens of the mud, a few days ago, immediately below Bower's Brook, into which we empty most of our chemical waste liquor, and we took it at low water, about half a ton of it, we found that in neither case was it acid.

3052. (*Dr. Frankland.*) Have you tested it repeatedly near to the bridge across Runcorn Gap, to see whether the river is ever rendered acid?

(*Mr. Gaskell.*) We never tested it before, and it was only in consequence of your visit drawing our attention to the matter, and my being requested to attend here to-day, that I took the precaution of taking some samples, and having them tested. I also had some calculations made to show the very small proportion that our waste liquid bears to the whole body of the river at that part. I did not take the entire river Mersey, but simply the broad estuary of the river, just below Runcorn, and immediately in front of Bower's Brook. where our waste liquors run in. Every day, about 153,000,000 of tons of sea water flow into that basin. Then I have estimated the quantity, and about 5,000 tons of waste liquids and acid chlorides flow into the same basin, from Bower's Brook, every 24 hours, which is about in the proportion of one ton of liquid refuse to 31,500 tons of sea water.

3053. (*Dr. Frankland.*) That assumes that they are thoroughly mixed together?

(*Mr. Gaskell.*) Yes. In the calculation I have taken two tides daily, but have omitted the great body of fresh water which is always running down into the sea. The result of that calculation gives about two grains of liquid refuse to every ton of sea water, or about $\frac{2}{10}$ of a grain of solid refuse.

3054. (*Dr. Frankland.*) Does not the refuse from your works flow on to the shore of the estuary?

(*Mr. Gaskell.*) Yes.

3055. (*Dr. Frankland.*) It does not mix with the main body of the stream until it has passed some distance upwards or downwards?

(*Mr. Gaskell.*) Exactly so, and for that reason, in making the calculation we took in the area of the basin three or four miles above Widnes and six or seven miles below.

22 June 1869.

3056. (*Dr. Frankland.*) Do the acid liquors from your works run in, in a constant stream during the 24 hours, or in gushes?

(*Mr. Gaskell.*) At Widnes, the whole of the liquid waste is turned into "Bower's Brook," which is the natural drainage channel of that part of the country. You took a sample from it, and that brook is always running.

3057. (*Dr. Frankland.*) Would you consider it a hardship if you were compelled to run the waste liquor into the brook at a certain mean rate extending over 12 hours or 24?

(*Mr. Gaskell.*) Yes, because we should have to collect it in some kind of way and feed it out differently. We do not empty all our stills at the same time.

3058. (*Dr. Frankland.*) How many alkali works in Widnes are situated on this brook?

(*Mr. Gaskell.*) Six or seven.

3059. (*Dr. Frankland.*) Are the stills emptied uniformly during the whole 24 hours?—

(*Mr. Gaskell.*) Yes; but of course each works has its own time, probably no two are alike.

3060. (*Chairman.*) What has been said with reference to the river Tyne applies, *mutatis mutandis*, and with a certain amount of reservation, to Widnes, but inland the case is different,—the refuse is turned into the river and the river is polluted. A nuisance, is created which is injurious to everybody who lives on its banks. It is therefore hardly necessary to say that if all the alkali refuse is turned into the sea, unless any person can say that you create a nuisance you will be exempt from the operation of the law, but if you create a nuisance, then the question will be whether you cannot by some process abate it. We have and shall make investigations in order to ascertain whether a particular manufacture carried on in a particular place can be rendered innocuous and prevented from causing a nuisance to those who are situated below.

(*Mr. Stevenson.*) We understood that evidence had been brought before you showing very strongly the advantages to be derived from the application of two particular patent processes — Mr. Mond's and Mr. Weldon's,—and we thought that you might be disposed to recommend one or other to be applied compulsorily, not to the whole trade, but to the trade in particular localities. We understand that it has been represented that no hardship would arise to manufacturers from having that obligation laid upon them. I have had no experience of either of those processes, but Mr. Muspratt is present, and, I believe, has prepared himself with some information with a view to show the Commissioners that some limitations must be taken into account in the application of these processes.

3061. (*Chairman.*) I believe we heard Mr. Muspratt at Widnes?

(*Mr. Muspratt*, Widnes and Liverpool.) That was in reference more particularly to Mond's process. To prevent the acid from getting into the Sankey Brook it must be neutralized. Any person who particularly understands the operation of Weldon's process knows that, even if it is carried out, there will still be the same or a greater amount of acid to run away, as it will require a smaller amount of acid to make the same quantity of bleaching powder.

3062. (*Dr. Frankland.*) Then there will be more acid?

(*Mr. Muspratt.*) Yes; but, as Mr. Stevenson has stated, the acid and the waste are not always found in the same works. I do not say positively that it is the case at St. Helen's, but it is so at Widnes. There are several alkali works at Widnes where they do not make any acid. In the course of the trade the acid is really separated from the waste, and in calculating the value of Mond's process for the extraction of sulphur, it is necessary to put a value on the acid.

22 June 1869.

Messrs. Tennant & Co., of Glasgow, make a large quantity of acid, and when the bleaching powder trade was good they used nearly the whole of the acid produced at their works for the purpose of making bleaching powder, and to carry out Mond's process were obliged to buy acid.

3063. (*Dr. Frankland.*) Then Weldon's process would rather help you, would it not?

(*Mr. Gaskell.*) Except that the manufactures are not always combined.

3064. (*Dr. Frankland.*) Is it not rather an exceptional state of things that the three processes are not combined in the same works? The manufacture of salt cake and muriatic acid, the manufacture of soda-ash and production of alkali waste, and the production of bleaching powder, are they not usually combined?

(*Mr. Gaskell.*) They are not always. At Widnes three works out of the six do not make any acid.

3065. (*Dr. Frankland.*) Speaking generally, you would say that it was an exceptional state of things if it were otherwise, would you not?

(*Mr. Muspratt.*) I think that Widnes is a good representation of the trade; I suppose that they have one-sixth of the trade of the country.

3066. (*Dr. Frankland.*) How many works are there on the Tyne where they do not make acid?

(*Mr. Stevenson.*) They all make acid, but the question is whether they make use of that acid to make bleaching powder.

3067. (*Dr. Frankland.*) Do they make bicarbonate of soda?

(*Mr. Allhusen*, Newcastle-upon-Tyne.) We have two large works, at one of them we make bleaching powder, at the other we do not. On the river Tyne out of twelve works four do not make bleaching powder, and the others do not use all the acid produced for making bleaching powder.

3068. (*Dr. Frankland.*) In those four works do they not produce alkali waste and muriatic acid?

(*Mr. Allhusen.*) Yes.

(*Mr. Muspratt.*) We were under the impression that it was the intention of the Commissioners to recommend certain processes for extracting the sulphur. I do not suppose that the alkali trade, as a whole, would say that they had any right to pour refuse into the rivers any more than any other trade.

3069. (*Chairman.*) Do not put any limitation and speak of their having a right to pollute the rivers at all.

(*Mr. Muspratt.*) No, I do not mean that, for I do not suppose they have, but it may be expedient, nevertheless, to let them do so.

3070. (*Chairman.*) That is quite another question.

(*Mr. Muspratt.*) I do not suppose that the alkali trade will object to being put under the same restriction as every other trade. If you say that there is to be, in future, no pollution from sewage, or from acids from dye-works, I do not suppose that we should say, if alkali works were placed under the same conditions on a stream, that we should be allowed to pollute it, when others were not allowed to do so. It has been said that before the woollen manufacturers were compelled to recover the fatty matters from soap suds, they were run to waste, but the value of the waste was so small in proportion to the value of the manufacture.

3071. (*Chairman.*) No compulsion has been put upon them; it is done as a matter of profit entirely.

(*Mr. Muspratt.*) And we say with regard to these processes for extracting sulphur that if they are profitable they will be used.

(*Mr. Gaskell.*) At the present time these processes are simply experimental. Two patents have been taken out, and the patentees say that they can be used very profitably and successfully.

3072. (*Dr. Frankland.*) We are informed by Dr. Angus Smith that there are 25 patents.

(*Mr. Gaskell.*) As I understand there are only two that the Commission seem to have taken, as it were, under their patronage, and they are Mr. Mond's and Mr. Weldon's.

3073. (*Chairman.*) I beg to say that we disclaim anything of the kind; you have quite mistaken our position. We prosecuted inquiries, and have found that there are certain processes by which the nuisance from alkali works can be prevented, and at a profit, although the question of profit and loss is a different matter altogether. With regard to the sewage, it may be found that it can be profitably used, but still that is a different thing. We are not to look to the profit. It will be for those upon whom the necessity is thrust to get rid of the sewage, to see whether they can, or not, turn it to profitable account, and every means will be afforded to them for doing so. As to any special process to be carried out by alkali manufacturers we are not going to deal with that in any way, except with a view to get rid of the nuisances.

(*Mr. Muspratt.*) In common with all other kinds of nuisances?

3074. (*Chairman.*) Yes, in common with other nuisances.

(*Mr. Gaskell.*) As I understand it, the Commissioners are disposed to take, what may be called, a common-sense view of the question.

3075. (*Chairman.*) I hope so.

(*Mr. Gaskell.*) I believe that no manufacture can possibly be carried on in this country, without a certain degree of nuisance arising from it. I take it that with regard to alkali works, that are situated practically on an arm of the sea, such as the river Mersey at Widnes, and also with regard to the alkali trade of the river Severn, that where they are throwing their waste liquor into a branch of the sea, or into salt water, the Commissioners would not be disposed to interfere with them in the same way that they might be disposed to interfere with those whose works are situated on inland waters, and who are inflicting injury on the owners of the land in the neighbourhood.

3076. (*Chairman.*) If there are no grounds for complaining against you, of course you will be free from the operation of any law that may be passed.

(*Mr. Gaskell.*) If the result of your Report was that legislation took place, and we were forbidden by penal statute to throw our waste liquor into a tidal river; then you would really be practically interfering with us, although no one complained of what we did.

3077. (*Chairman.*) It think it would depend upon what the definition of a river is. I take it for granted that there would be some limitation in any Act of Parliament.

(*Mr. Muspratt.*) I did not refer to Weldon's process particularly at Liverpool, and the only remark that I have to make about that is this,—that you will really increase the quantity of acid by its use.

3078. (*Dr. Frankland.*) While the other process will diminish it?

(*Mr. Muspratt.*) Yes, but not in the same proportion.

(*Mr. Gaskell.*) We say that both are experimental processes. There are two manufacturers who are thought to have an interest in the use of these two processes; one is using Weldon's process, and the other is using Mond's process, but it must be seen that neither of them is using it to any great or serious extent, but only in an experimental way.

3079. (*Dr. Frankland.*) I think that Mr. Worsley is making use of it in a way that can hardly be called experimental. Perhaps he will state what proportion of the alkali waste, at the Neltham Chemical Works, is now being submitted to that process.

(*Mr. Worsley*, Bristol.) The whole of it.

3080. (*Dr. Frankland.*) How long have you been applying the process to that extent?

(*Mr. Worsley.*) For about three months.

3081. (*Dr. Frankland.*) Before that, had you used about half of it?

(*Mr. Worsley.*) Yes.

(*Mr. Gaskell.*) I may be allowed to remark that Mr. Worsley's works are carried on under special circumstances, that may not apply to the rest of Lancashire. The application of the process may pay him when it would not pay others to apply it; and, moreover, the question is, whether it would even pay him to do it, if all of us were doing the same, for example, what would sulphur be worth, if we were all doing it.

3082. (*Chairman.*) There again I think you are mistaking the object of this Commission. Our object is not to force particular processes upon any persons, but to give them an opportunity of profiting by the information that we collect in various places, and we say, here are processes which will have a certain effect when applied to alkali waste; and therefore there will be no hardship in insisting that the alkali manufacturers, who are, while carrying on their business, creating a nuisance, shall abate it. It is not that we are about to recommend any particular process for adoption; for we are really endeavouring to obtain as much information as we possibly can, as to the different modes of dealing with refuse of all kinds; and we are desirous of putting this information before the manufacturers to indicate a means by which they can abate the nuisance which has now become so great and crying an evil.

3083. (*Dr. Frankland.*) There is Hofmann's process for extracting sulphur from alkali waste, which has attracted a good deal of attention, and we should like to have some information about it. Perhaps Mr. Muspratt can give us that information.

(*Mr. Muspratt.*) I inquired into Hofmann's process long before I took to Mond's process. I am persuaded that the other processes will not compete with Mond's in England.

3084. (*Dr. Frankland.*) Have you seen Mr. Lothian Bell's report upon Hofmann's process?

(*Mr. Muspratt.*) I have read about 10 different descriptions of it either by Hofmann himself or by others.

3085. (*Dr. Frankland.*) Are you aware that at the last Paris Exhibition a gold medal was awarded to that particular process?

(*Mr. Muspratt.*) Yes, I am aware of that, but it involves so much labour. I do not say that you do not produce sulphur by it,—you do,—but the question is at what cost.

3086. (*Chairman.*) I understand from you that you are satisfied with Mond's process?

(*Mr. Muspratt.*) Yes, I say that it is suitable for certain manufactures, but not for others. Certain manufacturers can carry it on profitably, but others cannot. I think if the manufacturers are left alone, those who can carry it on will do so without any legislation whatever.

3087. (*Chairman.*) Still you say that others who do not find it profitable will have to turn their acid into the brooks and streams, and so damage their neighbours below.

(*Mr. Muspratt.*) I have no answer to that if you apply the rule to all trades.

(*Chairman.*) It is our business to do so.

3088. (*Dr. Frankland.*) Is it not the case that Hofmann's process disposes also of the waste from the chlorine stills?

(*Mr. Muspratt.*) Yes.

3089. (*Dr. Frankland.*) So that Weldon's is not the only process of doing it?

(*Mr. Muspratt.*) The difference is this, if you use the chlorine still liquor to make sulphur, the sulphur is of a dark colour and contaminated with a certain amount of sulphate of iron, which is of less value than pure sulphur.

3090. (*Dr. Frankland.*) Mr. Lothian Bell says that you can avoid that contamination by the sulphate of iron, and that he gets one ton eight hundredweights of pure sulphur from a certain quantity of waste together with two tons four hundredweight of sulphur, mixed with sulphates. 22 June 1869.

(*Mr. Allhusen.*) Mr. Lothian Bell has been referred to, but he has not applied the process at one of the works; of course the manufacturers on the Tyne will apply the process, where it is possible to do so, after a little more experience has been gained.

(*Mr. Stevenson.*) I am afraid we have trespassed too long upon the attention of the Commissioners, but we thank you for the patience with which you have listened to us, representing, as we desire to do, the vast importance of the alkali trade, which is now suffering from foreign competition, anything that would put restriction upon our manufacture might be seriously injurious to us, and especially anything which I am glad you disclaim,—recommending the adoption of certain processes. I believe there is no doubt that your Report is intended to be made the basis of legislation, and while I believe Parliament would be very jealous of doing anything that might interfere with manufactures, they might be made less unwilling to do so if the idea was conveyed to them that these alterations, with the view of mitigating existing nuisances, might be carried out with profit to the manufacturers. One great object of our coming here to-day has been this, we think that while, no doubt, in the case of some particular manufacturers, this process can be carried out with a profit, the circumstances of the different manufacturers are so various that any positive requisition made by the Government to the manufacturers to turn to account the waste products in every case might be productive of very serious inconvenience. Considering the importance of the trade, we hope that any legislation that may be founded upon the recommendations of the Commission will prove beneficial, and we have no doubt you will give full consideration to the practical difficulties which may attend the carrying out of any such law.

3091. (*Chairman.*) That we shall, of course, do.

(*Mr. Allhusen.*) I wish just to add that if the alkali trade were injuriously affected by legislation, it would, in my opinion, be seriously prejudicial to national interests. In the first place it would materially affect the prosperity of the mercantile marine, inasmuch as, in the Tyne alone, one-sixth of the trade depends upon the continuance of the alkali works. The Tyne loads annually 19,692 ships, measuring 4,300,339 tons. The importance of this state of things is best represented by comparison; and I wish further to mention that the total trade of all the French ports, beginning with Dunkirk and ending with Nice, only employs two-thirds of the number of tons employed at Newcastle alone. We are desirous of employing Weldon's process, and my son inspected the Weldon process in operation at Mr. Gamble's works at St. Helen's, and he was favourably impressed with it. I have myself made some inquiries, and, although Mr. Gamble himself has explained to me that there are great difficulties and uncertainties about it, nevertheless we shall endeavour to try it. With regard to Mond's process, it is our intention to apply that in one of our works, but it is impracticable to apply it in all cases, as the arrangement of the apparatus would not allow of it. But, although the principle be applied, it will not destroy the alkali waste, as the drainage will still continue, in some degree, to run from it, but it will be modified. I am also apprehensive that the escape of sulphuretted hydrogen will be unavoidable, and that will naturally be prejudicial to the locality.

3092. (*Dr. Frankland.*) We have heard everywhere that after the waste has been treated by Mond's process there is no noxious drainage from it.

(*Mr. Allhusen.*) I am informed that there is still a partial drainage, although not so much as it gives in its original state.

3093. (*Dr. Frankland.*) Do you know, from your own experience, what is the kind of drainage that comes from the alkali waste after treatment?

22 June 1869.

(*Mr. Allhusen.*) No, only three tons have been treated in Newcastle.

3094. (*Dr. Frankland.*) In your opinion, does the admission of acid into the river Tyne at present interfere with fish life in that river?

(*Mr. Allhusen.*) I can, from my own knowledge, say, that salmon is more plentiful in the Tyne now than it ever has been during the 44 years I have known the river.

3095. (*Dr. Frankland.*) Have there not been some particular instances in which dead fish have been seen in the Tyne?

(*Mr. Allhusen.*) I have not seen one; I have seen fish jump into a lighter.

3096. (*Dr. Frankland.*) Is the acid admitted in a pretty regular stream into the river?

(*Mr. Allhusen.*) It runs regular when it is discharged into the Tyne from the chlorine stills. It runs at certain stated hours, but as no manufacturer runs off all his stills at one time, there are many manufacturers who run off their stills, and it follows that the discharge of the acids is tolerably well dispersed over the whole period.

3097. (*Dr. Frankland.*) Would it be a hardship to run this still liquor into the river in something like a regulated stream instead of in gushes?

(*Mr. Allhusen.*) It could not be done.

3098. (*Dr. Frankland.*) You mean, I presume, that it could not be done economically?

(*Mr. Allhusen.*) It could not be done economically; the arrangements could not be done in some cases; where the works are at a great elevation you might construct a pond possibly, and store the acid in it, and then run it out; but most of the works are on a level flat, and close to the river; you could not store the acid there.

3099. (*Dr. Frankland.*) I suppose there would always be a fall of three or four feet from the chlorine stills?

(*Mr. Allhusen.*) In my low works it is not so; it would not come to anything; it would be all the same thing so far as the effect is concerned.

3100. (*Dr. Frankland.*) Do they not use either Mond's or Hoffman's process in Germany?

(*Mr. Allhusen.*) Hofmann's process was used at two places, and I think Mr. Lothian Bell wrote a pamphlet about it, but writing about it is one thing, the adoption of the principle is quite another thing. I may add that the American tariff, with respect to the alkali trade, is so various that what might be done to-day could perhaps not be done six months hence. In the communication sent to the Commissioners in October 1868, we stated that about one-third of the acid that was produced in the Tyne was made available in the manufacture of bicarbonate of soda; and since that period the bicarbonate works on the Tyne have been all but shut up, owing to the effect of the American tariff, over which we have no control.

The Deputation withdrew.

EVIDENCE.—PART IV.

Enactments in force in PRUSSIA, FRANCE, and BELGIUM, to prevent pollution of rivers.

ENACTMENTS IN FORCE IN PRUSSIA, FRANCE, AND BELGIUM.

2, Victoria Street, Westminster, S.W.,
October 21, 1868.

SIR,

THE Rivers Pollution Commissioners having been informed that the Prussian Government exercises strict supervision over manufactories, in order to prevent as far as possible the pollution of rivers, I am directed to request that application may be made to them for a copy of the enactments in force in Prussia for that purpose, and also for a copy of the instructions issued by "Die technische Deputation des Handels Ministeriums," the Department charged with carrying out the provisions of these enactments.

It is most desirable that the Commissioners should be in possession of the enactments and regulations in force in other countries in order that they may be enabled to meet objections which may be made to interference on the part of the government of this country, with the different branches of trade and manufacture that now so seriously pollute the rivers.

I am, &c.
(Signed) S. J. SMITH, Secretary.

The Under Secretary of State, Home Department,
&c. &c. &c.

Foreign Office, December 16, 1868.

SIR,

I AM directed by Lord Clarendon to transmit to you a copy of despatch from Her Majesty's Ambassador at Berlin, with its enclosures, containing information which he has procured in obedience to instructions conveyed to him on the receipt of your letter to the Home Office of the 21st of October last, respecting the system in force in Prussia to prevent pollution of rivers.

I am, &c.
(Signed) ARTHUR OTWAY.

S. J. Smith, Esq., Secretary,
Rivers Pollution Commission, 2, Victoria Street.

Enactments in force in PRUSSIA.

Enactments in force in Prussia.

(1.)

Lord A. LOFTUS to the Right Hon. Lord STANLEY.

No. 447.

MY LORD,

Berlin, December 10, 1868.

WITH reference to your Lordship's despatch, No. 196, of October 24th, instructing me to procure, for the information of the "Rivers Pollution Commission," copies of the enactments in force in Prussia for the supervision over manufactories in order to prevent the pollution of rivers, and copies of the instructions issued by the Department charged with carrying out those enactments, I have now the honour to transmit to your Lordship the copy translation by Mr. Harriss-Gastrell of a note from M. de Thile enclosing the documents in question, translations of which by Lord Brabazon are also annexed.

The regulations bearing upon this subject are to be found in the Royal Cabinet Ordinance of February 24, 1816, in the law relating to the cultivation of meadow lands of October 28, 1846, in the statute relating to the use of private rivers of February 28, 1843, and in the statute of July 1, 1861, under which the erection of certain manufactories requires a special Police licence.

In addition to the above-named enactments, the local Police authorities are armed with certain powers for enforcing sanitary regulations in regard to running streams.

The Technical Department for Manufactories in the Ministry of Commerce has no executive functions.

I have, &c.
(Signed) AUGUSTUS LOFTUS.

The Lord Stanley,
&c. &c.

(2.)

Translation.—Baron THILE to Lord A. LOFTUS.

Berlin, December 2, 1868.

THE undersigned has the honour to state to his Excellency Lord A. Loftus, &c., in reply to his letter of the 31st ult., that according to a communication received from the Minister for Commerce and Agriculture, special regulations for the inspection of factories in order to prevent the pollution of running waters do not exist in Prussia.

Enactments in force in Prussia—*cont.*

Certain limits are set to the pullution of navigable and boatable rivers and of canals by the Order in Council (Cabinets Ordre) of Feb. 24, 1816 (see pp. 108 of Collection of Laws), and to the pollution of streams which are private property by section 3 of the Law of Feb. 28, 1843 (see pp. 41 of Collection of Laws). The improved system of meadow cultivation in the district of Siegen has moreover caused the regulations with respect to meadows for this district, of Oct. 28, 1846 (see pp. 485 of Collection of Laws) to contain at section 74 a special provision directed against the pollution of the streams by manufacturing establishments. Copies of these regulations are respectfully annexed.

Finally, the Law of July 1, 1861 (see Collection of Laws, pp. 749), offers a legal means of interference in every separate case of pollution of running waters by the refuse of manufactories, inasmuch as certain named manufacturing establishments (as entered in the accompanying list) require a special authorization from the Police, and can be subjected to certain due restrictions in the manner in which they are carried on.

Moreover it is permitted to the Policial authorities to make, by means of a Policial decree, any regulations which may be deemed necessary for sanitary reasons, in consideration of local circumstances, respecting the use of running waters in connexion with the carrying on of manufacturing processes. Universal regulations only exist in respect of Aniline factories, inasmuch as throughout the State it is strictly forbidden by Policial decrees to carry off the Arsenical refuse of those factories in running waters.

No regulations in connexion with this question here have been made by the Technical Commission for Manufactures under the Ministry of Commerce, as is assumed in the letter of the 31st of October, for that Commission has only consultative and not executive functions.

Whilst the undersigned respectfully submits the foregoing to his Excellency for the information of his Government, he avails himself, &c.

His Excellency Lord A. Loftus, (Signed) THILE.
&c. &c. &c.

(3.)

Translation.—Enclosure in Lord A. Loftus', No. 447, of Dec. 10, 1868.

ROYAL CABINET ORDER of February 24, 1816, for preventing the pollution of rivers and canals navigable by ships and boats.

WITH reference to your report of the 18th instant, it is hereby commanded, for preventing the pollution of rivers and canals navigable by ships and boats, that no owner of saw-mills, saw-dust, or bark, and in particular no person who makes use of such stream in the prosecution of his business, shall throw refuse into it in such manner that the stream, in the opinion of the provincial Police authorities, shall be thereby seriously polluted, and that every person so doing shall not only undertake at his own expense the removal of the objects arresting the course of the stream but shall pay in addition a fine of from 10 to 50 thalers.

Berlin, February 24, 1816.

Count Von Bulow, (Signed) FRIEDRICH WILHELM.
&c. &c. &c.

(4.)

Translation—Enclosure in Lord A. Loftus', No. 447, of Dec. 10, 1868.

STATUTE touching the erection of manufactories of July 1, 1861.

We, William, by the grace of God King of Prussia, &c., order, with the consent of both Houses of the Landtag, applicable to the whole monarchy, with the exception of the territory of Hohenzollern, as follows:

§ 1.

The following shall be reckoned amongst those manufactories which require a special Police licence, (§ 26 to 1 of the General Trade Statute of January 17, 1845).

I.—Gunpowder factories, manufactories of fireworks and inflammable materials of all descriptions, gasworks and reservoirs, manufactories of peat tar, coal tar and coke, in case they are erected away from the spot where the material is produced, porcelain, delft and earthenware manufactories, glass and blacking ovens, lime, brick, and gypsum kilns, works for the production of raw metals, smelting furnaces, metal casting factories, if they are not simple pot and pan casting works, foundries, chemical factories of all sorts, quick bleaching, varnish works, starch manufactories with the exception of those of potato starch, oilcloth, catgut, pasteboard for roofs and roof felt, soap and bone factories, boiling and bleaching-yards, tallow factories, slaughter-houses, tan-yards, flaying-yards, establishments for pulverizing human and animal manure, as well as machinery of all kinds worked by water-power (mills, &c.).

II.—Boilers, whether intended for propelling machinery or not (§ 12).

(5.)

Translation.—Enclosure in Lord A. Loftus', No. 447, of Dec. 10, 1868.

EXTRACT from the Statute concerning the use of private rivers of Feb. 28, 1843.

§ 53.

No water applied to dyeing, tanning, fulling, or other similar purposes, is to be suffered to enter a river, if thereby the means of procuring clean water be endangered to the neighbourhood, or any actual annoyance be occasioned to the public.

The decision thereupon rests with the Police authorities.

Enactments in force in Prussia—*cont.*

(6.)

Translation.—Enclosure in Lord A. Loftus', No. 447, of Dec. 10, 1868.

EXTRACT from the Meadow Regulations for the Circuit of Siegen, of Oct. 28, 1846.

§ 74.

The owner of such works as impregnate the water used in the manufactory with materials hurtful to meadow land must, in accordance with the judgment and directions of the Police authorities, precipitate these materials by means of fresh-water ponds or other arrangements before the water is reconducted into rivers, streams, or watercourses, under penalty of a fine of from 5 to 10 thalers.

Enactments in force in France.

Enactments in force in FRANCE.

2, Victoria Street, Westminster, S.W.,
December 21, 1868.

SIR,

I HAVE received under date the 16th inst., from the Under Secretary of State, Foreign Department, copy of a despatch from Her Majesty's Ambassador at Berlin giving cover to certain documents containing information respecting the system in force in Prussia for preventing the pollution of rivers, and have brought the same under the notice of the Commissioners.

I am directed to request that application may be made to the Governments of France and Belgium for copies of the enactments in force in those countries to prevent pollution of rivers.

I am, &c.
(Signed) S. J. SMITH, *Secretary.*

The Under Secretary of State, Home Department,
&c. &c. &c.

SIR, Whitehall, 2nd February 1869.

WITH reference to your letter of the 21st December last, I am directed by Mr. Secretary Bruce to transmit to you a copy of a note and its enclosures, addressed by the French Government to Her Majesty's Ambassador at Paris, giving information as to the prevention of the pollution of rivers in France.

I am, &c.

S. J. Smith, Esq., Secretary, (Signed) A. F. O. LIDDELL.
Rivers Pollution Commission, 2, Victoria Street.

M. L'AMBASSADEUR, Paris, Janvier 26, 1869.

V. Ex. m'a fait l'honneur de m'informer le 28 Décembre dernier que les Commissaires de la Navigation fluviale en Angleterre désiraient prendre connaissance des réglements en vigueur en France pour prévenir la corruption des eaux des rivières.

M. le Ministre d'Agriculture du Commerce et des Travaux publics que j'avais prié de me mettre à même de satisfaire le plus tôt possible à cette demande vient de m'adresser la note dont je m'empresse de communiquer ci-joint copie à V. Exc. Ce document fait connaître en l'absence d'une réglementation spéciale sur la matière les lois et les règlements divers qui se rattachent à la police des eaux, en général et qui figurent au bulletin des Lois de l'Empire. En ce qui concerne d'ailleurs plusieurs arrêts et ordonnances également rappelés dans la note et qui n'ont point été insérés au bulletin des Lois, M. Gressier n'en a fait parvenir des extraits que V. Exc. trouvera ci-annexés.

Agréez, &c.

S. Exc. Lord Lyons, (Signé) LA VALETTE.
&c. &c.

Note.

Il n'existe pas en France de réglementation spéciale ayant pour objet de prévenir la corruption des eaux. Cette question se rattache à la réglementation générale de la police des eaux. Dans cet ordre d'idées la législation distingue les fleuves et les rivières navigables et flottables qui font partie du domaine public et les cours d'eau non-navigables ni flottables qui appartiennent au domaine commun. Cette législation n'a pas été résumée dans un texte unique ; elle se compose d'éléments divers repartis dans un certain nombre de lois et de réglements d'origine et de dates différentes.

En ce qui touche les rivières du domaine public, les prescriptions réglementaires sur la grande rivière sont éparses dans un assez grand nombre d'anciennes ordonnances royales ou d'arrêts du Conseil, maintenus en vigueur par la loi des 19, 22 Juillet 1791. Cinq de ces réglements ont un caractère général et sont journellement appliqués : l'ordonnance des eaux et forêts d'Août 1669 ; l'arrêt du Conseil du 24 Juin 1777 ; (ces deux règlements sont applicables à toutes les rivières de l'Empire) l'ordonnance de 1672 qui a pour but de réglementer l'approvisionnement de Paris par les rivières du bassin de la Seine ; et les deux arrêts du Conseil des 17 Juillet 1782 et 23 Juillet 1783, concernant spécialement le 1^er^, le bassin de la Garonne, et le second le bassin de la Loire.

Au point de vue de la question sur laquelle des renseignements sont demandés, ces réglements renferment des dispositions à peu près identiques : l'ordonnance de 1669, titre 27, article 42 ; l'arrêt du Conseil de 1777, Art. 4, l'ordonnance de 1672, Art. 9, et les arrêts du Conseil de Juillet 1782 et Juillet 1783, l'un et l'autre titre 2, article 9,

Enactments in force in France—*cont.*

interdisent d'élever moulins bâtardeaux, gords, pertins, plants d'arbres nuisibles au cours de l'eau ni d'y jeter aucunes ordures immondices, graviers, pailles ou fumiers, ce à peine de punitions corporelles et d'amendes, et prescrivent l'enlèvement de ces objets aux frais et dépens de ceux qui les ont élevés, jetés ou déposés.

En cas d'information à ces dispositions des procès verbaux sont dressés par les agents assermentés, et déférés aux conseils de préfecture dont la compétence à ce sujet a été déterminée par la loi du 29 Floréal, an 10.

En ce qui concerne les cours d'eau non-navigables, l'autorité administrative a des attributions moins étendues; néanmoins, elle doit veilles au libre écoulement des eaux dans l'interêt de l'agriculture et de la salubrité ainsi, la loi du 22 $\times^{bre}$ 1789, section 3, article 2, charge les Administrations départementales de veilles à la conservation des rivières; celle des 12–20 Août 1790, chapitre 6, lui donne la mission de procurer le libre cours des eaux; celle du 6 Octobre 1791 de fixer le niveau des déversions de superfice, enfin celle des 16–24 Août 1790 permet à l'autorité municipale d'intervenir quand les eaux deviennent une cause d'insalubrité. En vertu de ces dispositions législatives les préfets et les maires, selon le cas prennent des arrêtés, pour prescrire les mesures jugées nécessaires dans l'intérêt de la salubrité, en ce qui touche particulièrement le curage des petites rivières, le réglement des moulins, le rouissage du lin et du chanvre et l'évacuation des matières et residus provenant des fabriques et établissements industriels. Ces arrêtés n'ont qu'un caractère local, et les infractions aux dispositions qu'ils renferment sont déférés aux tribunaux de simple police. A cette nomenclature on pourrait ajouter la loi du 15 Avril 1829, dont l'article 25 interdit de jeter dans les rivières des drogues de nature à détruire le poisson.

Le projet du code rural en ce moment à l'étude, précisera sans doute, et résumera les différents éléments de législation sur cette importante question.

Extrait de l'ordonnance du mois de Décembre 1672.

Article 9.

Défence a toutes personnes de jeter dans le bassin de la rivière de Seine, le long des bords d'icelle, quais et ports de la dite ville, aucunes immondices, gravois, pailles et fumiers, à peine de punition corporelle contre les serviteurs, et d'amende arbitraire, au paiement de laquelle pourront être les maîtres contraints, et enjoint aux propriétaires des maisons bâties sur les ports, le long des quais et bords de la dite rivière, et aux entrepreneurs qui auront travaillé ou travailleront à la construction et rétablissement des ponts et arches, ou murs des quais de faire incessamment enlever les décombres provenant des bâtardeaux qu'ils auront fait faire pour les dits ouvrages, à peine d'amende et de répétition contre eux des peines d'ouvriers employés à l'enlèvement des dits décombres. Et à ce que le présent règlement soit plus punctuellement gardé, sera affiché à la diligence du procureur du Roi et de la Ville, et renouvelé de six mois en six mois.

Arrêt du Conseil d'État du Roi du 24 Juin 1777.

Article 4.

Défend S. M. sous les mêmes peines, à tous riverains et autres, de jeter dans le lit des dites rivières et canaux, ni sur leurs bords, aucuns immondices, pierres, graviers, bois, paille ou fumiers, ni rien qui puisse en embarrasser et attérir le lit, ni d'en affaiblir et changer le cours par aucunes trancheés ou autrement, ainsi que d'y planter aucuns pieux mettre rouir des chanvres, comme aussi d'y tirer aucunes pierres, terres, sables et autres matériaux plus près des bords que de six toises.

Arrêt du Conseil d'État du Roi, du 17 Juillet 1782.

Titre II., *Article* 9.

Défend S. M. sous les mêmes peines, à tous riverains et autres, de jeter dans le lit de la rivière ni sur les bords, aucuns bois, graviers, pierres, ni rien qui puisse en embarrasser ni arrêter le lit, d'en affaiblir ou changer le cours par aucune tranchée, ni autrement; d'y mettre rouir des chanvres et de tirer de la rivière aucunes pierres, terres, sables et autres matériaux plus près des bords que de dix toises.

Arrêt du Conseil d'État du Roi du 23 Juillet 1783.

Titre II., *Article* 9.

Défend S. M. sous les mêmes peines, à tous riverains et autres de rien jeter dans le lit des dites rivières et ruisseaux qui puissent les encombrer; d'en détourner ni affaiblir le cours par des tranchées ou autrement; d'y mettre rouir du chanvre, ni d'enlever aucunes pierres provenant des ouvrages des turcies et levées, en quelque endroit qu'elles se trouvent. Défenses sont également faites de déposer des matériaux, déblais et immondices, sur les bords et chantiers des dites rivières et ruisseaux, si ce n'est à trente pieds au delà des dits bords. Défend également S. M. d'entreposer aucunes marchandises sur les dits bords et chantiers.

Extrait de l'Ordonnance des Eaux et Forêts du Mois d'Août 1669, enrégistrée le 13 du même mois.

Article 42.

Nul, soit propriétaire ou engagiste, ne pourra faire moulins, bâtardeaux, célures gords, pertins, murs, plants d'arbre, amas de pierres, de terre et de fascines, ni autres

Enactments in force in France—*cont.*

édifices ou impêchements nuisibles, au cours de l'eau dans les fleuves et rivières navigables et flottables ni même y jeter aucunes ordures, immondices, ou les amasses sur les quais et rivages, à peine d'amende arbitraire. Enjoignant à toutes personnes de les ôter dans trois mois du jour de la publication des présentes, et si aucuns se trouvent subsister après ce temps, voulons qu'ils soient incessamment ôtés, et levés à la diligence de nos procureurs des maîtrises, aux frais et dépens de ceux qui les auront faits ou causés, sous peine de cinq cent livres d'amende tant contre les particuliers que contre le juge et notre procureur qui auront negligé de le faire, et de répondre en leurs privés des dommages et intérêts.

Enactments in force in Belgium.

Enactments in force in Belgium.

Sir, Whitehall, January 22, 1869.

With reference to your letter of the 21st ult., I am directed by Mr. Secretary Bruce to transmit to you, for the information of the Rivers Commissioners, a copy of the Regulations in force in Belgium for the prevention of the pollution of unnavigable streams and rivers which has been procured by Her Majesty's Minister at Brussels.

I am, &c.

(Signed) E. H. Knatchbull Hugessen.

The Secretary, Rivers Pollution Commission,
2, Victoria Street, Westminster.

Extrait des Réglements Provisionaux en vigueur sur la Police des Cours d'Eau non-navigables ni flottables en Belgique.

Anvers.

Il est défendu de jeter dans les ruisseaux et cours d'eau des matériaux, décombres, sables, terres, pailles, herbes, etc., et généralement tous objets qui peuvent entraver le libre écoulement.

Il est également défendu d'y jeter ou laisser écouler des matières ou liquides pouvant corrompre ou altérer les eaux, d'y faire rouir du lin ou du chanvre, le tout à moins d'autorisation préalable de l'autorité compétente.

Aucun depôt de fumier ne peut être fait sur la digue ou le bord d'un ruisseau ou cours d'eau.

Les contraventions au présent article seront punies d'une amende de cinq à quinze francs.

Brabant.

Art. 20. Il est défendu de jeter ou de laisser écouler dans les cours d'eau aucun résidu solide des établissements industriels.

Les propriétaires de ces établissements où l'on fait usage de procédés pouvant salir corrompre ou dénaturer l'eau, sont tenus de faire construire, sur leur propriété des réservoirs assez spacieux pour contenir, chaque jour, les residus de la fabrication, de manière que la partie liquide soit décantée avant d'être déversée dans le cours d'eau.

L'écoulement ne pourra avoir lieu avant la nuit, ni à d'autres heures que celles que la Députation aura fixées.

Tout retard dans l'exécution complète des mesures prescrites, ainsi que toute autre infraction à la presente disposition seront punis des peines qui, appliquées séparément ou cumulativement, ne peuvent excéder huit jours d'emprisonnement et deux cents francs d'amende, ni être au dessous des peines de simple police.

Flandre Orientale.

Il est défendu de jeter dans les cours d'eau des matériaux, decombres, sables, terres, pailles, herbes et d'y placer tous objets quelconques, qui peuvent obstruer le cours des eaux.

Il est également défendu d'y jeter ou faire écouler des matières liquides, pouvant corrompre ou altérer les eaux, à moins d'autorisation de l'autorité compétente et d'observation des mesures de précaution prescrites dans l'arrêté d'autorisation.

Flandre Occidentale.

Il est défendu de combler ou d'obstruer aucun ruisseau ou cours d'eau, d'y établir des ouvrages temporaires ou à demeure, sans les autorisations qui peuvent être obtenues, en faveur de l'irrigation et des usines, conformément aux dispositions sur la matière et de porter aucun obstacle ou empêchement quelconque au libre écoulement des eaux.

Hainaut.

Il est défendu de jeter ou de laisser écouler dans les cours d'eau des matières solides ou liquides pouvant corrompre ou altérer les eaux, à moins d'autorisation de l'autorité compétente.

Art. 25. Les propriétaires des lavoirs de minérais de fer, ou d'autres matières pouvant troubler le régime des eaux, dont les eaux se rendent dans les ruisseaux et cours d'eau de la province, devront dans les trois mois de la publication du présent réglement, faire construire en aval et près des dits lavoirs, deux bassins pour l'épura-

Enactments in force in Belgium—*cont.*

tion des eaux bourbantes provenant des lavoirs. Ces bassins auront chacun cinq mètres de longueur, quatre mètres de largeur et un mètre de profondeur ; ils seront pourvus chacun d'une vanne de décharge de 90 centimètres de hauteur, dont le couronnement servira de déversoir pour laisser couler, en aval, les eaux clarifiées. Les bassins seront curés à fond toutes le fois que le depôt de boire s'élèvera à soixante-quinze centimètres de hauteur.

Les commissaires-voyers constateront dans leur visite la situation de ces lavoirs.

Liège.

Il est défendu de jeter dans les cours d'eau et canaux non-navigables ni flottables, des matières liquides qui peuvent corrompre ou altérer la pureté des eaux courantes, sous les réserves ci-après.

Les eaux ayant servi au lavage des minérais, des betteraves, ou d'autres substances, pourront, en vertu d'autorisations spéciales de la Députation permanente, être jetées ou conduites dans les cours d'eau, fossés ou contre fossés, après qu'elles auront déposé, dans deux bassins adjaunts, les matières dont elles sont chargées.

Les conditions relatives aux bassins, à leurs déversoirs, et aux appareils destinés à dégager les eaux des corps solides qu'elles contiennent seront déterminées dans chaque cas, par la Députation permanente.

Les prescriptions qui précèdent seront immédiatement applicables aux lavoirs existant actuellement. Toutefois, il est accordé un délai de six mois, à dater de la publication du présent réglement aux exploitants, pour s'y conformer.

Aucune dérogation aux dispositions qui précèdent ne pourra être autorisée, qu'en vertu d'un arrêté spécial de la Députation permanente.

Limbourg.

Il est défendu de jeter dans les rivières et les cours d'eau des matériaux, décombres, sables, terres, pailles, herbes, et généralement tous les objets qui peuvent les obstruer.

Il est également défendu d'y jeter ou faire écouler des matières liquides, pouvant corrompre ou altérer les eaux et d'y laver toutes les substances quelconques qui pourraient produire le même effet, et tout, à moins d'une autorisation préalable de l'autorité compétente.

Luxembourg.

Les propriétaires ou détenteurs de lavoirs pour les minérais et de bocards pour les laitiers, dont les eaux se rendent dans des cours d'eau non-navigables ni flottables, seront tenus de faire construire, en aval de ces établissements, deux bassins dépuration, ayant chacun au moins 20 mètres de surface et 1 mètre de profondeur, et munis chacun d'une vanne de 90 centimètres de hauteur, dont le couronnement fera fonction de déversoir pour l'écoulement des eaux clarifiées.

Néanmoins, les propriétaires ou détenteurs de lavoirs voisins pourront se faire autoriser par la Députation, afin de n'avoir en commun que deux bassins ayant la même surface qu'auraient tous les bassins ensemble, et une profondeur à déterminer par l'arrêté d'autorisation.

Namur.

Il est défendu de jeter dans les cours d'eau des matières solides telles que des animaux morts, des poissons de la viande gâtée, ou d'y laisser écouler des matières liquides pouvant corrompre ou altérer les eaux.

Nul ne peut établir, sur un cours d'eau non-navigable ni flottable, aucun lavoir de minérais de fer ou d'autres matières donnant lieu à des dépôts, sans en avoir obtenu l'autorisation préalable de la députation du conseil provincial.

Dans les trois mois de la publication du présent réglement les propriétaires de ces lavoirs, déjà existants, devront, si la chose n'a pas encore été faite, faire construire, en aval et près des dits lavoirs, deux bassins pour l'épuration des eaux bourbantes provenant de ces lavoirs, ces bassins auront chacun 5 mètres de longueur, 4 mètres de largeur et 1 m. 50 centimètres de profondeur ; ils seront munis chacun d'une vanne de décharge dont le couronnement sera de dix centimètres en contre bas du bord du bassin et servira de déversoir pour laisser écouler en aval les eaux clarifiées. Les bassins seront curés à fond toutes les fois que le dépôt de boire s'élèvera à un mètre de hauteur. A l'avenir, aucun lavoir ne sera autorisé et ne pourra être établi qu'avec cette condition ; en cas d'inaccomplissement de la part du Concessionnaire, l'autorisation lui sera retirée.

Néanmoins, la Députation permanante est autorisée à déroger au présent article, et à imposer telles conditions qu'elle jugera utile pour l'épuration des eaux dans des circonstances exceptionnelles, lorsque, par exemple, la disposition des lieux serait un obstacle à l'exécution des prescriptions ordinaires ou permettrait d'employer avec avantage un autre mode plus efficace d'épuration.

REPORT by THE COMMITTEE OF MILLOWNERS on the Rivers MERSEY, IRWELL, and their TRIBUTARIES. Signed by Mr. E. C. Potter, Chairman.

Reports by the Committee of Millowners in the Basins of the Mersey and its Tributaries.

The Committee appointed to represent the case of the millowners and manufacturers on the rivers Mersey and Irwell and their tributaries, with reference to the pollutions of those waters, desire to communicate to the Commissioners the following facts and circumstances.

In accordance with a suggestion of the former Rivers Pollution Commission, the Committee issued a circular to all persons or firms whom they could ascertain to be using the waters of the streams in question, asking for information as to the nature of their business, the number of persons employed therein, the proximate annual amount of wages of all persons employed therein, and the proximate value of the manufactures produced or operated on at their respective works, including in such returns their operations thereon when not manufactured there, as in the case of bleachers, dyers, and printers for hire.

It was not to be supposed that particulars such as were thus sought would be given for publication in detail, and many firms objected to give any information on the points; but the Committee received replies from about one-eighth of the whole number applied to, constituting as the Committee believe a fair average of the whole. Those returns show an aggregate annual amount of wages paid by 111 firms making returns of 1,142,124*l.* 16*s.* 8*d.*, and the proximate gross value of the manufactures annually produced and operated on amounts to 16,752,707*l.*

If we assume these amounts to constitute one-seventh only of the whole, we arrive at an amount of wages close upon 8,000,000*l.* per annum, and of manufactures of the value of above 117,000,000*l.* sterling annually, which will be affected by a prohibition of the use of these waters.

These are amounts so startling that the Committee submit them to the consideration of the Commissioners, feeling confident that they will use every caution in dealing with interests so vast and momentous. The Committee desire to secure to the Commissioners the fullest opportunities of inspecting works where operations causing pollution of the waters are carried on, and will be glad to know their wishes on this point. They would also impress on the Commission the difficulties and insuperable obstacles which exist in many cases to any means of purifying the water after having been used in the works where pollution may have taken place.

The Committee have a mass of statistical and other information with regard to the details of various manufacturing processes, which they will be glad to communicate to the Commissioners at the proper time, and they will be obliged for an interview with the Commissioners at such time and place as may be fixed upon.

Additional report by the Committee of Millowners on the Rivers Mersey, Irwell, and their tributaries. Signed by Mr. E. C. Potter, Chairman, and dated Manchester, 16 February 1869.

We, the Committee of Millowners, submit the following statements on the subject of the pollutions of these rivers for the consideration of Her Majesty's Commissioners.

In the following observations the Committee do not refer to operations producing obstructions to the streams by deposit in their beds of solid and bulky substances, but more particularly to causes producing pollution which affect the purity of the water, and the consequences resulting from such pollutions.

These pollutions may be divided generally into two great classes, viz., those caused by the sewage of towns and large populations being conveyed into the streams, and those occasioned by trading and manufacturing operations, and these are hereafter respectively designated as sewage pollutions and trade pollutions.

These two classes are so distinct as regards their nature, utilization, and results, that they almost necessarily suggest different modes of dealing with them.

Sewage pollutions and refuse if conveyed into the stream not only injure the waters for manufacturing but unfit them for domestic purposes, and on fermentation produce atmospheric exhalations and malaria inducing disease, whilst if prevented from flowing into streams they may be beneficially applied to land cultivation.

Trade pollutions as a rule consist chiefly of chemical agents and oxides, partly in mechanical suspension and partly in chemical solution in the water, and they vary not only in every distinct class of manufacture or works where they are caused, and thus vary the character or quality of the water in its course down the stream, but they vary it in the same place in the stream at different times of the day (as proved by testing the water taken out of the stream at the same spot but at different times in the day when different operations are going on in the works above), and no uniform agent of purification could therefore be employed to precipitate, disengage, or remove the pollutions so occasioned.

In the great majority of trading operations requiring water the chemical agents, though deleterious to the water and rendering it unfit for the domestic use of the inhabitants, do not impart to it any quality to render it of any value for agricultural purposes, but rather have a noxious tendency in that respect. They have however no tendency to produce disease by the exposure of the water to the atmosphere, but on the contrary have an antiseptic or disinfectant effect, and neutralize the ill effects arising from decaying organic matter which may have got into the stream.

If the sewage pollutions were allowed to flow into the streams uncounteracted by the trade pollution, the noxious consequences to health would, it is believed, be greatly increased.

The Committee obtained returns from millowners and manufacturers using the waters of the Mersey and Irwell and their tributaries in trading operations, with a view to arrive as nearly as may be practicable at the value of the manufactures

ADDITIONAL REPORT by the COMMITTEE OF MILLOWNERS on the Rivers MERSEY, IRWELL, and their TRIBUTARIES—*cont.*

annually produced and operated on by them at their works on those streams, the use whereof necessarily produced some pollution of waters.

From the returns thus obtained they believe the value of the products so manufactured or operated on exceeds the enormous sum of 100,000,000*l.* sterling per annum, from which an idea may be gained of the immense interests involved in this question if the same is to be carried out universally.

The works in which these manufactures and operations are carried on embrace every variety of circumstance, detail, and peculiarity arising from locality, mutual covenants as to receipt, impounding, use, and delivery of the water by successive millowners on the streams, the arrangements of reservoirs for filtering and other purposes, as well as local legislation affecting various streams on which the flood waters are impounded and delivered down the streams in regulated supplies within stated hours per day, and for which the existing reservoirs and provisions of the millowners are adapted. All these have by successive measures during a long course of years settled into arrangements by which the mutual rights of parties have been adjusted to each other and to the existing state of things, and any material change of such state would involve new arrangements and construction of the works and additional or increased reservoirs which could not in many cases be carried out for want of land or facilities to effect the necessary changes, or which if possible would involve such outlay and destruction of existing property as to be practically confiscating it on measures which after all might fail to secure the purification of the water after use.

The Committee have directed their most anxious and careful attention to this subject, as they feel that the evils of the existing system are increasing and require control, and they offer the following suggestions:—

Any legislative action to prohibit or interfere with the pollution of streams by trading operations must be universal as regards the United Kingdom, and should be controlled, superintended, and carried out by central authority to secure its uniform and impartial action, as local influence would otherwise render local legislation on the subject inoperative and valueless.

Legislation, therefore, if affecting only the Mersey and Irwell and their tributaries, and not applying to all other rivers in the kingdom, would by throwing burdens and imposing restrictions on the millowners of these localities to which others would not be subject involve the removal of trade to the districts where such restrictions did not exist, and thus destroy an immense amount of property, and encourage the outlay of property to produce the like evils elsewhere to be in turn legislated for and destroyed when the evil had in turn been produced.

It is believed to be absolutely utopian to expect that the trades of these kingdoms can be carried on if all the streams are to be preserved in absolute purity or in such relative purity as that the waters thereof shall after use for trading purposes be simultaneously rendered fit for domestic consumption.

It is therefore submitted that trading pollutions of waters which do not by atmospheric agency become dangerous to public health should not be prohibited by public legislation, but that as between successive users of streams entitled to such use their respective remedies against each other should not be interfered with; their jealously as regards each other being believed to be the best security for no improper increase of pollution being permitted.

The Committee are of opinion that measures should in the first instance be adopted for preventing the sewage of towns and large populations being conveyed into the rivers or streams, and for securing its application for agricultural purposes, and if this were done that no appreciable injury to the population in a sanitary point of view would arise from the use of the waters for trading purposes in comparison with those now existing; or that if any such were found they might be separately dealt with as bearing no proportion to the benefits which the exercise of the trades necessarily secures, or with the injury which the destruction of the trades would involve.

If in connexion with the system of prohibiting the flow of sewage into streams and its utilization for culture purposes a system of impounding the waters of the streams in favourable localities before they have been polluted by use for trading purposes were simultaneously adopted, delivering a portion of such supplies for the use of millowners on the recognized principles of compensation, and securing the remainder for distribution amongst the inhabitants a pure supply, the means most conducive to public health would be secured, and if only that pollution of rivers, whether by trade or otherwise, which tended to produce disease by fermentation and atmospheric causes were interfered with, it is believed that comparatively little injury would be inflicted on trade whilst interference with its legitimate pursuit would not be sanctioned, and the sewage being utilized a benefit would be derived from what is its greatest evil, and the cost of remedying the evil would fall on the public by whom it had been created, and who would derive the advantage from its abatement or abolition and the concomitant measures for securing them permanent supplies of pure water.

Report by Mr. ALFRED E. FLETCHER, Sub-Inspector under the Alkali Act for West Lancashire, Wales, and South-west of England, 2nd February 1870.

An Estimate of the Quantity of Free Muriatic Acid which is allowed to run Annually away as Waste in the United Kingdom.

Muriatic Acid accounted for.

	Tons.
1st. In the production of chlorine - - - - (54,000 tons manganese ore, containing 60 per cent. of binoxide, are annually consumed. One-half of the above quantity of muriatic acid goes into the water-courses as chloride of manganese. The other half is fixed in bleaching powder, chloride of potash.)	62,812
2nd. In the manufacture of 15,000 tons bi-carbonate of soda -	8,000
3rd. In galvanizing iron, making salammoniac, solutions of tin, iron, zinc - - - - - - -	50,000
4th. Lost by leakage, both gaseous and liquid, in the alkali works, say 5 per cent. - - - - -	12,222
Total - - -	133,034

Muriatic Acid produced.

The amount of muriatic acid produced from 423,630 tons salt, the quantity reported as used in the alkali works of the United Kingdom during the year 1867 - - - -	244,434
Deduct from this the quantity accounted for above - -	133,034
Difference - -	111,400

This is equivalent to 371,133 tons of commercial liquid muriatic acid of 30 per cent. strength, and is 45½ per cent. of the quantity made. It is allowed to run away as waste.

REPORT by THOMAS ANDERSON, Esq., M.D., Professor of Chemistry in the University of Glasgow.

Recovery of Sulphur from Alkali Waste.

My attention has been especially directed to the alkali manufacture, and particularly to the processes which have been proposed for the recovery of valuable matters from the waste products.

These products are two in number, viz.:—Muriatic acid and soda waste, a grey solid matter, of which the most important constituent is sulphide of calcium. In the early period of the alkali manufacture the muriatic acid was allowed to escape from the chimney, but the nuisance thereby produced was so great that some manufacturers found it necessary to condense it, and this process was rendered compulsory by the Alkali Works Act (1862). This Act prohibited the manufacturer from sending the muriatic acid into the air, but left him at liberty to get rid of it in any other method he found convenient.

The soda waste which accumulates in large heaps in the neighbourhood of the works is productive of nuisance from the rain falling upon it and washing out the sulphide of calcium it contains, which then gradually finds its way into the nearest streams and pollutes them. As the soda waste contains the whole of the sulphur used by the manufacturer, its recovery from it has formed a problem which has long engaged the attention of both scientific and manufacturing chemists, and an immense variety of processes have been proposed for the purpose, but most of them have proved too expensive and tedious for use.

During the last few years, however, better processes have been proposed, and the problem of the recovery of sulphur may be said to have been practically solved.

Mond's process is the simplest yet proposed, and it is already being introduced into several works in this country, but other, though more complex methods are in use in some continental works, and more especially at Dieuze, in France, where both sulphur and manganese are recovered.

The particular advantage of Mond's process lies in its making use of the plant which is found in all alkali works, so that it can be introduced without much outlay or derangement of the works.

In the manufacture of soda what is called "ball soda," a product obtained in a particular part of the process, is introduced into iron tanks technically called "kieves," in which it is treated with water so as to dissolve out the soda it contains. The residue constitutes soda waste, and is generally thrown out in the neighbourhood of the works. It contains a large quantity of sulphide of calcium, which on exposure is gradually washed out by the rain falling on it, and the solution so produced escapes into the nearest watercourse. This fluid is in itself noxious and evolves sulphuretted hydrogen gas, an extremely offensive and injurious gas.

But if, as frequently happens in the neighbourhood of alkali works, it should come in contact with an acid, as muriatic acid, the quantity of sulphuretted hydrogen evolved is much increased and a nuisance of the worst kind is produced.

Where Mond's process is used the waste is retained in the vats or "kieves," and a current of air is blown through it for some hours, by which it is partially oxidized and the sulphide of calcium partially converted into hyposulphite of lime. It is then washed with water, by which hyposulphite and sulphides of calcium are extracted. This is repeated three times, after which the quantity of sulphide of calcium remaining in the waste is so small as to be practically unimportant. The solution obtained is

Report by Thomas Anderson, Esq., M.D., Professor of Chemistry in the University of Glasgow—*continued.*

then treated with the waste muriatic acid by which sulphur is thrown down and the muriatic acid combining with the lime forms chloride of calcium, which remains in solution.

As chloride of calcium is an innocuous salt having no smell, the fluid containing it may be allowed to run to waste in the streams without creating a nuisance. The chloride of calcium will have the effect of rendering the water harder than it was, but this is a matter of comparatively little moment. Mond's process has now been in use for some time in several manufactories in this country. It is used on a large scale in the works of Messrs. Tennant and Company, St. Rollox, Glasgow, where they now recover about 12 tons of sulphur a week, and are about to extend their operations. Messrs. Tennant and Company are well satisfied with the result of process, though they are placed in much less favourable circumstances for conducting it economically than most alkali makers. In general the muriatic acid used is a waste product which, if not so used, must be got rid of by throwing it into the nearest stream to its great injury. At Messrs. Tennant's works, however, it is a valuable product entirely used in the manufacture of bleaching powder, and in order to carry out Mond's process they have been obliged to buy muriatic acid at a cost of 1*l.* per ton, and as $3\frac{1}{2}$ tons of muriatic acid are required to produce one ton of sulphur, the cost of manufacture is of course very materially increased. They are now erecting a special apparatus in order to manufacture muriatic acid for this branch of their operations. Messrs. Tennant and Company have derived another advantage from this process of recovering sulphur, for they have been able to find a market for the oxidised waste which is now taken by farmers and used as a manure. The price at which it is sold is at present merely nominal, but it has been found profitable by farmers to carry it a considerable distance by railway, and it has in some cases been used with advantage when the whole cost of application has amounted to 13*s.* per ton.

The demand during the last four months has been so large that Messrs. Tennant and Company have not added more than 40 or 50 tons to their waste heap, while formerly the daily addition was nearly 40 tons.

In a sanitary point of view the use of this process has proved of much importance. At one time the drainage from Messrs. Tennant's works escaped into a stream which forms the municipal boundary of Glasgow, into which acid fluids were also discharged from other works. I have seen this stream as white as milk from the separation of sulphur, and evolving a horrible smell of sulphuretted hydrogen, and though Messrs. Tennant have expended many thousand pounds in attempts to abate the nuisance it is only since they adopted Mond's process that complete success has attended their efforts. At present none of the drainage from their waste heaps is allowed to escape. It is all used for lixiviating the oxidized waste, and then the sulphur it contains is economised in place of being allowed to run to waste to the annoyance of the neighbourhood.

My experience leads me to think this or some of the other processes which have been proposed should be used in all alkali works, and that the manufacturers should no longer be permitted to pollute the streams in their neighbourhood by discharges which are not only injurious to the streams, but also to the health of the population living around them.

I know that muriatic acid is to a large extent a waste product in the St. Helen's district, and I cannot doubt that a process which succeeds at Messrs. Tennant's works must be highly profitable when the acid can be procured at a much cheaper rate.

It is worthy of remark that the Alkali Works Act which compels the manufacturer to condense the muriatic acid has really not abated the nuisance produced by that substance, having merely transferred it from the atmosphere to the streams. At the time that Act was passed no satisfactory process for dealing with the waste heaps was known. Had there been I think it extremely probable that the Act would have gone further than it does and the state of the streams as well as the atmosphere have been taken under its care.

If Mond's or some of the other processes were adopted at St. Helen's there can be no doubt that all future deposit of noxious waste from which sulphur escapes would be prevented, the discharge of muriatic acid into the brooks which so greatly increases the offensive smell and is at the same time so injurious to all metal, lime, and cement with which it comes in contact, would cease, and the liquor running from the existing heaps might be utilized in the works so that nuisance would be at once greatly abated and would become less and less as the drainage from the old waste heaps which could not be so easily utilized, becomes gradually oxidized.

Recovering Manganese from its Chloride.

Report by Mr. Walter Weldon, West Hill, Highgate, London, on his process for recovering manganese from its chloride.

I have the honour to submit to the Rivers Pollution Commissioners the following statement with respect to my process for utilizing the residue of the manufacture of chlorine, which process they saw in operation at the works of Lieutenant-Colonel Gamble at St. Helens.

The ordinary process of manufacturing chlorine consists in digesting together hydrochloric acid and ores containing peroxide of manganese. The residue of this process is a solution of chloride of manganese, containing small quantities of earth-metal chlorides, larger quantities of acid sesquichloride of iron, and very considerable quantities of free hydrochloric acid: this residue the manufacturer throws away, thereby losing all his manganese after he has used it only once, and sending into the watercourses what not only is very objectionable in itself, but moreover aggravates

Report by Mr. Walter Weldon—*continued.*

and intensifies other nuisances. The immense quantities of sulphuretted hydrogen which are given off into the atmosphere by the Sankey brook, for example, are mainly due to the liquors which drain into that brook from the heaps of alkali waste meeting therein with the free acid of this residue.

My process saves this free acid; recovers, in a condition in which it is more valuable for the purposes of the chlorine manufacturer than in the state in which it was originally purchased, the manganese which he at present throws away, as chloride very greatly reduces the cost of the manufacture of chlorine, and enables that manufacture to be conducted without the manufacturer having to send into the watercourses any offensive bye-product.

Commencing with the hitherto waste residue of the ordinary process of manufacturing chlorine, I first treat this residue with carbonate of lime, so as to neutralize its free acid and decompose its sesquichloride of iron. There is thus obtained a neutral solution of chloride of manganese and chloride of calcium containing sesquioxide of iron in suspension; this sesquioxide of iron is allowed to deposit, and to the clear supernatant solution, after it has been decanted, there is added enough lime to decompose its chloride of manganese. Air is then blown into the resulting mixture of hydrated protoxide of manganese with solution of chloride of calcium, a further proportion of lime being added gradually during the first stages of this treatment with air. Lime being a base with which nascent peroxide of manganese has a strong tendency to combine, its presence causes the MuO to rapidly absorb oxygen from the injected air, and within a few hours from 75 to 90 per cent. of the MuO becomes converted into MuO^2, the greater portion of this MuO^2 being combined with lime, forming therewith a compound which I call manganite of calcium, and the remainder of it being similarly combined with the small portion of MuO which has not undergone peroxidation. The product thus obtained is next left to settle until it has become about one-half clear liquor and one-half black mud. The clear liquor is drawn off, and at present is thrown away; it is simply a perfectly clear and perfectly neutral and innocuous solution of chloride of calcium. The black mud is used instead of native peroxide of manganese to liberate chlorine from hydrochloric acid; it is a mixture of manganite of calcium and manganite of manganese, with solution of chloride of calcium, and the liquor which remains after the reaction upon hydrochloric acid by which it liberates chlorine is a mixed solution of chloride of manganese and chloride of calcium, containing scarcely more than a trace of sesquichloride of iron, and only a very insignificant quantity of free hydrochloric acid. With this liquor the round of operations just described is recommenced, and so on continually, the same manganese being thus made to serve in the manufacture of chlorine perpetually over and over again, and nothing being ever thrown away but perfectly neutral solution of chloride of calcium. The sample of the product of my process which was given to the Rivers Pollution Commissioners at St. Helens was from a charge of manganese which had generated chlorine fully fifty successive times.

The quantity of native peroxide of manganese necessary to liberate the quantity of chlorine required for the manufacture of a ton of bleaching powder ordinarily costs between 4*l.* and 5*l.* My process substitutes for this cost for native peroxide of manganese a cost for the operations I have above described of not quite 1*l.* per ton of bleaching powder. Moreover, the solution of native peroxide of manganese is so difficult to effect, except by the aid of a large excess of acid, that for every ton of bleaching powder made by means of native peroxide of manganese there has ordinarily to be employed the acid from between 70 cwt. and 75 cwt. of salt; but the compounds produced by my process dissolve so readily that a ton of bleaching powder can be made by means of them from the acid from only 40 cwt. of salt. The difference between these two quantities of acid is absolutely wasted in the ordinary process of manufacturing chlorine. A portion of it is neutralized by the earthy bases usually associated with native peroxide of manganese, but the greater part of it is contained in the still liquor as free acid, and thrown away as such. My process saves this acid, and enables it to be applied either to the manufacture of more bleaching powder, or to any other use for which ordinary commercial hydrochloric acid is available.

That these economies, which have been demonstrated by seven months' continuous working of my process, are likely to lead, very speedily, to its general adoption, may be judged from the fact that although it is only within a very few weeks that I have felt quite ready to invite the manufacturers generally to see the process in operation, and although only very few of them have seen it as yet, manufacturers whose collective make of bleaching powder exceeds 400 tons per week are already preparing to put up plant for it. There is thus every reason to believe that my process will shortly put a complete end to pollution of rivers and streams by residues of the manufacture of chlorine; and I believe that it is destined to do more than this. I believe that it will put the manufacturers, for the first time, in a position to deal with their alkali waste. The majority of them have hitherto been unable to deal with that residue by any process in which hydrochloric acid is used: and although I, for one, venture to entertain the opinion that it will yet prove possible to recover practically the whole of the sulphur contained in alkali waste without using hydrochloric acid at all, no process for the recovery of any part of that sulphur, otherwise than by the aid of hydrochloric acid, has yet come into practical operation, because all their hydrochloric acid has been required for their manufacture of chlorine. My process, however, will enable them to manufacture more chlorine than they manufacture at present, and at the same time to be able to devote to the treatment of their alkali waste all the hydrochloric acid which the treatment of the whole of their alkali waste by any process at present in operation would require.

ALKALI MANUFACTURERS' ASSOCIATION. TYNE BRANCH.

Palace Chambers, Abingdon Street, Westminster, S.W.
Dec. 16, 1868.

SIR,

I AM directed by the Alkali Manufacturers' Association to forward you, to be submitted to the Members of the Rivers Pollution Commission, copies of a Report by the Tyne Branch of the Association with regard to the river Tyne.

I am, &c.
(Signed) J. B. SIMSON.

S. J. Smith, Esq., Secretary,
Rivers Pollution Commission.

Report signed on behalf of the Association by John Glover, William Allen, Henry C. Allhusen, and Richard Cail.

Report by the Tyne Branch Alkali Manufacturers' Association.

The tide of the Tyne extends over an area of nearly 20 miles in length, by 550 feet in average width, the mean depth being 33 feet at high and 20 feet at low water.

The vessels that annually enter its harbour number about 20,000, of which one-quarter discharge raw materials for the chemical works. These manufactories employ directly more than 6,000 men, and consume yearly 650,000 tons of coal, 140,400 tons of salt, and produce 300,000 tons of goods, 26,000 consisting of bleaching powder.

The water of the Tyne, as it flows past the various alkali works, is daily raised into their reservoirs, and used in all their processes, excepting when want of rain renders it unusually saline.

The total quantity of dry hydrochloric acid obtained in these works per 12 hours is 130 tons, of which one-third is available in the manufacture of bi-carbonate of soda, and pearl hardening, and thus mainly falls into the river as chloride of calcium, whilst the remaining two-thirds are generally exposed to the action of manganese in the bleaching powder process, where chlorides are formed, and the actual quantity of dry hydrochloric acid discharged into the Tyne, reduced to 29 tons per 12 hours. These chlorides are disinfectant, and the free acid is so infinitesimal as compared with the stream into which it runs, that even at low tide no trace of acidity can be discovered either in the liquid or solid contents of the river.

The drainage from tank waste is not sufficient in quantity to do injury, and none need be apprehended, as sending this product out to sea is found to be the cheapest and best method of disposal whenever practicable.

To attempt the neutralization of still and tank liquors on the ground of pollution, would simply mean the substitution of one impurity for another—a change that would be inappreciable, excepting in the seriously increased cost of alkali and bleaching powder to all consumers, and also in the rendering of competition with foreign producers more difficult than ever to the British manufacturer.

From the above statement and annexed calculations, but more especially from the actual condition of the water, and increasing quantity of salmon taken, it may reasonably be concluded that no adequate cause exists to necessitate interference with chemical manufactories situated on the banks of a tidal river like the Tyne.

In elucidation of this Report a Statement of Statistics and Calculations in support of the arguments introduced into it, prepared by Mr. Glover, was brought before the Meeting, and adopted as a part of the Report.

(*a*) 100 : 35 :: 500 : 175.

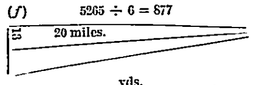
Cl. Na. Cl.
(*b*) 35 : 58 :: 175 : 290
(*c*) 2511 − 290 = 2221.

Pure Na. cl. Com. Salt.
(*d*) 93 : 100 :: 58 : 62

Pure Na. cl. c. ft.
58 : 60 :: 62 : 64.

(*e*) 2221 × 64 = 142144 C. ft.
142144 ÷ 27 = 5265 C. yds.

(*f*) 5265 ÷ 6 = 877



yds.
(*h*) 1760 × 20 = 35200 length of river.

Width. Area.
(*i*) 35200 × 183⅓ yds. = 6453333

Depth of Tidal Tidal Water. Water.
$\frac{6453333 \times 4\frac{1}{3}}{2}$ = 13982221 C. yds.

(*l*) 12 : 11851 :: 7 : 6913 C. yds.
(*m*) 13982221 plus 6913 = 13989134.
(*n*) 43800000 ÷ 13989134 = 3.

The quantities of common salt decomposed, and bleaching powder made, on the Tyne per week, are 2,700 tons salt decomposed = 2,511 tons chloride of sodium (pure), and 500 tons bleaching powder made (at 35 per cent. chlorine) = 175 tons chlorine (*a*). This weight of bleaching powder would fix the chlorine from 290 tons of salt (*b*), thus leaving the acid from 2,221 tons of salt (*c*) to be sent into the river, say as free acid at 30° Tw. As 60 cubic feet of acid at 30° Tw. is obtained from one ton of commercial salt, 64 cubic feet would be obtained from a ton of pure salt (*d*), which the above 2,221 tons is taken to be, and consequently 142,144 cubic feet, or 5,265 cubic yards (*e*) per week, say of six days = 877 cubic yards per 24 hours (*f*), or 438 cubic yards per 12 hours.

A section of the river at high water, for the purposes of this inquiry, should be represented by a triangle having its apex at Hedwin Stream, and its base at the bar, as shown at (*f*), the centre line representing the tidal displacement each 12 hours. The cubic capacity of the tidal water would thus be 13,982,221 cubic yards for a tide having a rise of 13 feet at the bar (*i*).

In addition to this tidal water there is the water flowing into the Tyne from the West, which amounts to 11,851 cubic yards per 12 hours; but as we can only fairly add the quantity flowing in during the ebb, or seven hours, we must reduce this to 6,913 cubic yards (*l*), thus making the total volume of water entering in and flowing out 13,989,134 cubic yards per 12 hours (*m*) which must be mixed with the above 438 cubic yards of free acid, or about three parts in 100,000 (*n*) or ·00003, or $\frac{1}{33333}$, or in the proportion of about five pints of water to one grain of free acid at 30° Tw.

As hydrochloric acid at 30° Tw. contains only 30 per cent. (by weight) of dry hydrochloric acid, even this small proportion would be about halved when converted (as it is) into chloride of manganese and chloride of calcium.

ALKALI MANUFACTURERS' ASSOCIATION. TYNE BRANCH REPORT—*continued.*

The above acid is equal to 1·6 grains per gallon, or when neutralized with manganese and lime to about 0·9 grain per gallon.

Experiment shows that the sediment from Tyne water, taken at Wallsend, contains a large quantity of carbonate of lime, thus proving that there can be no free acid in the river water.

REPORT by SAMUEL BARTON WORTHINGTON, Esq., C.E., Resident Engineer Northern Division of the London and North-western Railway, Victoria Station, Manchester.

Pollution of Sankey Brook and Canal.

I am a member of Institution of Civil Engineers, Resident Engineer of the Northern Division of the London and North-western Railway, have charge amongst other works of the Saint Helen's Canal.

The Sankey or Saint Helen's Canal was first constructed under an Act of Parliament granted in the reign of Geo. II. in the year 1754. This Act was modified in the first year of Geo. III. 1761, and by subsequent Acts.

The canal as existing extends from the River *Mersey* at Widnes to the town of Saint Helen's (with a branch called the *Blackbrook* branch to serve several collieries), and is navigated by vessels carrying cargoes of 100 tons and upwards. The total length is 17 miles.

The upper portion of the canal is supplied with water from streams above the town of Saint Helen's, which are most of them tolerably pure, although in some cases the waste acid liquors from the works contaminate the water.

The lower portion of the canal, however, from water meetings near Winwich to Widnes, about seven miles in length, is supplied from the *Sankey brook* after it has flowed through the town of Saint Helen's, and after the whole of the sewerage of the town and the waste acids and other liquors from the alkali manufactories and from the soda waste heaps have been discharged into the brook as the flood waters of the *Sankey brook* flow down the brook course from water meetings to the outlet into the River Mersey near Sankey bridges, but the Canal Company is under parliamentary obligations to use the ordinary water of the brook for the purpose of scouring the river channel at the entrance to the dock at Widnes.

The quantity of acid run to waste from the alkali works into the brook amounts to several thousand tons per annum.

The water in the brook below the town of Saint Helen's contained on the:—

16th April	1868,	32 grains	of free acid	per gallon.
30th July	1868,	50 do.	do.	do.
27th March	1869,	81 do.	do.	do.
30th March	1869,	697 do.	do.	do.

The acid from the alkali works flowing into the brook and thence to the canal causes injury to the works of the canal. It destroys mortar and metal and even stone itself. The effect is so serious that the lock gates are constructed entirely of wood; hard South American wood being used instead of iron for pins, bolts, &c. The boat owners also state that the vessels navigating the canal suffer from this cause, and no iron boats are used by the traders on the canal. I have seen sandstone taken from a watercourse through which such liquors run completely disintegrated, so that it would crumble in the hand. I have also seen a large iron casting which had been immersed for some time in the canal and had become entirely altered in nature, being in fact as soft as lead or chalk, and having the appearance of graphite.

There are also large deposits of the solid soda waste from the alkali works, amounting to upwards of 1,000,000 cubic yards. They consist mainly of compound of sulphur and lime.

The principal of these solid waste deposits covers nearly 50 acres of ground within the municipal area, and the liquor from them also drains into the brook.

When the acid from the works meets the liquor from the new waste heaps in the brook, that foul smell, consisting mainly of sulphuretted hydrogen, is generated, which is so well known in the neighbourhood of the brook. The railway company are occupiers or lessees of a considerable acreage of what were formerly very valuable water meadows on the banks of *Sankey brook*, but which in consequence of the foul state of the brook now produce only a few shillings an acre.

If the alkali manufacturers were not to discharge their acids into the drains and watercourses flowing into the brook, but to use them in their manufactories, in recovering from the solid waste the sulphur, which is a principal cause of the nuisance, and for the effecting of which several processes are known; the sewage waters would be comparatively harmless to the masonry and metal work with which they come in contact, and the foul and noxious smells now generated would be, to say the least, very much abated, and a proper scheme of sewage could be more easily and effectually devised.

Another benefit to be derived from the adoption of these processes would be that the constant accumulation of these heaps of noxious soda waste which cover the district would be stopped, and the sulphur liquor running from the more extensive of the old waste heaps now in existence may be profitably used.

This has already been done by Messrs. Tennant of Glasgow. The discharge from whose large waste heaps into the River Clyde, which for many years was so great a nuisance, having been in consequence greatly abated if not discontinued. A report of Dr. Anderson, Professor of Chemistry at the University of Glasgow, as to the effectual application of this process by Messrs. Tennant of Glasgow, has been forwarded to the Commissioners.*

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* *See* Part IV., pp. 291 and 292.

REPORT by SAMUEL BARTON WORTHINGTON, Esq., C.E.—*continued.*

There are a number of processes patented for the purpose of recovering sulphur from the soda waste. Amongst these are the following :—

Schaffner.	Townsend and Walker, 1861.	Alfred Noble, 1863.
Kopp.	Andrew Geo. Hunter, 1861.	Wilson and Tatters, 1862.
Jullien, 1861.	Schnell, 1863.	Ludwig Mond, 1863.

One of these processes is known as Mond's process, and is in operation at two of the most considerable works at Widnes (viz., Muspratt's and Hutchinson's), and is considered so profitable that, as I have been informed, the use of it is about to be considerably extended.

This process can be introduced into the several alkali works at comparatively small cost, all that is necessary being to increase the number of vats, and to put up a small fan similar to that used for blowing smith's fires.

After this process has been completed, the waste liquors are comparatively innoxious, the solid waste has parted with the noxious matter which it before contained, and Dr. Anderson states that this waste is now used in great quantities as manure by the farmers in the neighbourhood of Glasgow.

In addition to this it appears that the waste liquors from the old heaps where they are near the alkali manufactories can be most profitably used in carrying out the process, and are in fact so used by Messrs. Tennant.

If this plan were carried out, and the whole of the drainage from the town and manufactories collected into tanks or reservoirs in which it could settle, so that the deposit might be removed from time to time, the overflow water might then be passed off in a very different state from its present one. The acid which is so injurious would be used up in preventing the nuisance from the soda waste, and all future waste heaps would be free from noxious matter, and a proper scheme for intercepting sewers might be more easily carried out.

LETTER from Mr. ATHERTON SELBY, on behalf of the Hon. LEOPOLD W. H. POWYS, WARRINGTON, dated Leigh, Manchester, 17th May 1869.

Pollution of Sankey Brook.

I beg leave to lay the following statement before Her Majesty's Rivers Commission respecting the condition of the *Sankey Brook*, so far as it affects the property of the Honorable W. H. Powys, near Warrington.

The brook after receiving the refuse from alkali and other works at St. Helens and the paper works at Newton, enters Mr. Powys's property near Causeway Bridges, in Burtonwood, about four miles from its junction with the Mersey.

The brook water is impounded by the Canal Company below this point for about a mile of its course and is partly diverted into the canal at water meetings and there used for navigation purposes, so that from this point to the *Mersey* both the canal and the brook are greatly polluted.

The effect of the brook water upon the meadows, even when largely diluted with fresh water after heavy rains, is to destroy vegetation to a great extent and the meadows which were very valuable a few years ago are becoming useless although the water is carefully excluded from them, except in times of very high flood.

The stench from the canal and the brook is intolerable and in certain conditions of the atmosphere, as on damp foggy days, a blue deposit is formed upon the painted woodwork of doors or windows and upon pools of water in the roads or fields within a distance of 200 or 300 yards of the canal or brook.

The stench interferes with the letting of houses and of land for building upon in the neighbourhood of the brook and sensations of nausea and headache are experienced by the persons breathing the atmosphere near it.

Within the last few years the condition of the canal and brook has become much worse, 25 years ago fish were caught in both of them, cattle drank at them, and the water was used for domestic purposes. At present the water in the canal is of the color and consistency of buttermilk.

I have estimated the value of Mr. Powys's estate, if offered for sale by auction, is less by (50,000*l.*) fifty thousand pounds than if the water in the canal and brook were clear. No offensive matter is put into the brook in its passage through Mr. Powys's estate.

I do not know how far the noxious qualities now contained in the brook water can be neutralized by chemical process, but I beg leave to suggest for the consideration of Her Majesty's Rivers Commission, that so long as the refuse made at St. Helens is offensive and destructive to vegetation it should be conveyed to the *Mersey* by a separate covered channel which might be formed of bricks along the side of the canal with a gradual fall of about six feet in a mile towards the river.

The distance would not exceed 12 miles and a sufficient culvert could be constructed for (30,000*l.*) thirty thousand pounds to take the refuse at present carried by the *Sankey Brook*, a sum trifling in comparison with the capital expended on the St. Helens works, or with the damage occasioned by them.

The brook course should be left as the channel for the ordinary surface and storm water and would soon be again available for the use of the people living on its banks.

In its present state the damage is accumulative so that the injury if no remedy is applied will be greatly increased in a few years.

LETTER from J. E. PARDEY, Esq., on behalf of WILLIAM JOHN LEGH, Esq., of Lyme Hall, Cheshire, the Rev. Thomas Whitley, Incumbent of St. Peter's Church, Newton, dated Newton-le-Willows, Lancashire, 25th May 1869.

Pollution of Sankey Brook.

ACCORDING to the request of Her Majesty's Commissioners, expressed at their meeting at Warrington on the 13th inst., I beg to bring before their notice the case of two riparian proprietors for whom I act as agent.

William John Legh, Esq. of Lyme Hall, Cheshire, is the owner of upwards of 60 acres of meadow land, immediately adjoining and having a frontage to the canal and brook of about six miles.

Such land has at times of heavy rains been subject to irrigation by the *Sankey Brook*, and before that brook was polluted by the chemical and other refuse, the irrigation had a highly fertilizing effect on the land, and heavy crops of hay were obtained often twice in one season.

At present these meadows, from the deleterious effects of the waters overflowing them from the brook are absolutely valueless for agricultural purposes, assuming the appearance of a barren waste. There is also considerable damage arising from the falling in of the banks of the brook, which falling in is caused by the destruction, by the noxious waters, of the willows and other plants which formerly grew along the banks of the brook, the roots of which willows and plants when growing formed a very effectual support to the brook sides.

It is true that in consequence of proceedings taken by Mr. Legh about 10 years ago, the land belonging to him, then subject to the destructive influences of the brook was by arrangement taken and rented by the St. Helen's Canal and Railway Company (now represented by the London and North-western Railway Company) for a term of years, but the damage has since that time extended and is still extending itself to lands beyond those held by the Company, and rents have to be and are reduced from time to time in consequence of such damage.

Further the damage is not confined to the land so destroyed, but the value of the *whole* farm, which is thus robbed of that portion of its land which is absolutely necessary for the keeping up of a proper stock of cattle, is considerably and most prejudicially affected, and it is not an easy matter to find tenants to remain on the farms even at a reduced rent.

There is also another very serious cause of complaint ; I refer to the offensive stench arising from the brook, and which (especially when the atmosphere is heavy) can be smelt for a very long distance. This nuisance of itself renders a very large area of land which would otherwise be available and very eligible for building sites, quite unfit for that purpose, as very few persons, unless compelled by business calls or requirement, will reside sufficiently near the brook to inhale the sickening and noxious vapours emitted from it.

I will now shortly refer to the case of another riparian proprietor, the Rev. Thomas Whitley, incumbent of St. Peter's church, Newton.

Part of the endowment of this church is comprised of 10 acres of meadow immediately adjoining the *Sankey* canal and *brook*. This meadow was formerly of a very valuable and highly fertile nature, producing extraordinary crops of hay, and also an adequate rent. It is now, from the destruction of the herbage by the waters of the brook, practically valueless and produces merely a nominal rent.

No compensation has ever been received by Mr. Whitley, or by his predecessor, the late incumbent, for the damage sustained, and in this case the loss is a very serious one.

LETTER from ROBERT N. PHILIPS, Esq., M.P., dated 47, Berkeley Square, W., 31st May 1869.

Suggestions on the best practical Method of preventing the Pollution of Rivers in Lancashire.

As far as I have formed an opinion, I think the best practical method of curing the evil of pollution of rivers in Lancashire would be to place by the side of or near to the rivers *Mersey, Irwell, Roch*, and *Irk*, a main sewer into which the sewage of the towns situate on these rivers should be conveyed.

This main sewer would of course increase in size as it passed the various towns.

I would take this sewer across Cheshire and let it empty into the river Dee. I would have places as it passed through Cheshire where the sewage could deposit itself, and be used as far as practicable by the farmers of that county, the impure water emptying itself into the Dee near Park Gate.

Then with respect to the rivers themselves, dye and chemicals must be allowed to go into the rivers or the trade of the district would be stopped, which in my opinion would be absurd. Upon the whole dye and chemicals are not in themselves dangerous to health. Where the rivers passed through a large town I would have the bottom of the river paved or flagged in the shape of the letter V, so that the deposit in the water would move on anything dangerous to health in manufacture, and at a future day be ordered to be put into the main sewer should it be found necessary.

Pure water for the supply of towns must be gathered on hills and brought to the towns in pipes. Windermere Lake might be made the means of supply for Lancaster, Preston, Wigan, Liverpool, Chorley, Bolton, Manchester. Water brought in pipes might also be sold to manufacturers en route if required.

Such a plan as this might, I think, be managed, and the money would have to be raised on the security of the county rate, to be repaid by fixed sums over a considerable space of time. As this would be a work not only for the benefit of the present generation, but peculiarly so for the generation which succeeds us, and therefore posterity might with fairness pay a considerable sum.

I have given this matter considerable thought, and I really do not see any other practical method of meeting the evil.

Notes by Dr. R. Angus Smith, F.R.S., Manchester.

Purification of Sewers.

If the perfectly tight, close, and unventilated sewers were in use, with a current constantly outwards, and without a large empty space fitted to hold occasional excess, then we might allow many impurities to enter without fear. The material from slaughter-houses and breweries would be accepted as a favour by those who farmed land and by the city which sold the sewage.

It may happen that we shall deprive the land of a great deal of that which would be a benefit to it if we press on manufacturers the necessity of keeping as much as possible all refuse out of the sewers. There are not very many substances from manufactures that are injurious to land, and the advocates of sewage manure must feel the importance of keeping to the sewers as much valuable matter as possible. There may, in fact, be a struggle some day with manufacturers, the towns insisting on receiving the refuse into the sewers, and the others objecting, as even now in Manchester a man may not sell the refuse of his own midden.

If the sewers are well filled, and liquid constantly rushing downwards, we may put anything into them without fear of ventilation from them. If they are to be partly filled, waiting for storms, we have the question of ventilation into houses or into streets, processes which no man can admire, although he may prefer the street rather than the house to receive the gases.

If the sewer water is to be used for land the more sewage matter the better, and the less water. This will be true for wet counties.

There is little noxious smell coming from manufactures. There are, however, some important cases of exception.

If the sewage is not to be used for land then it does not injure it to send manufacturing refuse along with it. If it is to be used for land then there ought to be a separation of drainage, some allowed to enter and some not. It would do no harm, for example, to allow some salts of iron to enter sewage for land, but it would destroy the value of sewage if a great deal of the protoxide were to mix with it. If, too, sulphide of calcium from the soda waste were to mix with manure the land would be hurt for a while, unless the quantity were very small. If, also, strong acids were to mix, a similar evil would result. Still, it is also clear that a certain quantity of manufacturing refuse is of great service in preventing putrefaction, which, although a purifying influence, is by no means either a pleasant or a wholesome process.

If the streams are to be freed from colouring matter, &c. from works, still retaining the sewage, the result will be a deterioration of the air around. If the sewage water is to be used for land there seems no need of removing the refuse when not hurtful to vegetation, and when unrestricted water is allowed; but if a restricted amount is allowed, then the question arises, how much of the refuse may be kept out of both streams and sewers?

Supposing the sewage removed, what would be the state of our Lancashire rivers? The colour of most of them would be just the same as now. It is remarkable how much iron salts united to colouring matter have to do with the colour of our streams. There would still be some putrefaction from organic substances.

Removal of Colour.

It is wonderful how much of this colour is removed by merely adding lime, and when soap is present from printworks the whole colour goes down in the lime compound.

When wool is treated with soap, or with oils and ammonia, the water flowing from the works is very rich in soapy matter. It is now about 20 years since this was used economically. A very large amount of oil can be obtained from these streams, and the mode of treating the water has been by a former Commission explained.

It has not hitherto been found economical to use the water from calico printworks so as to recover the oil or fat sent down with the soap. It never can be so economical as at wool works. There is less fatty matter used. Besides the soap in the form in which it is employed is not a pure soap of fat, but has frequently resin along with it. There is every reason, however, to believe that the fat can be recovered economically, as it most certainly is true that it can be thrown down or removed from the water. This process is peculiar. It may be supposed by some people that the removal would cause a river to be more wholesome; it is not at all probable that it would make a sewer river more wholesome, but the contrary. If, however, it is not a sewer river that is spoken of there will be a purity, of course, in proportion to the amount removed.

The large quantities of solid matter thrown into rivers is seldom the result of a continuous operation. Certain portions are sent out in a very dense state. So a man using several hundred thousand gallons of water per day sends, perhaps, only a few thousands in a greatly coloured condition, but these few colour enormous tracks of water.

It is not long since every trace of the roots of madder were thrown into the streams after one boiling. No one is now so extravagant.

Two friends of mine have large printworks. Mr. Thom has probably explained his mode in a separate paper. He uses the method of precipitation. Messrs. Aitken send the wash water into lodges, and allow it slowly to return to its original place, depositing all its colouring matter by the way. In the first case there is probably more labour, but the precipitate is obtained free from all other substances. In the second there is more time and space required, and the darkest portions of the water are not treated, but the result is in both a complete clearing of the water, rendering it available for further use, and immensely increasing the capacity of work which can be done by a stream.

Notes by Dr. R. Angus Smith, F.R.S., Manchester — *continued.*

Acids from Chemical Works.

The necessity for preventing the escape of acid into the air, where its presence is perceived, even when in very small quantities, has caused a greater amount to pass into the rivers, and especially since the introduction of the Alkali Act in 1863. The question now is, can this evil be avoided?

The answer is being gradually prepared by the more extended use of muriatic acid economically. I have not been able to decide on the exact amount which is actually sent away. In many cases it is of little consequence, as it passes readily into the sea. This acid is a very powerful disinfectant, and we cannot object to it passing into sewage rivers, which are apt to putrefy; but there are places where its presence is a very great evil. In harbours where there are iron vessels, or in canals where there are either vessels, or ironwork, or mortar, with a limited supply of water.

The total amount made at any alkali work is very rarely sent away. In writing this I shall not use any information that my office would allow me to obtain in a confidential manner from alkali works, but simply confirm what I have seen and what I believe will be said by others.

The result is, that an alkali work can make economical use of one-fifth of its muriatic acid in recovering sulphur from the alkali waste. The two waste substances aid each other. There are some alkali makers who sell all their acid, but it is not essential that each should use up his own heaps of waste. If the process is really valuable it will become a business of itself.

The alkali works send out a substance called alkali waste, and that increases in such enormous quantities that it threatens to alter the face of several districts. When it stands in the moist air the carbonic acid decomposes it, and sulphuretted hydrogen passes off, causing a most sickening odour, and when rain falls through the acid air of coal burning towns in which is this alkali waste, the rain itself becomes acid, and acts on the sulphide of calcium, giving out still more sulphuretted hydrogen. The rain passing through the mass dissolves it, and the yellow liquid passes down, giving out sulphuretted hydrogen as it flows; but if a stream of water containing muriatic acid from the alkali works joins this yellow stream, the result is a violent evolution of the offensive gas, whilst solid yellow sulphur falls down. This operation is common in many places, it is Mond's patent, carried out partly by natural operations. The sulphur is collected when the operation takes place in an alkali work and melted. I am told it is profitable to make it. If it is profitable, there can be no hardship in compelling the adoption of a plan of regaining the sulphur. At the same time there are many patents for the purpose, and there may even be many to come, but at present only one has found success in this country, and that is in a great measure owing to the remarkably careful way in which Mr. Mond has studied the subject. There may be much still to learn.

When the waste material is freed as much as possible from the sulphur, there is, however, still a little that may be washed off, but that ceases more rapidly than with the common material. The remainder is to a great extent carbonate of lime. This is soluble in acids, and could be used to neutralize a still further excess of acid if desired. There will soon be great heaps of it, and it would be an advantage to be rid of it. If treated with muriatic acid much of it at least would run off as a clear solution of chloride of calcium, a very innocent salt. This process would get rid at once of both the acid and waste.

As a rule, acids from works are not attended to with sufficient minuteness, and much may be done to improve the manufactures of the country if a little advice were allowed from authorized persons; or, in other words, by a little pressure from the hands of those who have sympathy in their touch.

I may say that I have tried water from the *Medlock* running through Manchester and found that it is cleared easily by lime, and that the remainder is fit to be used for most if not all purposes of manufacture.

A ton of caustic lime will precipitate five million gallons of the Medlock water, probably other waters in the same county will not differ much. The amount of lime does not depend on the amount of organic matter merely, but carbonic acid. A similar result can therefore be got by using caustic soda, and when the matter is to be used afterwards for boilers this plan is sometimes adopted.

I find, however, that a good plan for throwing down most of the colouring and putrefying substances in water is the use of aluminous or iron bases, with the addition of lime.

The use of sulphate of alumina is itself a great purifying agent, but when the salt is neutralized immediately after addition to the water by using lime the precipitation is very rapid. The lime salt remaining in the water is a sulphate, and the water is therefore rendered hard. This result will generally take place, unless an alkali, such as soda or potash, is used, and both of these are two expensive for general purposes, although not so if only boiler water is required.

If we use an iron salt a result almost as good is obtained, and for some things a result very much better.

The best is the persulphate. This removes sulphur if it exists with hydrogen, and it seems also to oxidize albumen and separate the ammonia from it. It unites with many of the colouring matters, and when the acid is removed by lime or any alkali the iron compound falls with great rapidity.

In some respects it would be better to use perchloride of iron, but not in all. I am not aware that it so readily oxidizes, but the lime compound called chloride of calcium is more soluble, and is not apt to form a crust on a boiler. On the other hand, it is more apt to wear out a boiler. However, as before said, when the matter is to be

Notes by Dr. R. AngusSmith, F.R.S., Manchester — *continued.*

precipitated for boilers the alkalies are the most manageable. The soda may even be thrown into very impure water, such as the *Medlock*, and the mixture used in boilers, if care is not taken to boil down to such a strength as to cause priming.

The use of the iron salt with the addition of the lime is capable of removing the colour of madder, logwood, sumac, and fustic, a little of the latter only remaining as a very delicate yellow.

I do not see that there would be a hardship in removing them from the water before passing them into the river. From dyeworks the greater part is obtained in very strong solutions, requiring only small precipitating tanks.

I should doubt if there are any streams that have solutions in them that would give strong colour and still resist clearing by means of lime or a salt of iron and then lime. I have tried it in various streams, but of course the proof would be better if each material were examined separately. I do not, however, say that the water would be fit for drinking, although in many cases it would be so decidedly, after standing and receiving its full portion of oxygen and carbonic acid from the air. It would, however, be hard at best, and in most cases very hard.

Report by W. S. Trench, Esq., M.D., Medical Officer of Health, Liverpool.

Trades and Manufactures which Pollute the Mersey and its Tributaries in the Liverpool District.

In obedience to the directions of the Health Committee that he should report on the letter of Mr. S. J. Smith, expressing on behalf of Her Majesty's River Commissioners a wish to be furnished with a list of the trades and manufactories which pollute the *Mersey* and its tributaries in this district, the Medical Officer of Health begs to state.

1stly. That no solid chemical or manufacturing refuse is allowed to be discharged into the river, either directly or by means of the sewers at any place within the boundaries of the borough of Liverpool.

2ndly. That he has not been able to trace any perceptible amount of pollution of the river from the manufactories and trades now carried on in Liverpool.

3rdly. That the chemist is not able to detect in the waters of the estuary opposite Liverpool any of the chemical refuse which must be carried down from Manchester, St. Helen's, Warrington, Runcorn, Widnes, and the other towns situated on the *Mersey* and its tributaries, nor any of the chemical substances discharged from the manufactories of Liverpool and its neighbourhood (see on this subject Dr. Edward's Report, 1865).

The above facts may be explained by the vast volume of the waters, and their constant agitation by currents and tides, as well as by the rapidity of fresh combinations among free chemical substances in water containing large quantities of natural salts, and of decomposing organic matter. In these respects there is no similarity between the estuary of the *Mersey* and the streams of the same river in its inland course, and certainly no possible similarity between the condition of the Mersey at its outlet, and the condition of those tributary rivers and streams, the Irwell, the *Irk*, the *Medlock*, the *Roch*, the *Spodden*, and the *Tame*, upon which are situated the large manufacturing towns of Manchester, Salford, Bury, Farnworth, Middleton, Rochdale, Hyde, Ashton, and Stalybridge; nor can there be any similarity drawn between the River *Mersey* at Liverpool and the Rivers *Aire* and *Calder* in the West Riding, which receive the refuse of Wakefield, Dewsbury, Huddersfield, Leeds, Bradford, Halifax, &c. Not only is the condition of the river different, but the manufactories carried on in Liverpool are neither of the magnitude nor of the great polluting quality of those of the woollen and other factories of Yorkshire and Lancashire.

The trades and manufactories of Liverpool which discharge fluid refuse into the sewers may be divided into,—

1stly. Those which discharge organic matter, chiefly vegetable or animal, in solution with their waste water.

2ndly. Those which discharge chemical solutions, either saline or free acids, and alkalies. These will also contain in many cases colouring matter, either vegetable or animal.

Among the first kind, or the trades and manufactories discharging chiefly organic matter, may be placed the brewers, the distillers or rectifiers, the sugar refiners, the fish curers, the tripe dressers, the slaughterhouses, the tanners, the felt manufacturers, and the oil and cake works. The refuse from breweries will consist chiefly of the washing of barrels, floors, and vats; that of the distillers will be something of the same sort. The refuse from the sugar refiners will be the washing of the charcoal after the purification of the sugar, and will contain besides animal and vegetable matter a quantity of free acid and a proportion of phosphates and sulphides; it has a slight straw colour, and a perceptible but not disagreeable sour smell. It is said that the scum water is occasionally discharged into the sewer; but this waste must be rare as it pays to collect and sell it for manure. All the solid refuse from the tan yard is either used in commerce or carted away as manure; but the liquid of the tan pits when exhausted, and the solution of salt from the salted hides, and the drippings from the hides when emersed in water or taken out of the tan pit, as well as the washing of the floors of the works, which contain a considerable quantity of animal matter, will all find their way into the sewers. The fish curers, tripe dressers, and slaughterhouses all send a considerable quantity of animal matter into the sewers. The effects of the two latter trades on the sewers of Liverpool were given in evidence

Report by W. S. Trench, Esq., M.D., Medical Officer of Health, Liverpool — *continued.*

on the Town Improvement Act, 1866. The refuse from the oil and cake works is of no amount or consequence; and that from the felt works, where there is nevertheless a considerable quantity of washing, does not contain anything at all likely to be injurious.

The second kind, or the manufactories which discharge chemical solutions, will include the chemical works acting under Lord Derby's Act; the distillers of acetic acid, the manufacturers of phosphatic salts, the tar distillers, the soap makers, the pharmaceutical chemists, the dyers, the match makers, the ink and blacking makers, and, lastly, the gasworks.

The working of the factories of Messrs. Hill and Sons, of Messrs. Slack and Ashcroft, and of Messrs. James Muspratt and Son, is under the supervision of a government inspector, Dr. Angus Smith, and it does appear that the amount of refuse or impurity now discharged from these works, either by the chimney or the sewer, is reduced to a minimum. The chief discharge by the sewer is a slight acid liquor, so slight that it is not easy to detect its quality at Messrs. Muspratt and Son by the taste. Occasionally, and during certain processes, a solution of chloride of manganese is thrown into the sewer; but the effect of this would be rather beneficial than otherwise. The refuse from the acetic acid distillers should be exceedingly slight, and in no way injurious; that from the bone distillers, animal charcoal makers, and phosphatic manure makers, will contain the animal matter of the water in which bones have been boiled, and occasionally, where there is carelessness, some portion, more or less, of the oil of distillation. The works of Messrs. Kurtz's and Son, Pumpfields, and of Messrs. Thacker and Co., Bankhall, are chiefly occupied in the utilization of the refuse matter from the gasworks. After all the ammoniacal and tarry liquors have been utilized, the refuse is discharged into the sewer. At Messrs. Kurtz and Son's works such refuse has the colour of dark sherry wine, and has a distinct smell of carbolic acid; it is said to contain traces of free sulphuric and muriatic acids. The refuse from the soap makers will contain the alkali lees of more or less strength; that from Martindale's match manufactory in Boundary Street will consist both of the water which has washed the apparatus holding the match igniting composition, and which is either of a blue or straw colour, according to the colouring material employed, and which consists of water containing glue, and holding in suspension phosphorus and chlorate of potash, and also the water of the liquid from which Prussian blue has been precipitated, and which will contain probably some quantity of sulphate of iron and prussiate of potash. The refuse of the dyers admitted into the sewer will vary according to the kinds of dye employed; as far as these dyes contain free acids, the effect upon the sewage will be rather beneficial than otherwise. The dye houses of Liverpool may perhaps be considered as renovating dye houses, and are not of the extent of the dyeing establishments in the manufacturing districts. The raspings, or chips of logwood and other dye woods, are not allowed to be discharged into the sewers. The refuse from the works of the pharmaceutical chemists will vary according to the materials among which they are working. If we take the large firm of Messrs. Evans, Sons, and Co., we find that the fluid refuse passing into the drain will consist in every hundred part somewhat as follows:

Washing of pans after vegetable extracts - - -	30
Decomposed nitric acid - - - - -	5
Washing of floors, &c. - - - - -	20
Washing of bottles containing acids, tinctures, &c. with soda -	45
	100

All the refuse of the gasworks is utilized, and there does not appear to be any whatever sent into the sewers.

The canal is supposed by some to be a source of pollution to the river; but though it appears that 10 factories receive from and return water to the canal, yet in no case are manufacturing products or refuse allowed to be emptied into it.

The Medical Officer of Health would respectfully suggest that the several manufacturers and traders be requested to give evidence on the nature of their processes before the Commissioners.

Additional Report by W. S. Trench, Esq., M.D., Medical Officer of Health, Liverpool.

Facts connected with the Sewage of Liverpool.

In accordance with the directions of his worship the Mayor, I have the honour to submit to your consideration a history of the facts connected with the sewage of Liverpool, so far as they seem to belong to the scope of the inquiry proposed by your Commission.

There are three distinct and well-marked periods in such history. The first period is when there were no laws or regulations affecting the existence, the position, or the construction of privies and cesspools; the second period is when by the Local Building Act of 1842, the owners of all subsequently erected houses were ordered to provide privies and ashpits for the same; the third period is when by the Liverpool Sanitary Amendment Act of 1854, power was given to the Council to enforce the abatement of the nuisance of privies which were in a situation, state, or condition injurious, dangerous, or prejudicial to the health of any of the inhabitants of the borough.

The population of the parish of Liverpool by the census of 1841, was 223,003, in 32,079 inhabited houses, on an area of 2,220 acres; that of the borough was 286,487,

ADDITIONAL REPORT BY W. S. TRENCH, ESQ., M.D., Medical Officer of Health, Liverpool—*continued.*

in 42,928 inhabited houses, on an area of 5,210 acres. Thus it will be seen that a large and, as respects the parish, a densely crowded town had been erected during the first or anarchial period, when every builder was allowed to follow his own fancies of construction, without any regard to the health, the convenience, or the well-being of the general community. It was then that most of those huge sanitary evils were consummated, which raised, and have since maintained, Liverpool so high in the comparative death records of the large towns of the kingdom. Not only was space economised at all risks, and the built-up area dreadfully overcrowded, but privies and cesspools were placed inside houses, and in other improper situations; while courts, terraces, and blocks of back-to-back houses, occupied by numerous families, were insufficiently supplied by a common latrine, with a deep, wide, open, and undrained cesspool. The remedy of these evils was not only not touched by the Act of 1842, but, on the contrary, the statute sanctioned and confirmed the erection of privies inside houses, common latrines at the entrances of courts, and common cesspools for the use of several houses. Even where the Act appeared to insist on some improvement of construction and used the terms in reference to the erection of privies, "In the yards of such houses," it really authorized the erection of privies in dangerous proximity to inhabited apartments. There was in the Act of 1842 no compulsory regulation as to the size of yards, even when such an area or open space did exist; but about the year 1846, a minute or resolution of the Health Committee recommended builders and owners to leave an area of 84 feet at the rear or side of their houses. A recommendation which cost money or lessened profit, and could not be enforced, became little more than a dead letter, and was seldom followed. The selection of 84 feet by the Health Committee was based upon the idea, that as the usual frontage of labourers' dwellings within their external walls was 14 feet, the prescribed superficies would give a free and continuous breadth of six feet space at the rear, available and sufficient for the due circulation of air. If the conditions of "free and open" had been maintained, such a hygienic conclusion would have been tolerably correct; but in this yard of 84 feet it was, even on the recommendation of the Health Committee, intended that the privy and ashpit should be erected. The average superficial dimensions of a privy and ashpit are 24 feet, so that not only was the open space really reduced to 60 feet, but the air was loaded with filthy miasma, and the current of its circulation checked and intercepted. Very few houses, however, of the labourers' class possess even this modicum of open space. In general, a scullery or outbuilding of the same height as the privy is also placed at one side of the yard. The average superficial dimensions of a scullery are 30 feet; so that the open area attached to the premises, even of those who seem to follow the suggestion of the Health Committee, dwindles down to an enclosed and air polluted well of 30 feet diameter. However much we may criticise these defective arrangements, it must not be forgotten that they represent only the very best of the houses for the labouring class. Most of the builders systematically rejected the suggestions of the Health Committee as to yard space about houses. It would be impossible to exaggerate, and very difficult to particularize in detail, the nature of the many and perversely ingenious contrivances adopted in houses which had privies but no yards. Sometimes the privy was situated inside the house, either in a nook leading directly from the sitting-room or kitchen, or at the end of the lobby or passage of the ground floor. In such places, nothing of the pervading nastiness was lost; for the kitchen fire and the heat of the interior of the house secured a constant unremitting evaporation of the fetid contents of the cesspool. Sometimes the privy was so far outside as to communicate by a door with the kitchen, while the cesspool abutted on the outer wall, and its contents were periodically emptied through the house. Sometimes the construction was improved by the privy being emptied through the usual three-foot passage at the rear of the houses of the street, or through a court at the rear or side of the houses. But the triumph of ingenuity was in the various ways by means of which one large deep open cesspool was made to receive the contents of four, six, eight, ten, or more adjacent houses, and yet not leave a yard of open space between or common to the whole lot. These arrangements constitute varieties in the well-known tunnel middens of Liverpool. They reach to their perfection in the architecture of terraced or flatted houses. The following description of the block of buildings known as Kent Terrace, taken from my report on tunnel middens in 1863, will give a tolerably good idea of their plan; for although Kent Terrace was far from being the worst of the kind, it presents a tolerably average picture of the contrivances adopted in these terraced houses. "This locality (Kent Terrace) is "bounded and enclosed on the west by the front houses of the street; on the north "and east by a high wall; on the south by oil mills. The entrance is a passage "15 feet in width; thus, though not ranked as a close court, it is without any "thorough ventilation. Here ingenuity has accumulated 76 houses, containing, at the "period of inspection, families consisting of 529 souls, on a superficial area of "2,346 yards. Beneath these houses are tunnels of the following dimensions, viz., "one under the south side 160 feet in length by six feet four inches in height and "three feet in width; one under the north side, 145 feet in length by six feet four "inches in height and three feet in width; one under two ranges of houses in the "centre terrace, 135 feet in length by six feet four inches in height and three feet "in width. The total area thus occupied by middens is 192 superficial yards; "their cubical contents 384 yards. In other words, the area of the middens is to "the whole area of ground occupied as 1 to 12·2; the area of tunnel and middens "is to the area occupied by buildings as 1 to 9·25. A rough estimate given by a "competent authority of the contents of these middens before thought full enough "for emptying is 225 tons. The only exit for the gases of this vast accumulated

ADDITIONAL REPORT BY W. S. TRENCH, ESQ., M.D., Medical Officer of Health, Liverpool—*continued.*

"sewage is through privies, which in the centre terrace are so placed between two "lines of double terraced houses that effluvium constantly and necessarily pervades "every room of the building; and in the side terraces, on ledges abutting on "sleeping and inhabited apartments, where the like noxious effect is unavoidably "obtained. The rain, as well as all the water escaping from taps, or used for house-"hold purposes, find their way into the tunnels; so that at every period of the day "there is disturbance of contents which stimulates the escape of the gases. No "breath of air can reach the unhappy residents which is not fraught with offensive "and deleterious compounds; no fire can be lighted in any household without "attracting the influx of pestiferous miasma."

It will be thus seen that when in 1854 the law gave to the Council the power, upon the certificate of the Medical Officer of Health, to compel owners to abate the nuisance of privies erected during the anarchial period, and yet gave no power to the Council to require a sufficient area around buildings, or to disturb any building already erected, it really and virtually compelled the Council to require the conversion of all the privies of the houses of the labourers' class into water-closets. As a natural sequence of the provisions of this Act of 1854 there began the controversy between the advantages and the evils of the water-closet and midden system of sewage.

If the position of privies was bad, their construction, as far as respects drainage, was, until the year 1846, equally defective. While the sewers were under the control of the Highway Board, no privy, water-closet, cesspool, or midden was allowed to be connected with them. Hence, at least until 1842, the fluid constituents of the sewage permeated into the ground, so that not only did the soil around become saturated, but the soakage reached through the walls into the inhabited rooms of houses. It was in 1842 that the Health Committee, availing themselves of the power conferred by the 15th section of the Local Building Act, first ordered the middens and open cesspools to be cemented and made water-tight. This to a certain degree ensured the retention of the fluids in the places of their deposit, but at the same time promoted the more speedy and perfect fermentation of the general contents of the cesspool. The disgusting dampness of houses was lessened, but the air was, if possible, more thoroughly loaded with offensive and gaseous emanations. But the cementing of open cesspools, even if a remedy, only met half the evil, so far as the soakage of fluids into the soil was concerned; for in the houses of the better class it was by the restrictions of the Highway Board necessary to convey all the sewage into deep wells or closed cesspools. When these wells were constructed in the red sandstone the fluids flowed away so thoroughly by the chinks and apertures of the rock that no other removal of contents was required during the lapse of years. When the wells dipped into the boulder clay, it would be only from the upper part in contact with the surface soil that any removal of contents by soakage would be possible; but how brisk that partial removal was, may be judged of by the fact that closed cesspools in the clay soil continued undisturbed and required no emptying for years. At the period when these unsatisfactory arrangements existed, the inhabitants of the borough drank the water obtained from surface wells (private), and from the wells in the red sandstone (water company). It was time for reform, and, therefore, when in 1846, the Council obtained the control of the sewers, they ordered all cesspools, middens, and water-closets to be drained into them.

The perfect drainage of middens and cesspools was a great sanitary improvement. It lessened materially, though it did not entirely remove, the evils of the existing system. It delayed and, for a certain time, arrested those chemical changes of fermentation and putrefaction, upon which the injurious consequences of accumulated refuse chiefly depend. But no precautions as to dryness, or drainage, or construction could render innocuous the privies and middens so contiguous to inhabited apartments as were those attached to the courts and cottage residences of Liverpool.

Some have reasoned as if a drained midden had only its own self-contained evil, and was in no degree answerable for the gaseous emanations from ill-trapped sewers; others, on the contrary, do, with probably more show of reason, hold that middens have not only an evil of their own, but do, by their drainage, pollute the sewers to an equal if not to a greater extent than water-closets. This question deserves some inquiry.

The researches of chemists have fixed the average total amount of the excrements of each individual of the population at 40 ozs. per diem, of which 2 ozs. will consist of dry solid matter. This will give a daily total of 28 tons of dry and 531 tons of fluid, or of 559 tons of all matter for the excrements of the population of the borough of Liverpool in the year 1868. There can be no doubt that in a well-drained midden not only do the whole fluids reach the sewers, but it may be also asserted that in rainy weather much of the solid matter will be also carried away in a moist and disintegrated state. Therefore, it would not be unreasonable to assume that, even if water-closets were abolished, sufficient of sewage would still pass into the sewers to cause all the evils that can possibly arise from putrefactive gases. But the process of putrefaction requires time. Decomposition of animal and vegetable matter does not take place immediately, and gases will not be generated if the sewage is speedily removed. Now, the difference between the water-closet and the privy is, that in the former the flow of water is so regulated as at once to take the sewage along the private or house drain into the main sewer, from which, as has been proved by experiment, it will reach the river in 60 minutes from the most distant parts of the borough; while in the latter or privy drain no such impetus is given by water as a moving power, and the sewage dribbles into, stagnates, and decomposes in the drain before it reaches the main sewer. Indeed, so perfect is the daily flushing power of what are termed the trough water-closets in courts, that never now we perceive those

ADDITIONAL REPORT BY W. S. TRENCH, ESQ., M.D., Medical Officer of Health, Liverpool—*continued.*

emanations from the grids at the entrance of courts, which were common during the period of court privies. But privies are also evaporating surfaces of decomposing matter, and, as such, produce specially injurious effects of no inconsiderable magnitude. There are about 76,554 inhabited houses in the borough of Liverpool. If these were supplied solely by privies and middens (the average superficies of the latter being estimated at 15 feet for each house) the total superficies of middens within the borough would be represented by an area of 26 acres. The place or square in which St. George's Hall and St. John's Church are situated, bounded by William Brown Street, Lime Street, St. John's Lane, and the old Haymarket is equal to nine acres. Now, it is only by imagining an open midden, with a surface nearly three times this extent, that we shall be able to realize the amount of noxious miasma which would be continually thrown off into the air we breathe, if Liverpool was supplied only by privies and middens. This illustration gives some idea of the magnitude, but certainly does not do justice to the intensity, of the evil. We should rather picture, and those who know Liverpool can bear witness how true a picture it is, numerous open cesspools, so situated that no breath of air could possibly reach the dwellings of the working man until deprived of ozone, and loaded with debilitating and malarious products.

The measures taken by the Council in reference to injuriously placed privies will not inaptly show the extent of the evil. The Act of 1854, as before mentioned, provides that when it shall have been certified by the Medical Officer of Health that any privy or cesspool was in a condition, state, or situation injurious, dangerous, or prejudicial to the health of any of the inhabitants of the borough, the owner thereof may be required, within a reasonable time, effectually to abate and remedy the same to the satisfaction of the Council.

In giving practical effect to the above powers of the law, it became necessary at once and *in limine* to define the nature of the required remedy, and also, as far as possible, the conditions which would justify the certificate of the medical officer. His power of certificate has been termed autocratic, and there can be no doubt that if exercised arbitrarily, it would lead at least to the suspicion of oppression and injustice. The medical officer, therefore, when, in November of 1863, he announced his intention of certifying against the injurious privies of the town, likewise laid down on that and subsequent occasions the rules by which he would be directed in the exercise of his certificates. He proposed to certify against—

1stly. Privies inside houses.
2ndly. Privies emptied through houses.
3rdly. Privies situated beneath rooms.
4thly. Tunnel middens of every description.
5thly. Combined open middens supplying many tenements, and placed near the inhabited rooms.
6thly. Privies of private houses clustered together in a *cul-de-sac*.
7thly. Privies of private houses in close confined yards, or situated beneath windows, or abutting on the walls of houses, or within two feet of the lower windows or of the door of the house.
8thly. Privies of courts.
9thly. Privies abutting or opening directly into streets and thoroughfares, and emptied before the doors and windows of houses.
10thly. Privies of front houses when emptied through a court.
11thly. Privies beneath the footpath of the street, and emptied through a grid on the footpath.
12thly. Privies of many houses when collected together as a kind of amphitheatre, as is seen between Prudhoe Street, Ilford Street, Gildart Street, and Audley Street.

The Council, in order to secure uniformity of action, and likewise to prevent future mistakes in the application of remedial measures, directed the town clerk to notify to the several owners against whom proceedings should be taken, "that it appears to "the said Council of the said borough that the only effectual remedy for such privies "and cesspools is by converting the same into water-closets." The number of privies which have been converted into water-closets, since the end of 1863 to the end of 1868, are 13,391, of which 2,110 were privies in courts supplying many houses in common, and therefore ordered to be changed into trough water-closets. In making up his list of certificates the medical officer invariably mentions the reasons which render the situation of the privies injurious or prejudicial to the health of the inhabitants, and he believes that in no single instance has he trangressed the rules made for his own direction, and notified to the Council in reference to the use of the certificates. In addition to the 13,391 privies converted by certificate, many hundreds were altered by the owners of their own free will, and many were altered under the presentments of the grand jury.

The substitution of water-closets for ill-placed privies did not and was not meant to affect the vexed question as to the best mode of disposing of the sewage of towns; for even the most zealous defenders of the midden system pre-suppose, for the success of their pet scheme, some conditions as to distance from inhabited apartments. None but the over-zealous will be found to tolerate or defend privies within or in immediate proximity to houses overcrowded on superficial area, as is the case in the densely populated districts of the town of Liverpool.

But the Council has not hesitated to take direct measures towards suppressing the old system of privies, middens, and cesspools; and with this view they have, since 1860, required the erection of water-closets in lieu of privies in all new houses where the land at the period of their building was sewered. The advancing civiliza-

ADDITIONAL REPORT BY W. S. TRENCH, ESQ., M.D., Medical Officer of Health, Liverpool—*continued.*

tion of the age, and the higher sense of propriety and decency among the people are working steadily to the same end, and it is not unreasonable to believe that in a very few years the public voice of the community will demand the total abolition of the privy system. In the meantime it will require the lapse of many months before the certificates of the medical officer (within the rules specified as above) will be able to reach all the privies which, by reason of their position, are injurious to health.

The sewers of the borough of Liverpool will bear favourable comparison with those of any other town in the kingdom. Their total length, in 1866, was as follows:—

	Miles.
Old sewers	43
New main sewers, from 1847 to 1866	127
Court and passage drains	90
Total	260

Some of the old sewers constructed before 1842 are square, but all the others have the approved egg shape. They are ventilated in three ways; firstly, when a sewer passes near to any manufactory or workshop where there is a furnace in constant operation a pipe is carried from it to the ashpit or chimney of the furnace; secondly, whenever the drop-spout of a house or other building is not in proximity to the windows of rooms it is carried into the drain without being trapped; thirdly, special ventilators are placed in many districts of the town. As a general rule, these latter are carried from the sewer at every change of its direction or gradient to the height of four or five feet above the highest house in the neighbourhood. The pipe of the ventilator is furnished at its summit with an Archimedian screw put up and moved by a fan, which makes it turn with the slightest breath of air. It may be said, indeed, to turn constantly, and at every revolution to remove a quantity of air equal to the capacity of the screw pump. There are at present 1,030 of these ventilators erected and in operation within the borough.

There are eight outlets of the sewers into the river, viz., the Bankhall outlet, the Sandhills outlet, the Beacon's Gutter outlet, the Battery Lane outlet, the Gower Street outlet, the King's Dock outlet, the Park Street outlet, and the Dingle Lane outlet. The gradient of the sewers is such that, as formerly mentioned, the fluids reach their outlet in 60 minutes from the most distant part of the borough.

I have frequently watched the sewage issuing from these several outlets, and have not been able to detect even a temporary pollution of the waters of the river, except in the case of the Gower Street outlet, where opposite the Albert Dock, and in the channel between it and Pluckington Bank, there is certainly a darkening of the water of the *Mersey*, as if due to some mixture containing a blackish dye. In no part of the shore of the river have I been able to detect any deposit which can with any reasonable probability be attributed to the sewage of Liverpool.

This is a fact which will scarcely surprise anybody who is familiar with the following description of the *Mersey* by Mr. Baines, the historian of Lancashire:—
"According to the calculations and observations of Admiral Denham, R.N., who "carefully surveyed the coasts of Lancashire and Cheshire, the quantity of tidal "water that enters the estuary of the *Mersey* at spring tides is 774,000,000 of cubic "yards, and at neap tides 299,000,000, making an average of 535,000,000 cubic yards "of water. The vertical rise of the tide at the entrance of the *Mersey* is from 30 to "33½ feet at the highest spring tides, and the tide flows through the narrowest part "of the river between Seacombe and Princes Dock at a rate varying from 4½ to 5½ "miles per hour. At high tide the immense mass of water brought into the wide "basin of the *Mersey* is received into a great natural reservoir, presenting the appear-"ance of a lake 20 miles in length and from two to five miles in breadth. No sooner "does the tide turn than this vast mass of water begins to flow back towards the sea, "carrying along with it the fresh water that has been brought down by rivers and "streams from the interior. At first its motion is slow, but the momentum increases "as the mass of water descends towards the sea, and it finally rushes through the "narrowest part of the estuary opposite to Seacombe and the town of Liverpool at a "rate of between five and six miles an hour. Owing to the force of the tide there is "scarcely any deposit of sand in this part of the river, where the rocks on the side of "the stream are quite bare at low water of spring tides. After flowing rapidly "through this narrow channel this great natural sluice, charged with hundreds of "millions of cubic yards of water, not only scours out the harbour, but strikes upon "the sand banks at the entrance of the river with sufficient force to clear a passage "into the sea, in which passage there is never less than 10 or 12 feet of water, "generally sufficient to admit the larger ships."

An opinion as to the practicability of applying Mr. Moule's plan in lieu of the present water-closets and middensteads might not be altogether out of place in this paper; but I will simply mention that the amount of soil required to carry out the earth-closet system renders it totally impracticable in such a place as Liverpool. Mr. Bateman, C.E., calculates that for London the amount of soil required will be 2,000,000 cubic yards a year, which would necessitate the digging of 200 acres to the depth of six feet, or 400 acres three feet deep every year. The amount required in Liverpool (calculated on the same ratio for population) would be 400,000 cubic yards, or the digging of 40 acres to the depth of six feet, or 80 acres to the depth of three feet.

A modification of Mr. Moule's plan has been suggested by Mr. Alderman Bennett. He recommends the daily or frequent removal of the sewage in closed pans or vessels without the addition of the earth. Both these plans require a moveable receptacle

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for the use of each house, and also a receptacle to replace the other at the period of removal. It will probably be not incorrect to estimate the dimensions of such a receptacle at three feet by two feet by two feet three inches. There were in the borough of Liverpool, at the census of 1861, 65,781 inhabited houses, and the number built since that period amounts to 12,772. There are no documents at hand to show absolutely the extent of house demolition, either by private owners or for town improvements, or for railway, dock, or warehouse purposes, since the census of 1861; but I think that the estimate of 2,000 houses will be above the mark. This will leave 76,553 as the probable present number of houses inhabited within the borough of Liverpool. But there frequently exists within the curtilage of what is termed a house in the returns of the Registrar-General, and of the borough engineer, two, or even more, separate, distinct and unconnected tenements, for each of which a moveable receptacle would be required. There were in 1868, 93,373 separate assessed tenements within the borough of Liverpool; and it will not, therefore, be unreasonable to take the average between the returns of the engineer and of the treasurer, and to estimate the number of tenements which would require separate receptacles at 84,963.

The space required for the reception of the spare receptacles, allowing that they were packed as close as possible, would be 11 acres 2 roods and 32½ perches, or would occupy a space nearly seven times the area of Abercromby Square within the railings, or three and a half times the area of the square and adjoining streets. It is not unwise to have some idea of the magnitude of the practical operations which will follow the carrying out of the theory, and, therefore, it may be mentioned that if the spare receptacles were put on a railway, four abreast, they would extend to Ormskirk, a distance of 12 miles. I can form no guess as to what would be the extent of land required for the reception, emptying, washing, and deodorising of the receptacles directly on removal from the various houses; nor can I conceive where, within the area of our overcrowded borough, such spaces could be found; nor where, outside and beyond the precincts of the town, the Health Board of any suburban locality would allow their parishioners to be poisoned for the convenience of Liverpool. The calculation of space for spare receptacles is of course made on the supposition that the several vessels or utensils so used would be marked and returned to the same tenements. This could not be managed at all, unless there were always two receptacles for each house; one to use and one to clean. But it may be said that there is no necessity to return always the same utensil. Then my answer is, that the disgust, the fear, the panic during epidemics of smallpox, of scarlatina, or of Asiatic cholera, that infection would be brought to one's home by these means would soon control all municipal authority and upset the whole scheme.

I do not wish by any of the above observations to give an opinion as to the feasibility of establishing the dry closet system in prisons, barracks, factories, or small inland towns. In the year 1864 I visited Hyde to inspect the "Eureka process," where the fæces are collected in boxes under the privy seats, and removed at frequent periods. Hyde, or at least that part of the town where the experiment was tried, was admirably calculated for the purpose. Rows and streets of houses belong to manufacturers, and were occupied by workmen in constant employment, and not by transitory tenants, as in Liverpool, where it is very exceptional to find the same tenant in the same house for three months consecutively. My own opinion of the process in all its details was, that it was a shocking and unmitigated nuisance; but it will be only fair to mention the opinion of Dr. Beecroft, a medical practitioner of great experience at Hyde. After having mentioned his own belief that the system had been the means of spreading infectious disease, and would be highly dangerous during an epidemic of Asiatic cholera, he thus concludes:—"If the Eureka Works were removed, so as to do away "with the excessive stink which we receive from them when they are in full work; "if the boxes were numbered, so that each house could always have its own returned; "if the boxes were made or lined with a non-absorbent material in the place of the "porous wood, as is the case at present; and if the boxes were emptied more fre-"quently (daily when infectious disease existed), the system would be superior to the "old ashpits, though not to be compared with water-closets."

The action taken by the Council in the substitution of water-closets for ill-placed privies, middens, and cesspools, has proved eminently beneficial to the public health, and especially to the health and moral and physical well-being of the poor inhabitants of the overcrowded and hitherto fever-stricken districts of the town. The extent to which this has really been the case can only be fully realized by those who were acquainted with the homes of the labourers' class and accustomed to visit and work among them before the alterations were commenced. The members of your Commission were, however, while inspecting the town, under the guidance of the borough engineer and myself, able to judge both of the nature of and the necessity for the alterations effected by orders of the Council; and therefore you are able to decide whether such alterations were or were not improvements due to humanity, demanded by justice, and justified by the teaching and experience of chemical and sanitary science.

During the course of your inspection the localities only too well-known as the fever districts of the town were pointed out to you; and I afterwards showed you in the fever map of 1865, and the cholera map of 1866, the dire effects of zymotic disease in these districts before the alterations were made; I now add to these two maps the fever maps of 1867 and 1868, showing the position of epidemic fever within the borough since the alterations.

The year 1868 was one in which the epidemic constitution of fever was peculiarly and markedly manifest. There raged, as described in my annual report, a widespread epidemic of typhoid fever in the town, and in the rural districts in the vicinity of the town; and there are few who remember such a prevalence of the disease among well-to-do classes. The exciting cause of this epidemic constitution of the atmosphere was the extreme heat and dryness of the summer season. It is gratifying to know that while in the families of the rich, in their costly suburban dwellings, there was raging a fever, clearly and unmistakeably due to the pestiferous emanations from ill-drained cesspools or other collections of filth or decomposing organic matter, the districts in the borough of Liverpool known as the fever districts, and wherein no middensteads and cesspools were allowed by the Council to remain unaltered, continued during the whole period of the epidemic remarkably healthy and free from fever.

I have added to this report and to the maps my annual report for 1868, because at pages 13 and 14 I refer to this question.

ADDITIONAL REPORT by W. S. TRENCH, Esq., M.D., Medical Officer of Health, Liverpool—*continued.*

Extract from an "Address on Public Health" delivered by Professor ROBERT CHRISTISON, M.D., President of the Royal Society of Edinburgh, senior physician to the Queen for Scotland, Professor of Materia Medica in the University of Edinburgh, &c., at the meeting of the Association for the encouragement of Social Science, held at Edinburgh in October 1863.

Influence of Sewage Irrigation on Health.—The Craigentinny Meadows, Edinburgh.

"THERE are still marshes in some parts of Scotland, but there is no ague; three sorts exist, peat marshes, irrigated meadows with pure water for the liquid, and irrigations with foul water; but all are alike ague-free. The last sort might with reason be strongly suspected, for as managed in the immediate neighbourhood of Edinburgh, they present that frequent alternation of considerable moisture and approach to dryness, that rankness of vegetation, and that abundance of decaying organic matter which are thought, when combined, eminently to foment intermittent and remittent fevers in countries liable to these diseases; but if there be any doubt as to the general salubrity of the now famous marshes of *Craigentinny*, there is none at least as to the total absence of ague among the inhabitants. I have recently been making careful inquiry respecting this famous and somewhat unsavoury institution; many years ago my own prejudices were all against the meadows; I have been compelled to surrender them. I am satisfied neither typhus nor enteric fever, nor dysentery, nor cholera, is to be encountered in or around them, whether in epidemic or non-epidemic seasons, more than in any other agricultural district of the neighbourhood. About twenty-five years ago it was stated that the cavalry soldiers at Piershill barracks, which are situated very near them, were unusually liable to the zymotic diseases caused or promoted by foul emanations, and also that meat could not be kept in the officers' larder on account of the absorption of foulness and quickly following decay. Either, however, there was some mistake committed through prepossession, or the meadows are now worked on a better system, but at all events, I have the assurance of Mr. Lockwood, surgeon of the Scots Greys, that during their late occupation of Piershill barracks for two years, the messman of the regiment never observed the meat to be injured, nor did he himself observe among the men anything but remarkable freedom from diseases at large. I think it right, in reference to the late introduction of the Craigentinny system of irrigation into the vicinity of other large towns, that these precise facts should be known."

Report by THOMAS LIGERTWOOD, Esq., M.D., Surgeon to the 8th Hussars at present (19th September 1868) stationed in Piershill barracks, Edinburgh.

Influence of Sewage Irrigation on Health.—The Craigentinny Meadows, Edinburgh.

FROM the 19th May to the 19th September 1868 there have been 41 admissions into the regimental hospital from an average strength of 320 non-commissioned officers and men; 20 of these admissions have been due to venereal diseases, 10 contusions, chafes, &c., 1 ophthalmia, 4 bronchitis, 2 phthisis, 1 rheumatism, 1 pneumonia, 1 tonsillitis, and 1 influenza. During the four months the regiment has been quartered at Piershill the men have been very healthy, and so have the women and children. Between the barracks and the sea there are upwards of 200 acres of land under irrigation from town sewage; these sewage fields do not apparently exercise any unfavourable influence on the health of the troops, or perhaps I should say, that my opinion is, that *in spite of these*, the health of the troops at Piershill is good, the site of the barracks being open and well exposed to the sea breeze counteracts any evil influences from proximity to such fields. These fields are certainly a source of nuisance to those living in barracks from the offensive emanations given off from the open ditches conveying the sewage, and also from injudicious flushing of the fields, the stench in barracks is sometimes quite sickening. All this might however be remedied by the sewage being conveyed to the fields in covered ditches or pipes, and outlets placed on the pipes in the fields at proper intervals for irrigating.

During the years 1865, 66, and 67 the 4th Hussars were quartered at Piershill; I was surgeon in charge; the health of the regiment was remarkably good; during a portion of this time cholera was epidemic at Leith and Edinburgh (not severe), but not a case occurred at Piershill barracks.

REPORT by MR. C. L. WHITEHEAD, of Atherton, near Manchester.

On Cleaning Filthy Water for Manufacturing Purposes by Irrigation.

IN the year 1863 I was surveyor to the Improvement Commissioners, Middleton and Tonge, near Manchester, and I constructed for them the Rhodes outlet sewer, which discharges itself in the river *Irk*, near to the Land's End Bleach Works,

REPORT BY MR. C. L. WHITEHEAD, of Atherton, near Manchester—*continued.*

in the township of Heaton, in the occupation of Messrs. Mellatt and Walker. Mr. Mellatt was compelled at times to use the filthy water of the *Irk* for bleaching purposes.

In order to render the water fit for use it was filtered by means of irrigation. Adjoining the works, but at greater elevation, there was a small field of about three or four statute acres. This field was irrigated, or rather deluged, with the water from the *Irk* by pumping the same thereon. The water percolated through the gravelly soil of the field and was afterwards found clear enough for the purpose of bleaching. This was in the summer of 1863, and the *Irk* had then the appearance of ink. In a small lodge or reservoir, which contained a large per-centage of this filtered water, I saw fish; the vegetation also seemed to flourish. Mr. Mellatt told me that he had mowed the field three times in one year, but when I saw it he was using it as a pasture.

I make no comments, I only wish to lay before the Rivers Pollution Commission the fact that the water of the *Irk* can be purified by irrigation.

REPORT by JOHN MOLESWORTH, ESQ., Solicitor to the Ecclesiastical Commissioners for England, in respect of the ROCHDALE VICARAGE ESTATE, dated Rochdale, 3rd May 1869.

How far the Sewage of Rochdale can be utilized and got rid of.

THE Rivers Pollution Commissioners having requested information, I venture, as the agent for the owners of a very considerable part of the town of Rochdale, to make a few remarks affecting the neighbourhood.

I will confine my remarks to the second inquiry by the Commissioners, viz., How far the sewage, &c. of the town can be utilized and got rid of.

I take it for granted that the most objectionable portion of the sewage is that arising from the fæcal matter and urine, and therefore I would confine my remarks to this part of the sewage. There are at present comparatively few waterclosets in Rochdale, and therefore but a small proportion of fæcal solids finds its way directly to the river, but a very large proportion of the urine. The present system of privies for cottage houses is highly objectionable, both in a physical and moral point of view.

There are numbers of houses without any conveniences whatever; in many cases there is not more than one privy and ashpit for every 10 houses, and a builder of cottage houses is considered very liberal who supplies to his cottagers one privy for every three houses. The great majority of privies, in all classes of houses, empty themselves into an ashpit, which is uncovered, and the roofs of the privies are generally so constructed as to drain into the ashpit, the consequences are that the ashes are, after rain, saturated with water as well as urine. The ashpits are emptied as they become full, and the contents deposited at a high bank in the borough, not fifty yards from the river, and the drainage from this mass of pollution runs into the river.

In all cases on the estate of the Ecclesiastical Commissioners where the houses are not held on building leases, we have introduced the system of M. Goux, the town authorities undertaking regularly to empty the night soil and ashes, which are placed in separate prepared tubs, and under cover.

As far as the health and comfort of the tenents are concerned, this system has proved most satisfactory, and the contents of the tubs are utilized instead of being allowed to drain into the river. I give this system the preference as far as I have observed its operation. I do not deny that there are other systems which would work satisfactorily to prevent the evil complained of.

REPORT BY MESSRS. HOLT AND GLAZIER, of Rochdale, Agents of M. GOUX, on the application of the system to Great Britain.

Application of the Goux System in Great Britain.

THE domestic life and habits of the French nation are so widely different from our own, that it is obvious considerable modifications in applying the new system in this country will be requisite. In our provincial towns and villages the ordinary plan is for the privy and ash-pit to be built in connexion, the solid and liquid matters from the former, draining into the latter, mixing with and being absorbed by the ashes and other refuse. Ash-pits, with their putrescent animal and vegetable matters, are universally condemned by medical and sanitary authorities as a prolific source of virulent disease. But their abolition has hitherto been virtually impossible, in consequence of the difficulty of removing the offensive fæcal matters. The Goux system, however, thoroughly meets this difficulty, consequently ash-pits are no longer a necessity. Concurrently with the introduction into this country of the new system of night soil removal, we propose the immediate suppression of ash-pits, thus promoting (1) the public health by removing one source of infectious miasma from our midst, and (2) contributing to national wealth by the profitable utilization of the multifarious refuse of which ash-pits are the general receptacle.

Our plan is to commence this sanitary and economical reform, by emptying and thoroughly cleansing the objectionable ash-pits and soil receptacles, and then pulling down and removing every vestige of the former. The seat of the privy or closet is then removed, and the soil receptacle filled up to the floor with dry earth or brick rubbish, leaving a cavity in the centre about two feet in depth. In this cavity is to be placed the new patent soil receiver.

Our design is to arrange the change from the old to the new system with the least possible outlay. For this purpose we shall use receivers of a conical form, 30 inches in depth and 16 inches in diameter, a size generally applicable without further alteration of the closet. The seat being made removable (instead of a fixture as at present), it is simply necessary to lift it up, place a newly charged receiver in the

REPORT BY MESSRS. HOLT AND GLAZIER, of Rochdale — *continued.*

cavity, replace the seat, and the closet is immediately ready for use. The receivers being replaced every week, or at the utmost every second week, by men regularly appointed for the purpose, not the slightest attention from the household is required. There can be no getting out of order, no waste of water, or the many mishaps and annoyances of that system. Those who know anything of the habits of the denizens of the worst districts of the metropolis, know the impossibility of getting them to take the most simple precautions to keep the pans of water-closets free and clean. A closet on the Goux system cannot be made uncleanly, except by the most positive wilfulness. Even on this ground alone, we contend it deserves the favourable consideration of our sanitary and municipal authorities.

For the interior of mansions, dwelling houses, schools, unions, hospitals, and factories, an adaptation of the system has been designed which provides for the removal of the collected matters, without the trouble and inconvenience of carrying them down stairs. This plan will cost less than the ordinary water-closet, and can be applied wherever such closets can be fixed.

Having thus pointed out the application of the Goux system in this country, we proceed to treat of the collateral branch of towns' refuse—the contents of dust-bins.

We have suppressed the ash-pits, and for these we propose to substitute a portable covered dust-bin of a size to contain a fortnight's ashes, and other house refuse. We say for a fortnight, but we strongly insist upon the desirability of all refuse being removed from the vicinity of human habitations *every week.* Arrangements to be made for the removal of the full receiver from the closet, and the emptying of the dust-bins at the same time, and by the same men. By the plan thus sketched out the refuse from our dwellings could be removed without annoyance, or the presence of the abominable effluvia, consequent on the clumsy and unscientific system now so general.

The contents of the dust-bins being received at the general depôt, are forthwith sorted, the rags, metals, &c. being sold, the vegetable fibres and a part of the ashes are retained for use as absorbents in charging the receivers. The surplus ashes, being mixed with from 15 to 20 per cent. of Portland cement, forms a useful concrete for the foundations of foot-paths, and may even be employed for building purposes.

The public urinals of our cities and populous towns are a source of exceeding difficulty to our municipal authorities. Even with copious supplies of water they exhale a most disagreeable effluvia. Where the supply of water is scanty, or only intermittent, which is the case with the larger number, public urinals are abominable; whilst of those to which there is no water-supply at all, their foulness is so well known and understood that we need not attempt to describe it. The use of disinfectants, such as chloride of lime (generally used), scarcely mitigates the evil, and in fact renders these places far more repulsive to some persons. The present system, or rather want of system, is admitted to be unsatisfactory. We have seen urinals of the Goux system frequented by hundreds of men, exposed to the full glare of a Parisian July and August sun, entirely free from all offensiveness, and from which no odour could be perceived; and its use in this country is strongly urged, as enabling our local authorities to satisfactorily deal with what at present is an unmitigated nuisance.

An improvement on the original Goux urinal has recently been tried with the most thorough success. The cask or other recipient is provided with a cover or basin six inches deep, and having a perforated bottom. In this basin is placed the absorbents, consisting of the sweepings of hay lofts, wheat chaff, &c., and coarsely pulverized charcoal. Thus placed, these absorbents really form a filter, through which the liquid urine passes into the receptacle below. A small quantity of sulphate of iron being placed in the receptacle, the urine mixed with this, and removed from the action of the air cannot ferment, consequently there is no evolution of noxious gases or unpleasant effluvia. The urine, which contains the most valuable part of animal dejections (and being the normal dissolvent of animal refuse), is subsequently used in the manufacture of manure; thus taking another step in utilizing towns' refuse.

The removal of refuse from slaughter-houses—another source of extreme difficulty in populous towns—can be easily effected by the Goux process, without escape of effluvia. Petroleum casks are prepared and charged with absorbents, and then filled up with the refuse. The latter being covered with absorbents to the depth of one or two inches, the removal to the general depôt is effected without the slightest annoyance. The collected matters may then be mixed with the fæcal matters from closets, or treated by themselves, and in either case a valuable and easily portable manure is the result.

EXTRACT from a PAPER read before the MANCHESTER and SALFORD SANITARY ASSOCIATION, March 19th, 1869, by Mr. J. CONYERS MORRELL.

Morrell's Patent Ash-Closet.

A PRIVY of the ordinary kind is to be provided for receiving the excrementitious refuse, with a water-tight pit, or a water-tight vessel, this latter easily removable. In lieu of the ordinary excrement and ash pit an apparatus, forming a complete substitute for the latter, is attached to the outside of one of the walls of the privy, at the side, or rear, as may be best suited. This apparatus is provided with an agitating screen of fine network (for the separation of the fine ash from the cinders, which may either have its own cover, or be covered by an overhanging roof, to keep the cinders and ashes dry when thrown into it). In some few cases, screens, composed of bars of iron, fixed at an incline, are used; a rake being required to pull the cinders and ashes down. They are defective, from the fact that the distance of the bars from each other does not procure a perfect separation of the dust from the cinders; they also soon lose their screening power, owing to the cinders fixing themselves between the bars, and so widening the

Extract from a Paper read before the Manchester and Salford Sanitary Association, March 19th, 1869, by Mr. J. Conyers Morrell—*continued.*

space between some and jamming other bars together. The fine ash dust cannot, therefore, by such a primitive arrangement be procured alone, nor can it be concentrated for sanitary uses. By the opening of the privy door, or as may be preferred by the attention of an assistant nuisance inspector, or other official, the screener is brought into motion, when the cinders thoroughly cleansed of the ash fall into the yard for re-use; the ash being conveyed into the excrement receptacle, or, if considered desirable, into a storing measurer fixed in the wall. In the latter case the seat orifice will be covered by a lid working horizontally on a pivot. In the act of opening or of closing this lid, it measures out into the excrement receptacle a quantity of ash sufficient to deodorize the contents of the receptacle.

In this way are procured the thorough separation of the cinders and the ashes, the cinders as fuel representing the value already shown to the occupier of each cottage-house, the ash being then a fine powder efficiently fulfilling the work as a deodorizer for which it has been separated.

So we make use of that which nature appears to have provided on the premises for averting decomposition, and preventing the escape of noxious gases and the generation of animalcule.

We reduce to a minimum the quantity of refuse to be removed by the scavenger,—the cinders being re-consumed until nothing but ash is left.

We greatly increase the value of the refuse to be removed as a manure, and make it available for immediate use or for storing until required.

I may here observe, as to the apparatus forming the substitute for the ash-pit, that from the frequent motion of the screener and consequently the continual disposal of the cinders and ashes it can never be overcharged, although only of small dimensions and occupying a much smaller space than the ordinary ash-pit.

Should it occur that in summer time, an emergency I do not apprehend, that there is not sufficient ash-dust to be had from the fire-refuse, it is easy to supplement it by throwing on to the screener some of the fine street-sweepings, they are at hand, and will, therefore, incur little or no cost to apply; their removal being made in combination with excrement, in lieu of being made alone. In case of unusual danger the ash may be further supplemented by a disinfectant being thrown upon the screener.

The solid domestic vegetable refuse may either be burned on the ordinary fire,—a plan recommended by Dr. Whitmore, and adopted by some,—or it may be collected in a separate box in the yard and disposed of for use as pig food, or it may be removed to the night-soil store house and there allowed to rot and become part of the manure.

The liquid refuse —the liquid only—I propose to pass into and away by the sewer, and for this purpose place in the yard a receptacle for it similar to the one proposed in the Manchester scheme.

For buildings requiring conveniences in the higher stories, I propose to substitute the watercloset, by having a wide tube brought to the ground floor, by which all refuse would be conveyed direct to a receiver placed there, or by a self-contained disinfectant closet, of good and inoffensive appearance, containing a receptacle in the form of a movable vessel. The latter are especially applicable to hospitals and public buildings.

Some prejudice would doubtless exist at first against them, but when the sanitary benefit was realized this prejudice would soon vanish.

As to removal: if the water-tight pit is adopted, the removal of night-soil will take place as now, but of course much less frequently, and certainly with less offence, from the equally absorbed and deodorized character of the mixture. If the vessels are used as receptacles, they will doubtless require more frequent removal, but this is of little consequence, as the work can only require to be done once. A circular vessel two feet deep, and one foot nine inches in diameter, will contain the ash and excrement refuse from one house with five occupants for twenty days. Removal once a week, or once each fortnight, for such a house will therefore be sufficiently frequent.

On the impounding of Floodwater in Upland Valleys.

Report by Mr. R. Hopwood Hutchinson, of Blackburn, 19th May 1869.

The impounding of waters in valleys on the course of rivers before they enter large towns is a general measure that will be required.

Such water will be used for flushing the river, and probably also the sewers, and this in addition to securing for manufacturers along its banks a supply of water for the purpose of their steam engines at a time when on many streams it is inadequate. Hitherto the parties on the banks of rivers have used this water without payment, but it would appear equitable that some charge should hereafter be made on them for water thus artificially supplied.

Suppose a town like ours largely engaged in manufacturing enterprise. We have mills on the canal bank, and they pay over 5*s.* per horse power for the water to supply their steam engines. Should a reservoir impounding the water above the town be made it would appear quite fair that some modified charge should be made to those who have a more regular supply through this, and who will possibly have less damage from floods, owing to the reservoir. My idea is if they paid 1*s.* per horse power after the first 10*s.*, and allowing no manufactory on a river paying less than 10*s.* they would have no good ground of complaint.

Report by Dr. R. AngusSmith, F.R.S., Manchester, January 18th, 1870.

Weight of Iron Pyrites imported, and per-centage of Arsenic contained therein.

In the report for 1868 by the Lancashire manufacturers, the amount of pyrites imported was stated to be:—

Pyrites, foreign - - -	80,000 tons
„ Irish - - - -	90,000 „
	170,000

The value of the manufactured material was 2,006,923*l.*

In the Tyne district the value was almost the same, and we may take the pyrites as the same in amount, more of it being foreign. This will give 340,000 tons, but there is more to be added, and the total must come close on 400,000 tons.

I think the average amount of sulphur may be called 40 per cent.

The arsenic is very uncertain; my present information would reduce it to nearly one per cent. upon the sulphur. Indeed my experiments at two works bring it down to one of the sulphur. The arseniferous ores of Cornwall are not used.

One per cent. of the sulphur would be 1,600 tons. Some who use Mond's process remove the arsenic. What is to be done with it? In Germany holes are made in which to put it. It has caused much trouble there. *See* Mr. Jas. Mactear's Paper, Lit. and Phil., Glasgow (Vol. VI., No. 4), for 1868, p. 345, as follows:—

		Arsenic per cent.
Spanish	pyrites, "Mason's" - -	0·28
„	„ "Iharsis" - -	0·31
Norwegian	„ first quality - -	—
„	„ non-cuprious - -	—
Swedish	„ - - - -	0·10
Belgian	„ - - - -	—
Westphalian	„ - - - -	Trace.
Italian	„ - - - -	Trace.

Letter from Mr. W. G. Wigner and Mr. C. Rawson, the Managers of the Company, dated 1, St. Swithin's Lane, London, E.C., December 17, 1869.

The Native Guano Company Limited (A. B. C. Process).

In consequence of the heavy rain which fell on the occasion of your official visit to our works at Leamington on the 11th instant, we take the liberty of asking the Commissioners to favour us with another visit under more favourable auspices, so that they may be able to report on the results of our A. B. C. process in fine as well as in wet weather.

The Commissioners are doubtless aware that the tanks were constructed for the lime process, and adapted only to receive and treat an average supply of about 700 gallons per minute, allowing the effluent water to subside for 1¼ hours before running into the *Leam*. We find, however, that we can with ease treat twice this quantity, or 1,500 gallons. On the 11th, the quantity of sewage rose to 5,700 gallons per minute, and the effluent water would thus only be about seven minutes in passing through the works, and leaving enough time for a proper admixture and settlement to take place. The consequence also of the heavy flood was to surcharge the sewers, and to bring down the decomposed deposit on their sides and top.

We have no fear but that the results of last Saturday will be found satisfactory under these inauspicious circumstances, but we should wish the Commissioners to satisfy themselves as to what our process can effect in more favourable weather.

It is on this account that we take the liberty of asking for another visit, feeling assured that the Commissioners are only anxious to ascertain the real advantages of every system before reporting upon it.

Letter to the Agents of the Bridgwater Canal and Mersey and Irwell Navigation; Rochdale Canal; Ashton, Peak Forest, Macclesfield; and Leeds and Liverpool Canal.

Navigation and Canal Companies.

2, Victoria Street, Westminster, S.W.,
May 6, 1869.

Sir,

I am directed by Her Majesty's Commissioners for inquiring into the Pollution of Rivers to request that you will be pleased to cause to be furnished to them the following particulars, viz.:—

1. Termini and length of canal or navigation.
2. Average width of water at the canal.
3. Number of locks, length, breadth, and depth thereof, and average fall.
4. Quantity of water each lock will hold.
5. When supply of water drawn, and maximum quantity taken in any one day.
6. Average number of boats passing daily.
7. Volume of water used yearly in passing boats through locks.
8. Purposes (if any) other than those of canal or navigation to which such water is applied.

I am, &c.
(Signed) S. J. Smith, Secretary.

Replies from the Agents of the Bridgwater and Mersey and Irwell Navigation; Rochdale; Ashton, Peak Forest, Macclesfield; and Leeds and Liverpool Canal Companies.

Bridgwater Canal and Mersey and Irwell Navigation.

Bridgwater Offices, Manchester,
May 11, 1869.

SIR,

IN Mr. Fereday Smith's absence I beg to hand you herewith a statement of the particulars you asked for in connexion with the Bridgwater Canal and the Mersey and Irwell Navigation, which I hope will meet with the requirements of the Commissioners.

I am, &c.
(Signed) JOHN D. ROBINSON.

S. J. Smith, Esq., Secretary,
Rivers Pollution Commission.

Bridgwater Canal and Mersey and Irwell Navigation.

Bridgwater Canal.

1. Length -	From Leigh to Manchester, and from Manchester to Runcorn - - - - -	40¼ miles.
	Note.—Length of River Mersey Navigation from the Bridgwater Canal at Runcorn to Liverpool -	16 miles.
2. Average width of water on the surface of the canal.		45 feet.
3. Number of locks on the canal - -		10, all at Runcorn.
Size of ditto - - - -		84 feet long by 15 feet wide, with a fall of 7 feet 8 inches each.
4. Quantity of water each lock will hold -		About 9,500 cubic feet.
5. Volume of water used *yearly* in passing boats through the locks.		About 492,385,000 cubic feet.
6. Average number of boats passing daily		238.

Mersey and Irwell Navigation.

1. Length -	From Manchester to Runcorn (*viâ* canal from Latchford to Runcorn) - - -	26½ miles.
	From Runcorn to Liverpool - - -	16¾ miles.
2. Average width of canal - -		From 114 feet to 120 feet.
3. Number of locks from Manchester to the tideway at Runcorn.		10.
Average size of ditto - - -		82 feet long by 15 feet 6 inches wide, depth about 9 feet 6 inches.
4. Average quantity of water each lock will hold.		About 11,000 cubic feet.
5. Mean summer flow of water at Throstle-nest.		The volume of water flowing over Throstlenest Weir varies from 4 inches deep (6,500 cubic feet per minute) to 2 feet deep (83,000 cubic feet per minute). When there is no *flood* in the river it might probably average one foot deep over the weir, or about 30,000 cubic feet per minute.
6. Average number of boats passing daily		61.

Rochdale Canal Navigation.

Manchester, May 10, 1869.

SIR,

IN accordance with your request I beg to supply you with such information as I have at command on the questions embraced in your inquiry.

I am, &c.
(Signed) R. EADSON.

S. J. Smith, Esq., Secretary,
Rivers Pollution Commission.

Rochdale Canal Navigation.

Information supplied to the Rivers Pollution Commission as to consumption of water for working the western section of the canal, situate in the Mersey Basin:—

1. The length of the canal, from the summit level above Littleboro' to the Bridgwater Canal in Manchester, is 19 miles of main line, and two miles of a branch to the town of Heywood, on which branch there is no lock.
2. The canal may be considered on an average 45 feet wide.
3. The size of the locks is 82 feet long, and 14 feet 6 inches wide; and the number in the above 19 miles is 56; and it requires on the average 75,000 cubic feet of water to fill each lock.
4. We have no record of the number of boats passing through a lock in one year.
5. The consumption of water may be taken to average 23,100 locks full per annum for working the western section of the canal, that is, from the summit level to Manchester.
6. The reservoirs for supplying the Rochdale Canal are 407 acres in area, and will hold when full 6,101,900 cubic yards. The whole supply to the canal for the western section for one year may be taken at 9,967,742 cubic yards.

Replies from the Agents of the Bridgwater and Mersey and Irwell Navigation; Rochdale; Ashton, Peak Forest, Macclesfield; and Leeds and Liverpool Canal Companies—*continued.*

7. We assume that the reservoirs are filled twice a year by the rainfall, and on the hills where they are situate the average rainfall per annum is 45 inches; of this, two-thirds are taken for the supply of the whole canal, and one-third by evaporation. The waste of water in the working of condensing engines has never been accurately ascertained.

Ashton, Peak Forest, and Macclesfield Canals.

Manchester, Sheffield, and Lincolnshire Railway Canal
Superintendent's Office, No. 70, Dale Street,
Manchester, May 12, 1869.

SIR,

I HAVE now the pleasure in handing you the information which you requested to be furnished with in reference to the Ashton, Peak Forest, and Macclesfield Canals, the property of this Company.

Our engineer will furnish any further information that the Commission may require.

I am, &c.
(Signed) R. W. HEATHCOTT.

S. J. Smith, Esq., Secretary,
Rivers Pollution Commission.

Ashton Canal.

This canal joins the Rochdale Canal at Manchester.

	Miles.	Chains.	Miles.	Chains.
1. Length, with branches -	17	36		
Private branches - -	1	0 =	18	36

2. Width of surface, 38 feet.
3. Twenty-five locks, viz., eighteen on main line, and seven on Oldham branch.
4 and 5. Capacity of lock, 83 ft. × 8 ft. 9 in. × 14 ft. 6 in. = 390 cubic yards.
6. Average number of locks of water consumed per week = 700.

One reservoir at Hollinwood, area, 8 a. 3 r. 36 p.

Peak Forest Canal.

	Miles.	Chains.	Miles.	Chains.
1. Length, with branches -	15	6		
Private branches - -	0	40	15	46

2. Width of surface, 34 feet.
3. Sixteen locks (at Marple) falling in Manchester direction.
4 and 5. Capacity of lock, 81 ft. × 8 ft. × 14 ft. = 336 cubic yards.
6. Average number of locks of water consumed per week = 600.

Two reservoirs, viz.:—

	a.	r.	p.
Chapel-en-le-Frith, area - - -	67	1	29
Whaley Bridge - - - -	53	0	5
Total - -	120	1	34

Macclesfield Canal.

1. Length, with branch, 26 miles 23 chains.

Of the length of the canal, viz., 26 miles 23 chains, 16 miles 25 chains, lie between Marple (the junction with the Peak Forest Canal) and the Bosley Locks, and 9 miles 78 chains between Bosley and the Trent and Mersey Canal, near Harecastle.

2. Width of surface, 36 feet.
3. Twelve locks, at Bosley, near Congleton.
4 and 5. Capacity of lock, 82 feet × 7 feet 3 inches × 10 feet = 220 cubic yards.
6. Average number of locks of water used per week = 100.

The water which flows through the above locks proceeds southward, and therefore in a contrary direction to Manchester.

Two reservoirs, viz.:—

	A.	R.
Sutton, near Macclesfield, area - -	23	0
Bosley, near Congleton ,, - -	131	0
Total - - -	154	0

The water from the locks of the Ashton, Peak Forest, Huddersfield, and Rochdale Canals flow into the Bridgwater Canal at Manchester.

Owners of works on the banks of the Ashton, Peak Forest, and Macclesfield Canals are entitled to the free use of water for condensing purposes, but it has to be returned to the canal.

No refuse is allowed to flow into the canals, so as to have the effect of polluting water.

Evaporation about one-ninth of an inch in 24 hours during the drought of 1868.

Leeds and Liverpool Canal.

Horton Hall, Bradford, August 9, 1869.

SIR,

I HAVE the honour to inform you that your letter of the 28th July was placed before a meeting of the Committee of the Leeds and Liverpool Canal Company on

Replies from the Agents of the Bridgwater and Mersey and Irwell Navigation; Rochdale; Ashton, Peak Forest, Macclesfield; and Leeds and Liverpool Canal Companies—*continued.*

the 3rd instant, and I was directed to acquaint you that the greater part of the information sought by the Rivers Commission will be found in the "History of Canal Navigation," compiled by the late Mr. Joseph Priestley, and published in London, 1831 (that gentleman had peculiar means of knowledge), and in Bradshaw's Maps of Canals and the Appendix, as well as in Carey's Inland Navigation, of late the entire south level of the Lancaster Canal has become the property of the Leeds and Liverpool Canal Company.

As the use of the canal varies at certain points according to the traffic, it is impossible to give any general averages either of the number of boats, or the quantity of water used either daily or yearly which could be relied on for the presumed purposes of the inquiry. No appreciable quantity of water leaves the canal for any purpose, but all the spare water at the western end of the canal is sent through the lockage into the docks at Liverpool by arrangements authorized for dock purposes under a statutory power.

I am, &c.

S. J. Smith, Esq., Secretary, Rivers Pollution Commission. (Signed) EDWARD HAILSTONE.

REPORT BY MR. JOHN NEWTON, C.E., Manchester, November 1868.

Utilization of Sewage.

UPON the question of "How far by new arrangements the sewage of towns and "populous places * * * can be kept out of the rivers and streams, or "rendered harmless before reaching them, or utilized, or got rid of, without risk to "the public health," I beg respectfully to submit the following remarks:—

(*a.*) The sewage of several towns and places is now being utilized by irrigation without injury to the public health.

(*b.*) The sewage is thereby rendered innocuous, and considerable pecuniary benefit results therefrom.

The sewage of all towns in the *Irwell* Valley, and also of Preston, Blackburn, and Darwen, in the *Ribble* Valley, can be utilized by irrigation.

THE IRWELL VALLEY.

The watershed of the Irwell above Patricroft comprises an area of 190,000 acres., and contains a population of a little over 1,000,000. The sewage from this population amounts to about 26,000,000 of gallons per day, and this I propose to divert from the *Irwell* and its tributaries by a system of intercepting sewers terminating near the river, one mile below Patricroft. From this point I propose to pump it by engine power on to the highest part of Chat Moss, from whence it would flow by gravitation over Chat Moss and other agricultural lands in the vicinity thereof. The height to which the sewage would be lifted is 50 feet, and the area on which it would be utilized 7,500 acres, a considerable portion of which is now lying waste. My plan contemplates the utilization of all the sewage from the *Irwell* Basin upon the area indicated and shown upon the map (*on the opposite page*); and, as the population increases, the irrigation conduits could be extended westward to Glazebrook Moss, Risley Moss, and Rixton, and by gravitation alone, 4,000 acres additional could thus be irrigated if, and when, found necessary.

An important question here arises as to the suitability of peat lands for receiving and profitably utilizing sewage. There can be no doubt that in the wet and swampy condition in which some portions now lie it would be folly to add more liquid, but if thoroughly drained, as most of the reclaimed land in the neighbourhood already is, it is certain that the land would be rendered capable of absorbing as much as the Edinburgh Meadows, and, if well marled, with equally profitable results.

In respect to the area necessary for efficiently utilizing sewage, much depends upon the nature of the soil, and the dryness or wetness of the season; on the Craigentinny and Lochend Meadows, more than 8,500 tons per acre per annum are profitably applied, without saturating the soil to such an extent as to create a nuisance. The experiments of the Royal Commission on the sewage of towns in 1861, 1862, and 1863, and the experience of other towns nevertheless demonstrate, that the application of such enormous quantities is not the most profitable mode of applying sewage; and although half the area recommended in this case would probably be ample to absorb and clarify the sewage, a much larger area is desirable on financial grounds.

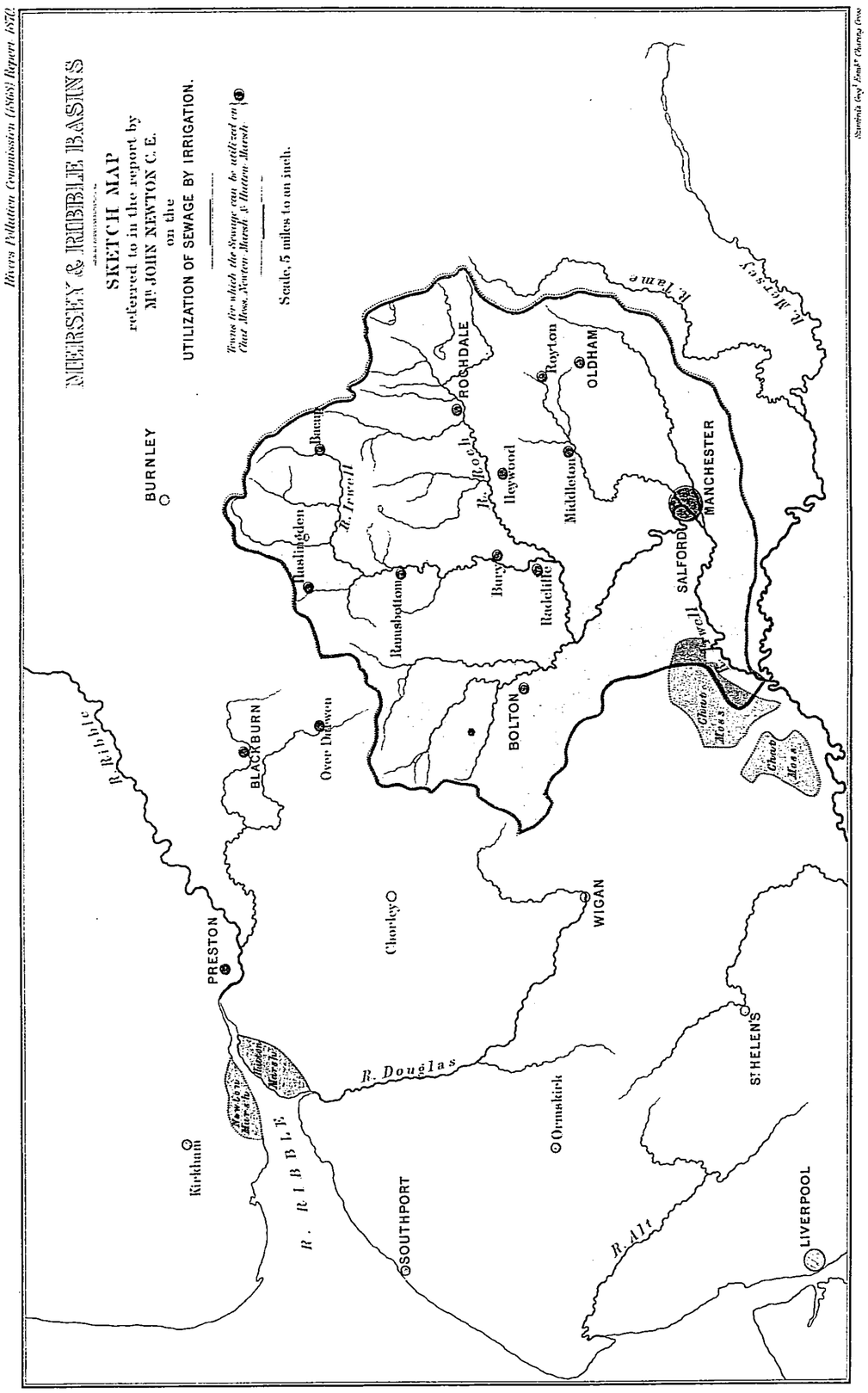
As before stated, I propose in the first instance, to distribute the entire ordinary daily discharge of sewage on to 7,500 acres of land. Calculating the daily flow at 26,000,000 gallons, each acre would thus receive 5,650 tons per annum. Subsequent experience might prove that the land selected is insufficient to ensure the maximum money value of the sewage, in which case the area might be increased without difficulty to 11,000 or 12,000 acres.

As to the value of sewage. The elaborate experiments conducted by Mr. J. B. Lawes, at Rugby, for the Royal Commission on the sewage of towns, show the following results:—

	£	s.	d.	
With applications of 3,000 tons per acre,	$\frac{1}{4}$*d.* per ton or	10	17	8 per acre.
„ „ 6,000 „ „	$\frac{3}{8}$*d.* „ „	15	15	0 „
„ „ 9,000 „ „	$\frac{1}{2}$*d.* (nearly) or	16	8	1 „

The amounts per acre here given represent the difference between sewaged and unsewaged land.

The results at Edinburgh are still more favourable, the Lochend and Craigentinny Meadows indicating $\frac{3}{4}$*d.* per ton as the value with applications of 8,000 to 9,000 tons per acre.



REPORT BY Mr. JOHN NEWTON, C.E., Manchester, November 1868—*continued.*

The ascertained value at Croydon is also about $\frac{3}{4}d.$ per ton with applications of 6,250 tons per acre, the sewage in this case being largely diluted with spring water.

Assuming, therefore, that the sewage of the *Irwell* Valley would be only worth $\frac{1}{2}d.$ per ton on Chat Moss, the entire volume of sewage would be worth 87,000*l.* per annum.

Many examples might be adduced to show the highly satisfactory results of irrigation, more especially with sewage, but it is questionable whether the maximum benefits are realized in any case considerable as these benefits have invariably been.

The cost of the proposed intercepting sewers and other works will be large, but not so when considered in relation to the extent of district and volume of sewage to be dealt with.

The total expense of the proposed works, comprising conduits from every town and village in the Valley, pumping apparatus, and conduits to the land, but exclusive of the necessary intercepting sewers within such towns and villages, and used for collecting the sewage of such places only I estimate at - - - - - - £400,000

Annual Expenses.

	£	£
5 per cent. on cost of works - - - -	20,000	
Repairs and renewal of engines, coal, oil, attendance, distribution, and management. - - -	10,000	
Total annual expenses - - - - -		30,000
Value of sewage at $\frac{1}{2}d.$ per ton - - - -		87,000
Profit per annum - - -		£57,000

It is admitted by all that the *Irwell* must be dis-polluted. Whether we adopt water-closets or not we have foul sewage to be dealt with, and experience proves that this can only be got rid of and profitably turned to account by applying it fresh to the soil.

I have endeavoured to show that this can be accomplished without injury to the public health and with the certainty of a revenue therefrom, which, irrespective of sanitary considerations, would justify the adoption of the plan I propose.

THE RIBBLE VALLEY.

The population of PRESTON amounts to 90,000 and the sewage to 2,000,000 gallons daily. A complete and modern system of sewers conveys the sewage from every house in the borough to Marsh End, where it is now discharged into the *Ribble*. Upon sanitary grounds utilization is perhaps less required here than in most cases, the river being a tidal one and the watershed above the outfall comprising 300,000 acres. Complaints have, however, occasionally been made by persons residing near the river, and for this and other reasons it is undesirable that the sewage should be permanently allowed to flow into the river.

On the map (*facing page* 314) is shown the district which I propose to irrigate with the sewage. The area indicated is situated on the north side of the Ribble, from three to five miles west of Preston, and contains 865 acres of marsh lands well adapted to the purpose. My plan as stated in a report which I presented to the Corporation of Preston in 1866 is "to appropriate the sewage at Marsh End near the junction of the "two mains which drain the entire town, and from this point to force it by means of "a 40 horse-power engine through iron pipes 20 inches in diameter on to the Marsh "lands above mentioned. From Marsh End the main would be laid alongside the "river, along the inner side of the Ashton Marsh embankment, and across Lea Marsh "to Clifton Marsh ; at short intervals along this portion of the line it is proposed to "leave openings fitted with sluice valves for the purpose of supplying sewage to the "district traversed in the event of arrangements being entered into with the land-"owners or occupiers to do so. From the large main which intersects the lands to "be irrigated, smaller mains would diverge and to these hydrants would be attached, "thereby dispensing with the necessity of large open conduits which if constructed "might possibly create a nuisance. The sewage would be distributed from these "hydrants by means of small open carriers or gutters, and it is believed that no "nuisance whatever would result from the operations."

Estimate of Cost.

The cost of the engines, pumps, iron mains, forming and laying out the land (but exclusive of land), drainage, farm buildings, and a short length of river embankment I estimate at - - - - - - £21,000

Annual Expenses.

Interest on cost of works, repairs, renewals, coal, oil, attendance and management - - - - - -	£2,448 per ann.
Value of sewage at $\frac{1}{8}d.$ per ton (see remarks on Rugby experiments, page 32) - - - - - -	£10,208 per ann.
Profit per annum - - - -	£7,760

REPORT by Mr. JOHN NEWTON, C.E., Manchester, November 1868—*continued.*

Taking the available sewage at 2,800,000 tons per annum, each acre would receive 3,200 tons per annum.

The Population of BLACKBURN OVER and LOWER DARWEN, exceeds 80,000.

The Corporation of Blackburn have recently constructed an expensive system of settling tanks with the view of freeing the River *Darwen* from the pollution to which it has hitherto been subjected. As might have been anticipated these works have failed in the accomplishment of their object, and there appears no alternative but to dispose of the sewage by irrigation. In December 1865 I submitted the outline of a plan to the Corporation in the following words: "I propose to take the sewage at its "present outlet and conduct it by means of a brick and stone conduit to the south "side of the *Ribble* estuary, and there to utilize it on lands which are in every respect "admirably adapted for the purpose. The length of the conduit would be 16 miles, "its fall 17½ feet per mile, and its cost 23,000*l.* Provision would be made for "supplying landowners with sewage for irrigating their lands along the line of "conduit, and from this source alone a considerable revenue may fairly be expected."

It is possible that along the proposed line of conduit the whole of the sewage might be thus absorbed, but if otherwise as much as 800 acres of the Longton and other marshes might be obtained for the purpose. At present some parts of these marshes are flooded at spring tides, and would have to be embanked. The cost of such embankments varies from 15*l.* to 20*l.* per acre of land reclaimed.

The sewage from Over and Lower Darwen might advantageously be conveyed by the Blackburn conduit to the *Ribble* Estuary also. The expense in this case would be increased from 23,000*l.* to 30,000*l.*

The annual value of the sewage of Blackburn and Darwen I estimate at 9,000*l.*, assuming the sewage, as at Preston, to be worth ⅛*d.* per ton.

The annual expense in this case, including interest upon capital expended, would not exceed 2,200*l.*

Utilisation of Sewage.

REPORT by Mr. E. J. THOMPSON, Estate Agent, Manchester.

The whole of the contents of our water closets and a great portion of the manure of the ashpits being turned into the same drains that take away the surface water is the cause of the great evil of the present system of sewage.

It is quite time a remedy was found for removing this long standing disgrace from our large towns, and also to prevent our smaller ones from falling into the same difficulty. Why continue this great waste of valuable matter and destruction of human life by the deliberate and systematic poisoning of the atmosphere with the injurious vapours arising from our sewers, polluting the rivers and sending into them and the sea every year millions of tons of valuable manure?

There are alone in one town (to which I shall again refer) about 30,000 street grids by which the bad gases accumulated in the sewers are dispersed through the atmosphere and at such a level that we cannot escape them, though nearly all of these grids are trapped of what use would they be in so dry a season as 1868. I do not think that 5 per cent. of them would contain a drop of water. And how much better are they in a rainy season, when we consider that on every flood, by the raising of water in the rivers, many of the outlets of the sewers are much below the water line? The poisonous gases must and cannot do otherwise than escape where there is the least resistance, and that is by the street grids though they be trapped. To this cause, and the stench arising from our open ashpits, more than a smoky atmosphere or many others that have been suggested, may we attribute the present awful and increasing death-rate of our large towns.

The best way in my opinion to put a stop to this dreadful state of things is by adopting what is called the double system, which is the keeping of the rainfall separate from the sewage, &c., the street drains would only then be used for taking to the natural outlets the surface water. This should be called by its proper name drainage, and should be maintained out of the same rate as the highways; a separate rate should be created, called the sewage rate, the users of water closets paying the greater portion. This sewage would be made up from the water closets, slopstones, and washhouses, and house maids closets, the sewer receiving these to have proper and lofty ventilating shafts.

It has been generally supposed that our present sewers would be stopped up if they were not from time to time flushed with the rainfall; the summer of 1868 has proved the fallacy of this idea.

Thirty per cent. of the water used for domestic purposes in towns and forming what I wish to call sewage, is an artificial supply, and if the rainfall is kept from mixing with it there should not be any difficulty in artificially disposing of it. I am satisfied that the mixing of the surface water has been the cause of the many failures and want of success in endeavouring to deodorize and utilize our sewage.

In keeping out the flood water and rainfall there would be some fair prospect of making what is now a great lost and waste into a partly self-paying undertaking; the supply of sewage would be regular and could be more easily dealt with, and the sewage could then be in a rainy season controlled and under command.

No doubt the day is fast approaching when the populations of large towns and also small ones will be prevented by legislation from disposing of their filth by poisoning the rivers between them and the sea.

I do not think the law will point out a remedy, but it will say, you shall not get rid of that which is a nuisance to yourselves at the expense and the injury of your neighbours. Whenever I have named the double system of sewering the usual remark made has been, "What a dreadful expense, the ratepayers would not stand it."

REPORT by Mr. E. J. THOMPSON, Estate Agent, Manchester—*cont.*

I beg to differ from them as to the expense and on the contrary believe that it will prove to be the cheapest and the most simple method of getting over the difficulty. I am glad to say the Sale Local Board have at length agreed to adopt it.

In addition to the keeping out the rainfall from the sewage, compel all open ashpits to be covered in, and discourage by every possible means the use, and more particularly the increase, of *waterclosets*; which instead of being, what some people think, a sanitary improvement are one of the greatest sanitary blunders of the present age, a double waste of water and manure. By these means we shall bring our sewage into something like a manageable compass and a vast amount of money will be saved in the disposing of it. Filtering tanks of moderate size could then be used for the sewage to pass through, and their contents would not be what they now are under the present system, only receptacles for sand and mud from the highways; but would contain a valuable and useful manure. The liquid after passing through these could then be used by being carried in pipes for irrigation, and after being filtered through the soil would be in a fit state for entering the rivers. As to our present system of open ashpits in connection with the privies, in Manchester last year 124,735 tons of night soil were emptied and disposed of, making the actual cost of emptying and carting, &c., 16,046*l.*; the sum received for the manure sold being only 3,839*l.* And this from a population of 350,000 people, or a little over 2½ per head, the loss to the ratepayers being 12,207*l.* in one year.

I wish to call particular attention to the following facts (which will account to a large extent for the above pecuniary loss) though the contents of the ashpits was 124,735 tons only, 69,468 were sold for manure, and the rest, 55,257 tons, were what is called rubbish. This consists of old cans, broken pots, bottles, &c., which have all to be picked out at a great cost of labour from the night soil; and the fact of all this being saturated and covered with excrement becomes a nuisance wherever it is deposited, and there is a difficulty and heavy expense in getting rid of it.

The question may be asked why the 69,468 tons sold as manure only produces the sum of 3,839*l.* or a little over 1*s.* 1*d.* per ton? This will not be wondered at when I state that from an experiment I made, there was in this 69,468 tons of so called manure the following:—coal and cinders (that would not pass through a grid with openings ⅜ of an inch wide), 7815 tons; rain water, 19,249½ tons; fine ashes, 21,709 tons; and only 20,694½ of manure real formed of excreta and urine. From these figures it will be seen that there is emptied rubbish 55,257 tons, coal and cinders 7815 tons, rain water 19,248½ making a total of 82,321½ tons of matter which should never find their way into our ashpits, and which it is so easy to prevent by a means I will hereafter explain.

It is a startling fact that from a population of 350,000 which produces annually 1,297,633 tons of excreta and urine, only 20,694 are collected and sold as manure, and that not less than 1,276,939 tons of valuable matter are turned into the sewers of our streets and thoroughfares, there to ferment and poison the atmosphere on its way to the river *Irwell* and thence to the sea.

One cause of this great waste of health, money, and valuable manure is an evil which we may easily at once rectify. The connection of the ashpits with the sewers for the purpose of taking away the rainfall that finds its way there is a great mistake. The water is not the only matter which escapes through the grid placed for that purpose near the bottom of these open cesspools, more than 40 per cent. of the manure also drains away.

The first step to take is to *prevent* the rainfall from entering the ashpits by covering them over; secondly, placing an iron grid so as to prevent anything but fine ashes from being put to mix with the excrements and urine. If these two simple things were properly carried out instead of our ashpits being what they now are, a great nuisance, loss, and cause of much disease, we should have a good and valuable manure and prevent those abominable stinks which now arise from them.

Eighty per cent. of our present privies and ashpits are built in pairs adjoining the scullery or back kitchen of the dwellings, with a lean-to roof sloping to the *open* ashpit. First, form a new roof over all, so that the rain shall drop into the yard; then, at about two feet six inches above the level of the yard, fix an iron grid over the ashpit with openings about ⅜ of an inch. This must not be flat but slanting; this is to prevent anything from being put into the ashpit that will not pass through the grid, such as broken pots, bottles, &c. There must be in each yard a receptacle similar to the ashpit but without a grid, the door for emptying to be in the entry or passage to receive any dry rubbish too large to pass through the privy grid; and when full the contents of the receptacle would be removed by persons appointed for the purpose. This would save the trouble and expense of picking them out of the night soil when it is emptied, and these would not then be the nuisance they now are, nor cost one half in disposing of them.

The Duke of Bridgwater's and Mersey and Irwell Navigation.

REPORT on behalf of the DUKE of BRIDGWATER'S TRUSTEES, and of the Company of Proprietors of the MERSEY and IRWELL NAVIGATION to such of the QUERIES as bear on their respective navigations. By THOMAS PART, Esq., Solicitor to the Trustees. April, 1869.

The first Act authorizing the construction of the Mersey and Irwell Navigation is the 3rd Geo. 1. cap. 15. The first Act authorizing the construction of the Bridgwater Canal is 10 Geo. 2. cap. 9 (1736). Owing to the want of roads, fuel, and all materials used in manufactures, were carried on pack-horses, the cost of carriage of merchandise between Manchester and Liverpool being, even when roads were made, 40*s.* per ton, and of fuel from the neighbourhood 6*s.* 8*d.* per ton. With the impetus given to trade so late as (about 100 years since) 1757, the united population of Manchester and Salford was only 20,000, and at that time there was not one private carriage kept by

Report on behalf of the Duke of Bridgwater's Trustees, and of the Company of Proprietors of the Mersey and Irwell Navigation to such of the Queries as bear on their respective navigations. By Thomas Part, Esq., Solicitor to the Trustees. April, 1869—*cont.*

any person in business; the population of those places is now near 700,000,—an increase in population and corresponding wealth arising from the increase of trade in no inconsiderable degree, obviously due to the construction and existence of the *Mersey* and *Irwell* Navigation and Bridgwater Canal, which until the opening of the Liverpool and Manchester Railway in 1829, were the only channels by which merchandize was forwarded between Manchester and Liverpool. The present total traffic on these two navigations exceeds 2,300,000 tons annually.

In 1862 there were thrown into the Mersey and Irwell and their tributaries, from works having an engine power equal to 22,726 horse power, cinders to the amount of 68,998 tons, besides deposits from foundations of works, chemical works, stone quarries, coal works, &c. These deposits, or the greater part of them, were in time of flood carried down into the navigation, as shown by the deposits, which were proved to consist in some places of two-thirds of ashes and one-third of sand or other earthy and sewage matter, and by means of those materials the bed of the navigation has (notwithstanding dredging to the extent of 60,000 tons a year) been silted up and raised to the extent of 1 foot 10 inches between 1849 and 1867, and the navigable capacity of the river diminished to that extent. But this has not been the extent of the mischief, for after a flood it not unfrequently happens that banks are formed in the river which entirely obstruct the navigation for several days together, until a navigable waterway has been made through such banks either by dredging or some other means. The effect of all this upon the trade of the river has been permanently to reduce the navigable capacity of the river, to diminish the loads each boat could carry, and seriously prejudice the general trade of the navigation.

The necessary effect of the bed of the river being so raised is not only to render the land on each side of the river more liable to flood, but also, in some instances, to obstruct and impede the outflow of the sewers, as shown in sections furnished by Mr. R. W. Barnes.

The Bridgwater Trustees have recently had a costly illustration of the effect on the condition of their canal in and near Manchester produced by the pollution of the feeders. The River *Medlock* has since the construction of the Bridgwater Canal been one of the main sources of supply of water to that canal. At the time the right to that supply was acquired, the stream was no doubt pure and free from pollution, for at that time the population of Manchester was small, and the trade very limited. By degrees, as the trade of Manchester and the surrounding districts increased, the *Medlock* became more and more polluted, until at last it became little better than an open sewer, and rendered the water in the canal so offensive that the Duke of Bridgwater's Trustees were indicted, and were advised that although they had a parliamentary right to the waters of the *Medlock* in their original pure state, and although they did not contribute in any way to their pollution, and had no means of preventing such pollution, yet that on the authority of a decided case (the Queen *v.* Bradford Canal Company) they were liable for the state of their canal, and bound to abate the nuisance complained of. They had therefore no alternative but to obtain another supply of water in lieu of that of the *Medlock*. This they have actually done, and in doing so have incurred an outlay of 10,000*l.*, in order to abate a nuisance created by others over which they had no control, and to which they had in no way contributed.

It is submitted that as regards the deposits of solid matter and all substances (other than sewage) not in a state of solution, such deposits can be effectually prevented with general advantage to the public, and without unduly interfering with the trade or commerce of the district, and that therefore there can exist no objection to a remedy, to that extent at least, being applied.

The injurious effect upon the *Irwell* and navigation, arising from the discharge of sewage matter into the *Irwell* and its tributaries, is shown by the reports of the borings made by Mr. Barnes in 1862, and by the evidence and reports of the scientific witnesses who were called in support of the Mersey Protection Act of 1862. Differences of opinion may exist as to whether the sewage can and ought to be entirely withdrawn from the rivers and applied for irrigation, or disposed of in some other way, but of this there can be no doubt, that if the evil cannot be entirely removed, it may, at all events, be to a very great extent diminished.

As regards the application of sewage to the purposes of irrigation, there can be no doubt that it has in many places been so applied with advantage and profit, and although this may not have been done on a scale equal to the magnitude of works such as would be required for Salford and Manchester, yet experience has shown that sanitary works can, as a rule, be executed at a less cost per head, where the population is large, than can be done where the population is small; and there does not appear to be any good reason why a similar result should not prevail in the construction of irrigation works. The level of the land below Manchester is favourable, the fall between Manchester and Warrington being 60 feet 7 inches in a distance of 18 miles, and the district through which the river between Manchester and Warrington flows is, to a great extent, agricultural, and for a considerable distance from the river favourable for irrigation works.

If irrigation were found to be practicable as regards Salford and Manchester, in like manner it might be available as regards all the other towns which at present discharge their sewage into the *Mersey* and *Irwell* and their tributaries.

It would seem desirable that any remedy for the existing evils should, in order to make it effective, be applied under the direction of some public conservancy authority; that the working of such remedy should be by local or district conservancy boards, so far as may be compatible with the efficient action and the due enforcement of the

Report on behalf of the Duke of Bridgwater's Trustees, and of the Company of Proprietors of the Mersey and Irwell Navigation to such of the Queries as bear on their respective navigations. By Thomas Part, Esq., Solicitor to the Trustees. April, 1869—*cont.*

provisions of the remedial Act, with a view to attain its object, and the proprietors of any river navigation within the limits of any local or district conservancy should appoint a certain proportion of such boards; that the acts of each local or district conservancy board should be subject to revision by, or appeal to, a central conservancy board, who should have power also to decide any disputes or differences between two or more local or district conservancy boards.

That officers should be appointed to enforce the provisions of the remedial Act and prosecute all persons violating such provisions, and should from time to time report to and advise the local conservancy boards, but should, as in the case of factory and mine inspectors, be appointed and removeable by and be subject to the control and direction of the central board. This has been shown to be necessary by the way in which the Smoke Nuisance Act has been dealt with. The power to put that Act in force is at present vested exclusively in the local authorities, and the consequence is that the Act has become in effect a dead letter in most places calling for its enforcement, the principal offenders against that Act being generally among the most opulent and influential members of the local authorities; and there is too much reason to suppose that such would probably be found to be the case with reference to the district or local conservancy boards if they appoint and have the control of the inspectors or other officers appointed to enforce the provisions of any remedial Act that may be passed; hence the necessity for making the officers whose duty it may be to put the Act in force against offenders entirely independent of the district or local conservancy boards and all other local influence, as in the case of mine and factory inspectors.

A conservancy Act would, of course, be so framed as to render a violation of its provisions penal, and punishable by summary conviction. It may not be desirable, and perhaps the Legislature would object, to make the penalties so heavy as to deter wealthy and extensive manufacturers from persevering in violations of the Act after conviction. In prosecutions under the Mersey Protection Act, 1862, there has, in some places, been an evident disinclination to convict, and where convictions have taken place inadequate penalties of 10*s.* have been inflicted, which, as affecting a wealthy proprietor of extensive works, is merely nominal and immaterial, and has failed to prevent a repetition of the offence. It therefore becomes a necessity that if the objects of any remedial Act are to be attained some further remedy should be provided. The most obvious and effective, and the one least open to objection that presents itself, is, that if a party should, after a first or second conviction, by himself or his employés, offend against the provisions of the Act, the tribunal having jurisdiction should (as in the case of the Nuisance Prevention Act as regards smoke) for a third or subsequent offence grant an *injunction* to restrain the offender and his employés from violating the provisions of the Act. This would be an effectual remedy, and yet could only be applied after the offender had shown his determination to be contumacious and to set the remedial Act at defiance. If it should be thought inexpedient to enable the public at large to put in force the provisions of a remedial Act the power should at least extend to all officers appointed by the central conservancy board, to the district conservancy boards, to the conservators or acting conservator of any navigable river, the proprietors of any river navigation, all corporations, improvement commissioners, local boards and other local authorities within the district, and all riparian owners and occupiers.

Irwell Basin.

Letter from Fereday Smith, Esq., transmitting Report of Mr. R. W. Barnes, C.E.

Dear Sir, Bridgwater Offices, Manchester, June 1st, 1869.

Mr. R. W. Barnes has re-surveyed the River Irwell and its most important tributaries, and I send you, as requested, his reports thereon (five papers), together with copy of a letter from him dated the 29th ultimo.

I also enclose five reports by him, dated December 1867, with copy of letter from him to myself of the 11th December 1867. These last named I send under the impression that you handed them to Mr. Robinson, at the Bridgwater Offices, Manchester, several weeks since, as a guide to what you required, and wishing them to be returned to you.

I am, &c.

S. J. Smith, Esq., Secretary, (Signed) Fereday Smith.
Rivers Pollution Commission.
2, Victoria Street, Westminster.

Letter from Mr. R. W. Barnes, C.E., to Fereday Smith, Esq., Bridgwater Offices, Manchester.

Sir, 63, Faulkner Street, Manchester, 29th May 1869.

In accordance with the instructions I received on the 21st instant, I have re-surveyed the River Irwell and its most important tributaries, and have ascertained the quantities of ashes, &c., thrown into the rivers, and beg to refer you to the accompanying reports thereon for the particulars.

The substance of this inspection goes to prove that since my last visit in 1867, where the rivers run through districts which are under the jurisdiction of Local Boards of Health, the streams are considerably deeper. I find the amount of solids thrown into the rivers is now trifling: the roads and streets being repaired by the ashes which otherwise would have been thrown into the rivers, consequently both roads and rivers are greatly improved.

From these causes, and because of the mills not working overtime, and because of certain millowners forbearing to throw their ashes into the rivers, the quantity of ashes so disposed of is not now so great as in 1867.

Letter from Mr. R. W. Barnes, C.E., to Fereday Smith, Esq., Bridgwater Offices, Manchester —*cont.*

I am compelled to add that the greatest quantity of ashes is conveyed into the streams by the most influential millowners and by petitioners against the Mersey and Irwell Protection Bill 1862. This you will find to be particularly the case on the Croal and its tributaries. Also, that in some cases the ashes are discharged into the mill race within the mills, to avoid detection. (*See Irwell, at* 93, *page* 321; *Croal, at* 3, *page* 321; *and Roch, at* 37, *page* 40.)

I beg to draw your attention to Messrs. Wilson's immense chemical deposit (*Irwell, at* 114, *page* 321); to Messrs. J. and T. B. Crompton (*Croal, at* 32, *page* 322), and to Messrs. Eden and Thwaites' contrivance for intercepting their ashes (*Eagley Brook, at* 8, *page* 322).

The bed of the *Whitwell* Brook is rising at the rate of a trifle more than one inch per annum.

The bed of the *Irk* at the junction of Whitbrook has risen four inches since 1862.

The bed of *Whitbrook* has risen four inches since 1862.

The bed of the *Medlock* has risen at Hilton's Mill, Beswick, two inches per annum between 1858 and 1862, and between 1862 and 1869 it has risen ten inches.

The bed of the *Irk* has risen two inches per annum for the last 44 years.

The bed of the *Irk* near Union Bridge in Manchester has risen annually $1\frac{3}{4}$ inches, which rise nearly corresponds with the rise of every extraordinary flood.

The bed of the *Irwell*, between Albert Bridge and Throstlenest, has risen on an average $7\frac{3}{10}$ inches since 1862, being at the rate of $1\frac{1}{2}$ inches per annum.

I have made an approximate estimate of the quantity of ashes thrown into the several streams annually, and find the amount to be about 44,580 tons.

I have, &c.
(Signed) R. W. Barnes.

Report by Mr. R. W. Barnes, C.E., Manchester, on behalf of the Duke of Bridgwater's Trustees and of the Company of Proprietors of the Mersey and Irwell Navigation. 29 May 1869.

Irwell Basin.

River *Irwell*, 31 miles long, takes its rise at Deerplay, on the Burnley Road, three miles north of Bacup, at an elevation of 1,325 feet above the sea. Commencing at the Erewell Spring as a small rivulet, it first takes a southerly course in the direction of Bacup, and after passing by various manufactories, gradually widens till it reaches the town of Bacup, where it flows rapidly through, receiving and taking away a quantity of rubbish of various kinds that is thrown into it. At a short distance, after leaving Bacup, it takes a western course, and passes through Stackstead and Waterfoot, close to and adjoining Newchurch. At this place the *Whitewell* Brook falls into it, and then, flowing rapidly onwards to Rawtenstall it receives the brook called *Limey* Water, when after leaving the neighbourhood of Rawtenstall, the river widens and flows steadily southward through the outskirts of Ramsbottom, and still keeping the same course through the outskirts of Bury and Radcliffe, a short distance from the latter place it receives the waters of the River *Roch*, after which it takes a southerly course, passing through Radcliffe Bridge, and the outskirts of Farnworth. At Prestolee Mill the waters are augmented by the River *Croal*, from the neighbourhood of Bolton, falling into it; after receiving the latter river it becomes wider and more important. After this junction the *Irwell* runs easterly through Ringley, and so on without much deviation to Broughton; it then takes a winding course previous to passing through Salford and Manchester, where, at the last-named place, it receives the River *Irk*, near to the Victoria Bridge; it then flows gently through the city, keeping a south-easterly course through Cornbrook, where it receives the River *Medlock*. The *Irwell* now, having received most of its tributaries and rivers, and having its waters thus augmented, flows gently onwards in a south-westerly direction, passing through the villages of Eccles and Barton, and finally flows into the *Mersey* at Carrington, in the neighbourhood of Chat Moss.

(9*a*.) At Bacup, through an opening in the wall which separates the road from the River *Irwell*, the surveyors of the turnpike road and adjoining occupiers continue throwing road scrapings and soil into the river.

(21.) The Bacup Local Board of Health prohibits ashes and refuse being thrown into the river, and in consequence the bed in some places is deepened from 6 to 8 inches, and the streets hereabouts, which were always flooded by a moderate rainfall, were, during the great flood, 16th and 17th November 1866, dry.

(37.) Immediately beyond the limits of the Local Board, Acre Woollen Mill (James Ashworth), the ashes and clinkers from the mill are thrown through a doorway, constructed for the purpose, into the river. A heap recently deposited was at the time of the inspection lying in the bed below the doorway.

(41.) Cotton Mill (Mr. Munn, late Joshua Taylor, Brothers).—The ashes and cinders from these works are thrown into the river. A heap of cinders is now lying in the mill yard contiguous to the river side, which will be carried into the river at time of flood.

(45.) A great many houses in the immediate neighbourhood of the Stackstead Railway Station deposit cinders and ashes in the river; also at Thrutchbar the cottagers continue to throw ashes into the river.

(56.) Opposite the Co-operative Mill, Messrs. Marsland and Pickup throw the ashes and cinders from their works into the river.

(57.) Holt Holme Cotton Mill (Jeremiah Lord).—The ashes from this mill are thrown into the river.

(60.) Irwell Mills (Richard Ashworth).—At these mills there is a curved incline between two sunk walls, extending from the boilers to the river side, and a plank is laid

Report by Mr. R. W. Barnes, C.E., Manchester, on behalf of the Duke of Bridgwater's Trustees, and of the Company of Proprietors of the Mersey and Irwell Navigation. 29 May 1869—*cont.*

to facilitate the fall of the ashes into the river. At the bottom of the river, immediately below the opening, and level with the top of the weir, is a large deposit of cinders.

(64.) Cotton Mill.—Peter Whitehead and Sons have constructed a tunnel from the boilers to the river. At the foot of the tunnel heaps of ashes are lying as in 1862.

(91.) Cotton Mill (John Walker).—The cinders from this mill are not now wheeled across the road, a substantial river wall having been erected between the river and this mill. The shoal below the bridge is the same as in 1867.

(93.) Paper Works (James Roger Compton).—The ashes from this mill are thrown into the mill race, and a very large quantity of fresh cinders lie on each side the race immediately it issues from the mill, and extends several yards beyond it.

(97.) Weir below Bealey's Chemical Works.—The shoal below this weir is in the same state as in 1867.

(98.) Chemical Works (Bealey's).—The chemical refuse from these works is not so extensive as formerly, but nothing has been done to prevent the chemical refuse being washed away.

(106.) Radcliffe Bridge Dye Works (James Milburn).—The ashes from these works are thrown through one of the old windows into the river; also the public deposit at Radcliffe Bridge is still used.

Opposite Richard Pendlebury's Mill a large shoal of shale cinders and stones forms a natural barrier to the progress of the stream, to the great injury and inconvenience of the millowners immediately below. On the opposite side of the river the ashes from James Heywood's works (105) are thrown from the boilers into the river through an opening in the wall.

(108.) Mount Zion Bleach Works (Whitaker and Muggleston).—The practice of throwing ashes into the river is continued as in 1862.

Dye Works (Horridge and Co.)—The ashes from these works are thrown into the river.

(111.) Lady Shore Colliery (John Fletcher).—The tramway within the tunnel, from the pit to the river's edge, is taken up and the deposit of ashes is discontinued; but there are still large quantities of shale and pit refuse thrown into the river.

(112.) Cream's Mill (William Broadbent).—A considerable portion of the ashes from the boilers are thrown into the river, and also at the present time deposited by the river side, lower down, contiguous to the river.

(114.) Chemical Works (Edward Wilson and Co.).—The deposit from these works is more extensive than it was in 1867. It now reaches into the river one-third of its breadth. In consequence of this obstruction the opposite bank, which is now 30 feet high, has been washed away. Both above and below the deposit timber trees are growing on the slope of the opposite bank, showing the length of time it existed before this obstruction in the river caused the bank to be washed away.

(116.) Kersley Paper Mill (Robert Fletcher and Sons).—A very large quantity of cinders and ashes are thrown into the river from these works. The immense heap of ashes and paper refuse lying contiguous to the works is from 10 to 15 feet high, and extends from 80 to 100 yards along the river bank, and projects into the river 20 feet (one-third of its breadth). The last two deposits, and that at the paper works of Messrs. J. and T. B. Crompton on the *Croal*, are the largest I have seen during this inspection.

Greaves Brook.—(Tributary to the Irwell.)

Owing to the vigilance of the Bacup Local Board the large deposits of earth and rubbish near Vale Street have ceased, and the condition of this brook, which in 1862 was very bad, has much improved, and the bed deepened since my last visit in 1867.

Whitwell Brook.—(Tributary to the Irwell.)

Takes its rise in the forest of Rosendale, after passing through Wolfenden. This brook flows in a southerly direction to Newchurch, half a mile beyond which it enters the *Irwell* at Waterfoot.

(17.) Whitwell Bottom Cotton Mill (Robert Hoyle and George Sandham).—The ashes and clinkers from this mill are deposited in the brook, as they were in 1862 and 1867.

(19.) Hollin's Bridge Woollen Mill (Taylor and Sons).—The ashes, refuse, and road scrapings are still deposited in the stream, as in 1862 and 1867.

(20*a*.) Tunnel beneath Mr. Munn's Works.—This culvert through which the brook flows now measures 4 feet 1 inch from the soffet of the arch to the bed of the brook; in 1862 it measured 4 feet 8 inches; and in 1867 it measured 4 feet. When first built it was 6 feet in the clear.

(23.) Walker's Cotton Mill.—On each side of the bridge ashes, excavation of house foundations, rubbish, and road scrapings are cast into the brook, as in 1862 and 1867. This deposit has narrowed the brook, which originally was 20 feet wide, to 4 feet.

(23*a*.) Cotton Mill (John and Thomas Barcrofts).—Contiguous to the bridge is a heap of ashes ready to be thrown into the brook when opportunity affords of their being washed away.

(24.) Weir near Baltic House.—Shoal of ashes, clinkers, and quarry refuse washed from above now extends further up the brook than it did in 1867.

River Croal (Tributary to the Irwell).

This river, six miles in length, takes its rise on the Red Moss, a short distance from Horwich, where it is called *Middle* Brook, and flows slowly eastward alongside the

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Bolton and Preston Railway to the town of Bolton; it becomes the public sewer; and, taking a southerly course at a short distance from the above town, receives the River *Tonge*, after which it becomes wider and more rapid, and, taking a winding course south-easterly, it finally flows into the *Irwell*, in the vicinity of Prestolee Mill, near Halshaw Moor.

(28.) Chemical Works (Smith's, formerly Hesketh and Co.).—The ashes and chemical refuse from these works are thrown into the river. There is now an extensive bank of such refuse, very offensive to the smell, lying in the river below the works, and extends into river one-third of its width.

(32.) Farnworth Paper Works (J. and T. B. Crompton).—There is contiguous to the colliery a large deposit of ashes from the coal-pit furnaces, similar to that of 1867; lower down the river, and adjoining the paper works, the ashes and refuse are still deposited; on the opposite side of the river there is a heap of ashes and cinders, extending 30 feet into the river, of 20 yards in length, and from 10 to 12 feet high.

RIVER TONGE (Tributary to the CROAL).

This river is two miles and three quarters in length, commences at the junction of the *Eagley* Brook and *Astley* Brook, these two combining at Meeting of the Waters Bleach Works, form the river, which, after flowing through a portion of the outskirts of Bolton, receives *Bradshaw* Brook, and finally flows into the Croal in the vicinity of the Raikes Bleach Works.

(3.) Little Bolton Bleach Works (Henry Slater).—The notorious deposit of ashes in the centre of the river has been discontinued, and the opening in the wall to the river bank built up. But a contrivance has been substituted, consisting of a trap door opposite the mill yard gate level with the public road, down which the ashes are thrown, and thence roll down into the river.

(7.) Turner Bridge Mill (William Warburton).—Near this mill is a large quantity of cinders lying in the river. This bank has greatly increased since 1867.

EAGLEY BROOK (Tributary to the CROAL).

This brook takes its rise at Longworth, on the range of hills north-west of Bolton, where it forms the principal feeder to the reservoir of the Bolton Waterworks at Belmont. Flowing in a south-easterly direction, it becomes an important stream for bleaching and manufacturing purposes; at the Egerton Mills it flows very rapidly, and is capable of carrying down a great weight of material that may obstruct its passage during heavy floods. Passing the Oakes and Hallith Woods, it runs due south, and shortly after falls into the River *Tonge* at Meeting of the Waters Bleachworks (average width 45 feet).

(4.) Eagley Bleach Works (Chadwicks and Phillips) continue to deposit the refuse from the dye works in the brook; a large quantity is lying on the left side of the brook below the bridge ready to be washed away by the flood.

(8.) In consequence of the Sharples Local Board of Health prohibiting rubbish, &c., being thrown into the brook, Messrs. Eden and Thwaites have constructed a trap or receptacle to catch the cinders and ashes from the boiler. This trap is frequently emptied, and the ashes wheeled away to the adjoining yard; nevertheless, a quantity of cinders is lying in the river at the junction of the *Eagley* Brook and River *Tonge*, thrown in from the works above named.

BRADSHAW BROOK (Tributary to the TONGE).

This brook is seven and three-quarter miles in length; commences at the Turton and Entwistle reservoir, then, after flowing for the distance of one mile, receives the *Know Mill* Brook, and flowing through Turton's Bottoms gradually widens to Bradshaw, where it assumes the form of river rather than brook. After flowing past and receiving the refuse and cinders from numerous works, the bed becomes very much impregnated with cinders; finally joins the River *Tonge* at the outskirts of Bolton.

This brook, like the *Eagley* Brook, is also very rapid, and in time of floods and heavy rain brings down a very large quantity of cinders and rubbish that is thrown in at the places mentioned hereafter.

(8.) Bradshaw Hall Print Works (James Hardcastle and Son).—The ashes from these works are deposited on the banks of the brook as in 1862 and 1867.

(11.) Below the weir is a large deposit or shoal in the brook 80 yards long, composed of stones, ashes, sand, &c. This shoal has so increased in height that it forms an artificial bank, confining the stream to less than half its width in ordinary summer flow.

(20.) Firwood Bleach Works (James Hardcastle and Son).—The ashes and refuse from these works are deposited on the bank of the brook at the works.

(23 to 24.) Messrs. Hardcastle and Son continue to cart the ashes, dye, and other solid refuse from the Firwood Bleach Works to the side of the brook near Thicketford Bridge, and this solid refuse rolls down the slope into the brook and is swept down the stream by a flood.

RIVER ROCH (tributary of the IRWELL).

This river, seventeen miles long, takes its rise in the neighbourhood of Light Hazzles Clough, four miles north of Littleborough; commencing there as a small stream, it gradually increases in width to Littleborough, a short distance from which it receives the River *Beale;* passing through Rochdale, it is joined by the River *Spodden*, and then, taking a serpentine course westward, passes close to Heywood and Bury, then takes a southerly course, and finall falls into the *Irwell*, two miles south of Bury.

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In its course this river collects many other tributary streams, which augment its waters considerably. The width between Rochdale and its junction with the *Irwell* averages 170 feet.

(24.) Hooley Bridge, Heywood.—Ashes from cottages and other refuse are thrown into the river, as in 1862 and 1867.

(29.) Bridge Hall Paper Mill (Thomas Wrigley and Sons).—The ashes and refuse from these works are thrown into the river.

(37.) Hampson Mill and Mount Zion Bleach Works (Edward Buckley and Co.)—At the end of the cottages situated near the foot bridge is a large and extensive deposit of cinders, earth, excavations, and rubbish on vacant land; I witnessed the deposit of ashes from one of the adjoining cottages.

(38.) At the Bleach Works, the extensive shoal of cinders, ashes, and rubbish existing in 1867 is increased; it now extends above the weir a distance of 50 yards, is 20 yards wide, and forms a barrier to the flow of the water in the river. I saw cinders and ashes discharged through the tunnel or mill race, and carried by the stream into the river.

RIVER SPODDEN (a tributary of the ROCH).

The River *Spodden*, six miles in length, takes its rise in the neighbourhood of Winterbut and Knott Hill; after receiving a few tributaries, finally joins the *Roch* near Rochdale. This stream above Rochdale is free from deposit.

(8.) Cotton mill (Hargreaves).—The ashes thrown in from this mill have formed a deposit occupying half the water-way.

(9.) Cotton mill (Rawstron).—The ashes from this mill are deposited in the river at the foot of the weir, and also near the culvert that issues from the mill.

(13.) Broadley Woollen and Cotton Mill (John and Robert Tweedale).—The ashes from this mill are thrown into the river as in 1867.

(15.) Fulling Mill (J. Tweedale and Sons).—The ashes and rubbish from this mill are thrown into the river.

(18.) Woollen Mill (Leach).—The ashes from this mill are thrown into the river.

(22.) The tenants of 18 cottages throw their ashes and refuse into the river, as in 1862.

RIVER IRK (tributary of the IRWELL).

This tributary to the River *Irwell* is nine miles in length. Taking its rise at Royton, two miles north of Oldham, it flows rather rapidly in a south-westerly direction, and moderately free from obstructions, to the town of Middleton; here it is joined by the *Wince* Brook, which takes its rise at Oldham. The *Irk*, passing through the town of Middleton, now becomes a common sewer, and the receptacle for the ashes from works and cottages in its immediate neighbourhood; flowing in a south-westerly direction it skirts Heaton Park, flows past the village of Blackley, where it receives a tributary from Boggart's Clough, and runs past the Queen's Park at Harpurhey to the city of Manchester, enters it at Cheetham, and finally joins the *Irwell* at the Victoria Station, Manchester.

(9.) Joseph Travis's cotton mill.—The ashes from the boilers are deposited in the bed of the river from the same aperture in the wall as in 1862. At present there is a quantity of ashes in the river below the aperture.

(12.) Shiloh cotton mill.—There is a quantity of fresh ashes on the bank near the mill, which will doubtless be carried away by the next flood.

(14.) Hamilton's bleach works.—The ashes, cinders, and clinkers thrown into the stream to be afterwards washed away by the current, they are also deposited on the bank of the river.

(16.) Street Bridge.—On each side of the river the inhabitants of 20 houses throw all the ashes into the river; the road scrapings are also deposited there.

(18.) Lee Pit colliery.—Shale is deposited on each bank, and a barrow road has been made to deposit the engine ashes on the opposite bank of the river.

Within the district of the Middleton Improvement Board deposit to a small amount has been made.

WHITBROOK (tributary of the IRK).

(33*a*.) The bed of the *Irk* at the junction of *Whitbrook* has risen four inches since the section was taken in 1862, and along the bank of the brook, ashes from 20 houses are deposited; also road scrapings. This place is a regular, as well as the only depository for the cinders and ashes of the neighbourhood, which are carried away in time of flood.

(33.) The top of the drain at Leefold Bridge, is now more than seven inches below the bottom of the brook. The bottom of the brook has risen four inches since 1862 at this place.

RIVER MEDLOCK (tributary to the IRWELL).

This river takes its rise two miles to the north-east of the town of Oldham, and flowing through Strinesdale constitutes the boundary between Lancashire and Yorkshire.

It supplies the Oldham waterworks reservoir in Strinesdale, and pursuing a south-easterly direction it passes through the village of Lees Brook, from which it takes the sewage, enters Nether Lees Clough; and then taking a south-westerly course, and

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passing through Clayton Vale, the townships of Bradford and Beswick, it intersects the city of Manchester, and flows into the *Irwell* near St. George's Church, Hulme.

(No. 24.) The Bangor Mill, John Ogden's Mill.—The ashes from these mills are wheeled into the bed of the river at the foot of the weir.

(No. 28.) Lees Brook bridge.—The tenants of above 20 houses deposit their ashes and refuse in the bed of the river for a flood to wash away.

(No. 30a.) Lees Brook gasworks.—The shoot for ashes beside the works is used by the surrounding cottage property as a means of getting rid of their ashes.

Hopkin Mills.—Mr. Thomas Taylor says the annual deposit which accumulates in his reservoir caused by cinders, clinkers, and ashes, thown into the river is the same as hitherto (viz.), from four to five feet deep.

(Nos. 48 and 49.) Fairbottom Bobs.—The shoal of cinders, coal-pit refuse, and sand, below the weir is much enlarged, being 1 foot 10 inches higher than in 1862, and more than one-half the weir which in 1862 was clear is now silted up level with the top.

Cornbrook (tributary of the Irwell).

This brook takes its rise at Gorton, on the east side of Manchester, in an agricultural district. Flowing in a westerly direction it passes by several manufactories, which make use of it as a vehicle for carrying away from the works solid refuse matter. The brook is not a rapid stream. On its entering the suburbs of Manchester it becomes the common sewer of Ardwick, Chorlton-upon-Medlock, and Hulme, and ultimately its water flows into the Bridgewater Canal, and the cinders, ashes, and rubbish into the River *Irwell* at Cornbrook.

Basin of the River Douglas from its source to the point where the Sewage of Wigan enters the River.

Report by Mr. J. Law Hunter, C.E., Borough Engineer of Wigan, June 9th, 1869.

(1.) Horwich Vale Bleach Works (Mr. Ryland and Messrs. Jolley and Jackson).—These works are situated on the River *Douglas* and receive the compensation water from the Liverpool Corporation reservoirs to the extent of several millions of gallons daily. Some or all the water is stored in reservoirs for use at the works. These works pollute the stream by the refuse turned into it. Above these works the stream is quite pure.

(2.) The village of Horwich had a population in 1861 of 3,471. It is situated on a tributary of the River *Douglas* called "*Pearl Brook.*" This brook receives the sewage of the village as well as the liquid refuse of numerous works; solid refuse is also thrown into it. When I inspected the stream last month I found it much polluted and in a most offensive condition.

The principal works upon this brook are occupied by Messrs. Ridgway & Co. and Messrs. Eckersley, bleachers.

(3.) Huyton Bleach Works (Messrs. Davis and Eckersley).—These works are situated on the *Douglas;* the water of the river is used for power and not as far as I know for other purposes, though such may be the case, at all events the water is much polluted when it reaches these works.

Some springs and small streams of water are collected in the vicinity of the works, and the water stored in a reservoir and is used for bleaching purposes.

The river is polluted by the liquid refuse turned into it from these works.

(4.) Adlington Village and the Dye and Print Works.—The population of Adlington in 1861 was 1,975, and judging from the number of new buildings completed and in course of erection the population is fast increasing.

The river receives the sewage of the village, and a main sewer discharges into the river at "Water House Bridge."

Water House Dye and Print Works (Mr. B. Pollitt) are chiefly supplied with water from the river, the water being stored and allowed to subside before use except for power. There are four small settling pools for dye water at the works, but they are not of any material benefit in saving the river from pollution. The liquid as well as the solid refuse from these tanks is turned into the stream. The ashes, &c., from a number of cottages on the opposite side of the highway are also thrown into the stream.

(5.) At Coshaw Wood "*Arley Brook*" flows into the river *Douglas* immediately adjoining the east end of the Wigan Waterworks Tunnel; this brook is much polluted by Ochry water pumped from a coal pit called "Billy Pit" and belonging to the Wigan Coal and Iron Company.

(6.) At a quarter of a mile above Worthington Hall the "Seven Stars Brook" before the construction of the Wigan Waterworks reservoir joined the river *Douglas;* this brook is now diverted into the reservoirs, with the exception of the water from about 400 acres, which still flows into the river. Works are about to be commenced by the Corporation of Wigan to utilize all or the greatest proportion of this water. The quantity of compensation water delivered from these reservoirs amounts to 800,000 gallons per diem and is received into the works in connexion with the Standish Paper Mills.

(7.) Standish Paper Mills (Messrs. J. and T. B. Crompton).—These mills are situated on the *Douglas* immediately below the reservoirs and the Wigan Corporation Waterworks; they are worked and are exclusively devoted to the manufacture of paper both white and brown.

Large quantities of rags, tar rope, and esparto grass are here used, and all the liquid refuse from the manufacture finds its way direct into the river.

Report by Mr. J. Law Hunter, C.E., Borough Engineer of Wigan, June 9th, 1869—*continued.*

No ashes or solid refuse, or refuse from the manufacture of gas, is, as far as I know, thrown into the river, though some years ago such was not the case.

"*Bradley Brook*" falls into the river *Douglas* at these mills, and the water is utilized for power and other purposes. There are three collieries situate within the watershed of this brook, and whatever is pumped from the mines finds its way into the stream.

(8.) Bottling Wood Brook.—This brook joins the River *Douglas* at Lower Haigh Plantations. It is principally polluted by ochry water pumped from the coal mines, but slightly so by sewage.

(9.) *Clarington Brook.*—This brook joins the River *Douglas* at a point where the river is crossed by the London and North-Western Railway. It receives some of the sewage from the Wigan, and also from the Ince district. It is polluted by colliery water, the washing of coal slack, also by refuse from alkali works. The sewage of the Wigan district will be diverted from this stream shortly, the plans for that purpose having already received the sanction of the Local Board of Health.

(10.) *Ince Brook.*—This stream joins the River *Douglas* at "Poolstock." It receives the sewage of a considerable portion of the Ince district, and a large volume of water from coal-pits.

The Wigan and Ince Cemeteries are also drained into it.

(11.) Newtown and Robbing Lane End.—The sewage of this village flows into the River *Douglas.*

(12.) Just below the junction of the Varley brook with the River *Douglas* the outfall sewer discharges the entire volume of the sewage of Wigan into the *Douglas.*

(13.) Dean Lock and Weir is about two miles from the outfall sewer, lower down the River *Douglas.*

As to obstructions on the river:—

There are fourteen weirs on the river above the point where the sewage of Wigan is discharged into it, and Dean Lock and Weir is about two miles below the same point.

At "Schole's Bridge Weir," in the Borough of Wigan, the water is intercepted and carried into the Leeds and Liverpool Canal, and feeds the "Manchester level" of the "Duke's" Canal.

"Henhurst Bridge Weir," also within the Borough, backs up the water so as to feed that portion of the canal as far as Dean Lock. At Dean Lock the water is again backed up so as to feed the lower level of the canal in the direction of Liverpool. Henhurst Bridge Weir is a great nuisance, inasmuch as the water is backed up to a considerable height, and a long pool of stagnant water created.

Other obstructions are caused to the river by encroachments on its banks, owing to the cupidity of some of the landowners, and also by buildings being erected over the same at too low a level. The most notable of these obstructions are at Standish Paper Mills, Water Heys Foundry, near Weir Bridges, at Cartwright's Mills, Douglas Forge, Sovereign Mills, and Johnson's Mills, other of smaller moment may be found. At Cartwright's Mills the width of the river has been reduced to a water-way of only 8 feet 6 inches.

Pollution of the Darwen, tributary of the Ribble.

Letter from Sir William Henry Feilden, Bart., of Feniscowles, near Blackburn, 10th May 1869.

As a resident landowner on the banks of the River *Darwen,* I am from personal experience able to state that the present "system of sewerage of towns and populous places" in the *Ribble* Basin is most noxious to the comfort of persons dwelling on the banks of the streams (into which the sewage is allowed to flow), as well as ruinous to the property of landowners. I am a riparian proprietor on the *Darwen;* my property is situated about three miles below the town of Blackburn, and in consequence of the fearfully polluted state of the river (which is nothing better than an open sewer), my own health and that of my family has been so much affected by the effluvium arising from the river, that I have been obliged to close my house, and at great inconvenience and very considerable expense remove from the neighbourhood. My estate has very considerably deteriorated in value, both for building and farming purposes; people naturally object to build near such abomination. The water of the river, which is the only supply for cattle on many farms situated along its course, is totally unfitted for the purpose.

Pollution of the Brun, tributary of the Ribble.

Letter from Lt.-General Sir J. Yorke Scarlett, G.C.B., Bank Hall, Burnley, 28th May 1870.

The River *Brun,* which is formed by the confluence of three streams at about a mile and a half above Burnley, is perfectly pure from any contamination down to the point of confluence, and until it flows past Bank Hall. From that point until it joins the *Calder* in the town of Burnley, it is subject to the most abominable contamination from the sewage of Burnley, as also from the refuse from works and factories situated on its bank. I think it possible that the sewage of the town might be intercepted and conveyed by sewers to be utilized. I am also of opinion that the fluid refuse from works and factories can be filtered, and the effluent water returned into the river in a comparatively pure state. A case in point has occurred near Aldershot. A washing house for camp sheets was erected on the banks of the river, flowing through Cove Common and the village of Cove, the soap suds from which are filtered, and the effluent water is reconveyed into the river in a very pure state.

REPORT BY THE BOARD OF CONSERVATORS of the RIBBLE FISHERY DISTRICT on Pollution within their jurisdiction, transmitted by the Law Clerks, Messrs. T. J. and H. Backhouse, Blackburn.

Ribble Fishery District.

Commencing at the mouth of the estuary of the River *Ribble*, the first place where any deleterious matter is turned into the waters within this district is Blackpool, whose sewage is emptied into the sea, but does no apparent damage. The same may be said of Lytham on one side of the river, and Southport on the other.

The next place on the *Ribble* is Preston, the whole of the sewage of which is turned into the river from two outlets. In certain states of weather, and particularly when the tide is flowing, the stench from these outlets is very bad, and is perceptibe for some distance, and frequently when salmon are returning from the sea during a fresh they are met by this sewage, which the rain has washed down the different drains throughout the town in such quantities, that they have been seen to turn back to sea to wait for purer water, and they are thus rendered more liable to be caught by the heave or haaf net fishermen at the mouth of the river, and in the estuary where the fish are often waiting in numbers for a fresh to enable them to go up to their spawning beds.

Following the course of the main river, the next source of pollution is the Barrow Print bleach and dye works, which, when in work, discharges a considerable quantity of deleterious matter into the river, and fish have been poisoned in considerable quantities by it.

The next source of pollution is the paper works belonging to Messrs. Mitchell and Bleakley at Primrose, near Clitheroe, the refuse from which is of a very poisonous nature, and has frequently killed hundreds of fish, and rendered the water of the brook on which the works stand so bad that cattle won't drink it, and farmers on the *Ribble* itself, several miles below the junction of the *Primrose Brook* with it complain that on several occasions their cattle have refused to drink the water of the *Ribble* when this refuse has been coming down.

The town of Clitheroe is very imperfectly drained ; some of the sewage is discharged into the *Primrose Brook* and thence to the *Ribble*, but it does not perceptibly injure it.

The only other town on the *Ribble* is Settle, the sewage of which goes into the *Ribble* by three different outlets. The Gas Company at Settle have on several occasions emptied the gas tank into the river, and about six years ago a considerable number of fish was poisoned by this means.

The tributaries of the *Ribble* are :—

1. The *Douglas*, on which and its tributaries are the towns of Wigan, Chorley, Ormskirk, Rufford, and several places in their vicinity containing mills, bleach works, print works, dye works, collieries, and other manufacturing establishments, all of which more or less seriously affect the purity of the river.

2. The next tributary of the *Ribble* is the *Darwen*, on whose banks, or those of brooks flowing into it, are the large manufacturing towns of Blackburn, Over Darwen, Lower Darwen, Tockholes, and Withnell. At Blackburn, the whole sewage of the town is turned into the *Blakewater*, a tributary of the *Darwen ;* and one of the proprietors on the banks of the *Darwen* has obtained an injunction against the Corporation of Blackburn to compel them to discontinue the pollution of the river by this means.

At Over Darwen and Lower Darwen there are six paper mills and one print and dye works which send their refuse into the *Darwen*, completely poisoning the whole stream for several miles. The sewage of Over Darwen has hitherto been turned into the river ; but the Local Board of Health there are now taking means to purify it before it flows into the river. Most of the other manufactories also take their water from the *Darwen*, returning it in a more or less polluted state.

3. The next tributary of the *Ribble* of any importance is the *Calder*, into which flows the *Hyndburn*. On the *Hyndburn* are the towns of Oakenshaw, Enfield, Church, and Oswaldtwistle. In the two latter townships there are seven chemical works, two print, bleach, and dye works, besides mills and several collieries. These chemical works and bleach and dye works turn all their refuse into the *Hyndburn*, which is thereby polluted to such an extent that no fish will live in it, and cattle will not drink of it except in times of flood.

For a considerable distance in the township of Church the banks and bed of the *Hyndburn* are literally composed of a mass of solid matter formed of the spent material used in chemical works. This mass is several feet deep and consists of several millions of tons of matter which is full of poisonous substances, and the banks and bed of the river for a mile or more is impregnated with it ; it cannot fail to be most injurious, not only to fish but to cattle. The sewage of Church and Oswaldtwistle is also turned into the stream and adds to its pollution, and the stench arising therefrom is often very bad and must be greatly injurious to health. Accrington is on the same stream, and here are two print and dye works and one bleach work besides several very large manufacturing establishments. The sewage of Accrington also goes into this stream, rendering it in its passage very offensive. At Baxenden on the same stream are bleach works, and Turkey red dye works, both of which are very injurious. At Oakenshaw and Enfield on the same stream there are also print works, bleach works, and dye works, besides cotton mills, and several coal pits also empty their water into this stream which is very much polluted during the whole of its course, and causes the Calder into which it falls to be also very much polluted, and such pollution is also at certain periods very perceptible for a considerable distance down the main stream of the *Ribble.*

On the *Calder* there is a print and dye works at Castle Clough in Hapton. In the same township are chemical and naphtha works belonging to Messrs. Riley, at which gas tar is converted into several dyeing materials, and the refuse from these works is very injurious both to fish and cattle, the former are continually poisoned by it. At Lower House near Padiham are extensive print, bleach, and dye works, which are

REPORT by the BOARD OF CONSERVATORS of the RIBBLE FISHERY DISTRICT on Pollution within their jurisdiction, transmitted by the Law Clerks, Messrs. T. J. and H. Backhouse, Blackburn—*cont.*

also very injurious to the river. Padiham is not sewered, but a portion of sewage finds its way to the river by private drains. At Burnley and Habergham Eaves there is one print, bleach, and dye works, and two other dye works. There is also a fellmonger's works and tanning, besides a great many manufactories, machine works. The sewage of the town is also turned into the river, which, with the *Brun* a small tributary which here joins the *Calder*, is very much polluted in its passage through the town.

The towns or places called Brierfield, Nelson, Barrowford, and Colne, are also on tributaries of the *Calder*, and contribute much to its pollution, as do also the extensive colliers at Hapton, Habergham Eaves, Burnley, Marsden, and Clifiger.

The consequence of this pollution of the *Calder* and its tributaries is that very few fish are ever seen in it. In a wet season fish will run up it for some distance but almost invariably get poisoned.

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