

in properly filtered Thames water, anything positively deleterious to health. Whatever may be the difference of opinion with respect to the time required for removal of all the objectionable organic matter, all the chemists agree that in Thames water taken from the present source and properly filtered, all such matter has disappeared, and that the resulting compounds, such as nitrates, &c., remaining therein are innocuous and harmless.

Having carefully considered all the information we have been able to collect, we see no evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome.

215. The only point raised against the Thames water on the ground of organic contamination is of a less positive character; it is said that water which has been once contaminated with sewage may still contain undecomposed organic matter, which, though inappreciable by the most delicate chemical tests, may still exercise prejudicial effects on the human system.

The strongest form of this objection has reference to some opinions now prevalent, that certain forms of disease, such as cholera and typhoid fever, are propagated by germs contained in excremental matter; and it is conceived possible that when matter of this kind once gets into streams, these germs may escape destruction and long preserve their dangerous character. It is said that no process is known by which such noxious material can be removed from water, and therefore it is argued that water which has at any time been contaminated by sewage is thenceforth unsuitable for domestic use.

These opinions have been advanced by many eminent men of science; they are worthy of respectful attention, and ought to operate as a constant stimulus to the most searching examination of the state of the water; to the improvement of the modes and means of scientific analysis; and to the diligent collection of medical data as to the effect of the waters upon the public health. But we cannot admit them as sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water supply.

216. We may also expect that the state of the Thames and the Lee will be very much improved by the exclusion from them of all sewage and other offensive matter, in accordance with the provisions of the Acts of 1866 and 1868. And it is worthy of consideration whether these provisions should not be extended higher up the tributary streams, so as to exclude all possible sources of noxious pollution.

217. We are of opinion that, when efficient measures are adopted for excluding the sewage and other pollutions from the Thames and the Lee, and their tributaries, and for ensuring perfect filtration, water taken from the present sources will be perfectly wholesome, and of suitable quality for the supply of the metropolis.

218. The analyses made specially for us of the waters in the various parts of the Thames basin are, we conceive, of great interest and value, and will be very useful as data for comparisons of the state of the river at future times. The result shown by them that the present point of intake is the best that could be chosen in the whole course of the river, is peculiarly important and satisfactory.

PART V.

REMARKS ON VARIOUS POINTS BEARING GENERALLY ON THE SUBJECT OF THE METROPOLITAN WATER SUPPLY.

SECTION I.

ON THE QUANTITY OF WATER LIKELY TO BE HEREAFTER REQUIRED FOR THE SUPPLY OF THE METROPOLIS.

219. The quantity of water that is likely to be hereafter required for the metropolis forms a prominent element in the consideration of any plans of supply, and we propose to devote a few remarks to the elucidation of this subject.

This quantity will obviously depend on two elements—

- (a.) *The estimated future population, and*
- (b.) *The quantity to be allowed for each individual.*

(a.) AS TO THE ESTIMATED FUTURE POPULATION TO BE PROVIDED FOR.

220. The population of London embraced within the limits of the Registrar General's district (see map Appendix AW.), was given for the middle of the year 1867 at 3,082,372 persons.

The number of persons estimated to have been supplied by the companies in that year, as given in the table in Part III. of our Report, amounts to 3,100,000. The districts supplied have a somewhat wider range than that of the Registrar General, as they extend farther into the suburbs; but on the other hand, it is probable that some portions of the population may not be included within the companies' returns.

221. In reasoning upon the probable number of persons to be hereafter provided for, Mr. Bateman states as follows:—

"Will you give us, in the first place, the population of the metropolis in the year 1861?—According to the population returns for that year the population within the district of the Metropolitan Board of Works was 2,803,034 persons.

"What is the present population?—The present population, taking the rate of increase at which the metropolis in recent years has been increasing, is upwards of 3,000,000 by estimate. Dr. Letheby, in December 1866, gives the population at 3,067,000 in round numbers. The rate of population has been as follows: it has trebled since the beginning of this century, it has doubled itself in the last 40 years, and it is now half as large again as it was 20 years ago; therefore, at the same rate of increase, in 20 years, it will be half as large again as it is now, and will amount to 4,500,000 persons. I believe that that will scarcely represent the whole population which may be expected to reside in the immediate neighbourhood of London at that time, because the suburbs of London beyond the area included in the district of the Metropolitan Board of Works are so rapidly increasing that they may be taken as forming a part of the metropolis, and ought to be considered with reference to any supply of water."

He gives further explanations of his views on this point, and adds:—

"In 1856 the supply was at the rate of 28 gallons per head per day, in 1866 it was at the rate of 31 gallons per head per day, and in 1867 it was at the rate of 32 gallons per head per day. If you take 32 gallons per head per day as the consumption, and estimate the population in 1877, nine years from the present time, at 3,650,000 persons, which it would amount to at the rate of 1.73 per cent., you will want 117,000,000 gallons a day. If you take the increase at the rate of 2½ per cent., you will want 127,000,000 gallons a day at that time; and if you take it at 3 per cent., which with all deference I think ought to be what you should take it at, you will want in nine years from the present time 132,500,000 gallons a day. Judging from the experience of all the places that I know, I think that is about the right amount to take, and my own belief is that when you get water which can be supplied by gravitation, when you include everybody as you ought to do upon the principle which I have laid down, and compel them to pay for water, and therefore give them an inducement to take it and use more than they have done, when you have converted every privy into a water-closet, and when you have water of the softness of Welsh water, in which case you would sell as much again for trade purposes as you do now, that is an under-calculation instead of an over-calculation, and my belief is that before nine years are over you will want more than 130,000,000 gallons a day. However, I have assumed 130,000,000 gallons, because that happens to be the scale on which I devised these works when I first laid them before the Commission, and that seems to me to be the quantity which may be required about the time at which they could now be executed."

In about 12 or 13 years from the present time he estimates that 170,000,000 gallons will be required, and ultimately 230,000,000 gallons; but he extends his estimates to the provision of 300,000,000.

Mr. Hawksley, on the other hand, does not agree to the probability of the increase continuing at such a rapid rate. He says:

502.

“Of course you must add to the present population, and that is a very difficult question, because it is quite impossible to take it that London should increase at the rate it has recently done; we know indeed by the census tables of this kingdom as well as of others that the rate of increase is declining. In all countries the rate of increase attains a certain maximum and after that it declines. Put it as it was in England at the period of the greatest increase; the increase I think was a little over 2 per cent. per annum throughout the kingdom in general. Then it declines and it will go down to $1\frac{3}{4}$ per cent. Then in future periods it will be $1\frac{1}{2}$ per cent., and so on till it comes down to a more moderate rate of increase. In England we have had a wonderful stimulus by the inventions which have been made; the introduction of the steam engine and railways in particular, and the enormous development of our manufacturing power, contributed for a certain period to a most rapid increase of the population, but the increase will not, in my opinion, continue at the same rate; nor is the supposition warranted by the statistical facts gathered in England itself and in other countries as well.”

The Government Commissioners, Captain Galton, Mr. Simpson, and Mr. Blackwell, who reported in 1857 on the Metropolitan Main Drainage, considered the question of the probable increase of population for which sewage should be provided, and they estimated the prospective population in the metropolitan districts at 3,578,000 as compared with 2,362,000 in 1851. They also added 401,000 for a suburban area beyond the limits, making a total prospective population of nearly 4,000,000 for which the sewage plan should be laid out.

222. With the view of aiding in the elucidation of this subject, we have had prepared, from the Census Returns, the four diagrams marked Appendices AL, Nos. 1, 2, 3, and 4 respectively.

Diagram AL (1) shows the increase of the population of the metropolis from 1801 to 1861, distinguishing the increase from excess of births over deaths, and that due to immigration. Diagram AL (2) shows the manner in which the increase of the metropolis has been distributed among the persons of different occupations in life. It will be seen that the increase due to immigration is very much the larger, being in the 60 years 1,287,200 as compared with 557,920. It appears somewhat doubtful whether this source of increase will go on as fast as heretofore; it has already diminished from $17\frac{3}{4}$ per cent. in the first 10 years of the period to 8 per cent. in the last 10 years; and if it should decrease further it will prevent the continuance of the increase of the metropolis in its former ratio. The diminished immigration, which probably consisted largely of bread-winning adults, exhibits a check to the increasing means of employment; and this is also borne out by the diminished rate of increase among the industrial classes, which was between 1841 and 1851 nearly 51 per cent., but was little over 11 per cent. between 1851 and 1861. This does not lead us to anticipate an increase in the population of London similar to that of past years.

Diagram AL (3) shows the increase as distributed among the districts of the various water companies, and AL (4) among the various metropolitan districts. This last diagram also gives the population *per square mile* of area in the different districts and parishes. It must be considered, that with the present great accommodation of suburban railways, which will doubtless further extend, the population will be likely to increase principally in the districts lying within a few miles of London, and it will undoubtedly be necessary, as Mr. Bateman suggests, that these districts should be properly provided for as a part of the system of the metropolitan supply. We believe all the companies are alive to this prospect, and have been arranging their plans to meet the wants of these districts as they gradually arise.

223. It is impossible to calculate with any exactness to what extent this increase will go on in any given number of years; but from the whole of the above data we have endeavoured to estimate what increase would be probable, and we are inclined to think that Mr. Bateman's estimate of $4\frac{1}{2}$ millions as the future population to be considered is reasonable, although we should allow more time than he does for this population being attained. In our calculations of quantity, we shall, to be on the safe side, assume an ultimate future population of 5,000,000.

(b.) QUANTITY OF WATER TO BE ALLOWED FOR EACH INDIVIDUAL.

4058.

224. The quantity of water, per individual, necessary to be supplied in any particular town appears to be very difficult to reduce to any definite rule. It is found that on an average about 10 gallons per head per day are sufficient for ordinary domestic requirements, including waterclosets; but to this have to be added large supplies for street watering, flushing sewers, &c. &c., and for trade purposes and other large

consumption, which in the case of London have been estimated at another 10 gallons. Then in addition to these there is considerable waste, often amounting to, or even exceeding, the whole domestic supply.

225. The following is a résumé of the evidence we have received on this point:—

Mr. Bateman states that the quantity varies very much, according to the character of the place and the class of inhabitants; it varies from 15 to 16 gallons a head a day to 50 gallons. Hence each town and city ought to be taken with reference to its own existing circumstances, and what the probabilities are of the supply being greater or stationary.

He takes the present London supply as equal to about 36 gallons per head per day, and he thinks that this, or even 40 gallons (looking to the constantly growing consumption of the place and the class of inhabitants; it varies from 15 to 16 gallons a head a day to 50 gallons. Hence each town and city ought to be taken with reference to its own existing circumstances, and what the probabilities are of the supply being greater or stationary. App. E.

He states that in Glasgow the consumption is 50 gallons, including, however, a very large waste; and that in Manchester the gross quantity supplied is 21 or 22 gallons per head, of which about one-third is for trade purposes; but as baths and waterclosets are very sparingly used there, this does not afford a safe criterion.

Mr. Duncan states that for a large town, where sufficient care is taken to prevent waste, 30 gallons per head per day would be about the right quantity; but he thinks it will go on increasing in future to probably about 45 gallons, which he would take as the measure of a future supply. 2365-74.

Mr. Hawksley says that in his view 25 gallons would be safe; but if this were extended to 30 gallons he thinks there is no doubt whatever that that would be a super-abundant quantity. He considers that 30 gallons per head would be quite a safe calculation for the probable necessity of a population like London—more than enough; including all trades, all waterclosets, stables, incidental causes of consumption, and all household consumption and street watering. 2502. 5088-92.

Mr. Simpson estimates that, looking forward to a few years to come, about 30 gallons per head would be a sufficient provision for the population of London, including all public sewers. 4718-21.

Mr. Hassard states that the Dublin Waterworks are estimated to supply 40 gallons per head, with provisions for a larger quantity if required. He considers that the estimate for London ought to be 50 gallons. 551-62. 865.

Mr. Rawlinson is of opinion that half the water now supplied in London is wasted, *i.e.*, is not used for any useful purpose. Allowing for waste, he conceives 30 gallons a head is sufficient. 1408-11.

Mr. Muir, after much investigation, has found that 10 gallons a day are ample for ordinary domestic purposes, and 20, including all other requirements, for such a city as London. The difference between this and 30 gallons, the present consumption, is due entirely to waste. But he adds,—

“I think a great deal more might be done than is done now for the prevention of waste. The companies, and the New River Company I may say especially, have attempted to check waste to some extent for the sake of the consumers, (for the waste of one set of consumers is very injurious to another, who may be upon a higher level,) and they have succeeded in some measure in reducing waste, without in the least degree stinting the proper supply of their tenants.”

Mr. Greaves gives an account of some special investigations on this point which lead him to the belief that the whole population of London ought to be very well satisfied with 24 gallons per head. The results are as follows:—

“Can you give the Commission the result of that?—I can give 15 cases of streets. One street averaged 306 gallons per house per day; the number of inhabitants I do not know; I have taken it per house. Those quantities were determined by the insertion of meters on the supply pipe of the street without any particular information or instruction to the people that they were being metered, but merely as a source of information for ourselves.”

“What would you take as the average population of each house?— $7\frac{1}{2}$ I should think. No. 1 street comes out at 306 gallons per day; No. 2 at 329 gallons; No. 3 at 283 gallons; No. 4 at 132 gallons; No. 5 at 90 gallons; No. 6 at 96 gallons; No. 7 at 148 gallons; No. 8 at 45 gallons; No. 9 at 87 gallons; No. 10 at 194 gallons; No. 11 at 78 gallons; No. 12 at 353 gallons; No. 13 at 146 gallons; No. 14 at 73 gallons; and No. 15 at 37 gallons.”

The average of the whole was 160 gallons per house, or 21 gallons per head.

Mr. Beardmore considers that, including waste, which is enormous, the quantity required for London per head, including trade and public supplies, would not be less than 35 gallons per head per day. 3326-7.

Mr. Dale allows 30 gallons per head for all purposes. The supply at Hull is 32 gallons. 1095-6.

3927-30.
3943-5.

Dr. Letheby considers 20 gallons per head for all purposes a good and sufficient supply. All beyond is wasted.

226. We have endeavoured to collect data as to the supplies in different towns, and Mr. Bateman and Mr. Simpson have communicated to us the particulars given in the tables printed in Appendix AM. It will be seen, however, that the quantities per head for the total supplies vary enormously in the different cases, from $14\frac{1}{2}$ gallons at Norwich to 53 at Glasgow, showing that every case must be judged by its own circumstances.

We conceive, therefore, that the only way to arrive at an estimate for the metropolis which shall have any pretensions to be relied on, is to reason from the present experience, making such alterations as may seem to be necessary for the future.

227. The quantity of water supplied per head in any town may be estimated in two ways; *i.e.*, by dividing the total quantity either among the whole population, or among that portion of them only who take the water, the latter number of inhabitants being frequently much less than the former. In the following table we have endeavoured to give the quantity according to both these methods:—

QUANTITY of WATER supplied to the Metropolis at different dates.

	1829.	1849.	1856.	1867.
Average daily quantity of water supplied - - - - -	29,000,000	44,388,129	73,376,860	98,600,248
Number of houses and tenements supplied by the companies	177,000	267,305	319,213	441,442
Estimated number of inhabitants therein - - - - - (N.B.—Where this item is not given in the returns it is obtained by assuming seven inhabitants to each tenement supplied.)	1,289,000	1,871,135	2,234,491	3,100,000
Daily supply per head to inhabitants taking water from the companies - - - - -	23·3	23·6	33	31·8
Total population of the metropolis - - - - - (N.B.—This has been filled in by proportionate interpolation from the decennial census returns.)	1,572,000	2,280,000	2,583,000	3,082,372
Proportion of whole population supplied with water - - - - -	79	82	86	100
Daily supply per head on the whole population - - - - -	18·3	19·4	28·5	32

It will be seen that in 1828 only about 79 per cent. of the inhabitants were supplied by the companies, the remainder procuring their supplies by shallow wells and pumps from the superficial gravel on which London stands. As this source has become worse, by the increasing contamination of the water from underground pollutions, it has been gradually abandoned, and the proportion of persons taking water from the companies has been gradually rising to the present time. It must be remembered, however, that the number of inhabitants in each tenement is merely an estimate, and the districts included extend in some cases beyond the limits of the census returns.

As regards the quantity supplied per head, the table shows that, estimated on the whole population it has increased from about 18 gallons in 1828 to 32 gallons in 1837;—while estimated by the number of persons actually taking water from the companies, it has increased from about 23 to 32 gallons.

228. This is no doubt a considerable increase, but we think it may be accounted for in a way that will not warrant the expectation of its continuance to any considerable extent. During the last 20 or 30 years very great advances have been made in sanitary arrangements; the introduction of waterclosets into houses, the much more frequent use of private baths, and a general advance in domestic cleanliness, have all tended largely to increase the quantity demanded. The companies have met the demand liberally, and all the upper and the middle classes of London may be said to be at present so plentifully supplied with water that further augmentation would be only waste. In regard to the lower classes, there is, no doubt, much sanitary improvement still to be effected, and much more useful application of water still to be promoted; but it is probable

that the improvement will have a tendency rather to check the waste than to increase the supply.

We are not aware that the requirements of trade, or the quantities used for municipal purposes, are likely materially to increase in a larger proportion than the increase of population, so that no variation on this ground need be taken into account.

The only remaining element of change likely to occur would be the introduction of the system of constant service. This would probably not materially affect the quantity of water actually used, but it would have a considerable influence on the quantity supplied, by affecting the amount of waste.

It has been found that where the system could be carried out perfectly, with suitable 2561. house arrangements and under efficient control, so far from wasting water it has considerably economized it; but considering the great difficulties that must be encountered in making the change under such disadvantages as will be experienced in London, there is reason to fear that, with every precaution, a considerably increased loss of water will at first be suffered. It is impossible to foretell to what extent this loss may go, or how long it will be before it can be subdued; all will depend on the caution with which the change is made, and the efficiency of the control exercised. But it is to be hoped that before many years after the constant service is commenced, the supply may be brought down again to its normal quantity. And it must be recollected that as the population extends, all new supplies, being adapted (as they ought to be even now) for the new system, will be on the most economical plan. And looking forward further still to the time when long experience shall have been gained of the plan, ample time allowed for making all improvements and changes, and a rigid supervision introduced, it would not be too much to expect that a considerable reduction of the present waste may be effected, and the supply be brought down much nearer than at present to the quantity beneficially used.

Estimate of Quantity.

229. If these views are correct, we may give the following as an approximate estimate of the quantity to be provided:—

The present supply is, say, for 3,000,000 of population, at $33\frac{1}{2}$ gallons per head, equal to - - - - -	Gallons per day.	100,000,000
Assume the population to have increased to 4,000,000, and at the same time the additional waste due to the new introduction of the constant service to have increased the supply to 40 gallons per head, equal to - - - - -		160,000,000
By the time the population has increased to 5,000,000 we may hope that the allowance may be reduced again to 35 gallons, which would give - - - - -		175,000,000
Or for the maximum summer consumption, say - - - - -		200,000,000

which we consider the highest demand that need be reasonably looked forward to for the metropolitan supply.

SECTION II.

PROVISIONS AND PROSPECTS OF THE VARIOUS COMPANIES FOR THE FUTURE.

230. Having thus arrived at an estimate of the future quantity of water which may be required for the metropolis, we have thought it right to inquire what provisions the various companies have made for increasing their supplies as the increasing demands arise. We had previously addressed, to the five companies now drawing water from the Thames, a letter on this subject, which is printed, with the answers to it, in Appendix L.; to these have been added further information given by the engineers of the various companies at our request; and the following statements will, we believe, express the companies' own estimates of their positions and prospective capabilities.

231. The *New River Company* state that from their present sources, and with their App. BF. existing works, they can obtain the following quantities of water:—

Average flow of the Chadwell Spring -	Gallons per diem.
Quantity which the New River Company are authorized to take at all times from the River Lee, through their gauge at Hertford	3,500,000
Additional supply from gathering ground at Cheshunt, &c.	22,500,000
Quantity obtainable from six existing deep chalk wells, upwards of	500,000
Water collected in ponds at Hampstead and Highgate, and distributed through separate mains for watering roads and other non-domestic purposes -	8,000,000
	500,000
Total -	<u>35,000,000</u>

In addition to this, there is the produce of a new well now in preparation at Wormley, and also the quantity of unfiltered water that might be drawn from the Thames through separate mains for street watering, &c.

The company are further entitled, by the "River Lee Water Act" of 1855, to increase their supply from that river by storing flood waters, and they believe that under these powers a considerable further addition may be obtained, the New River being capable of conveying twice its present flow. But they have not thought it necessary to mature any plan for this purpose.

The *East London Company* have felt the necessity of largely increasing their powers of supply. They have, like the New River Company, power to store flood water in the River Lee, and in 1867 they obtained an Act to make a considerable increase in their present reservoirs; but they have preferred, as a larger and more certain measure, to go also to the Thames, and they obtained, in the same year, an Act (30 & 31 Vict. c. 148), enabling them to draw from this source a quantity of 10,000,000 gallons per day.

The works authorized under this Act are now in course of construction. The water will be taken from the Thames at Sunbury, about a mile and a half above the intake of the other companies at Hampton, and from this point the water will be lifted to a station at Hanworth, where it will be filtered. It will then be pumped through an iron main, 18 miles long and 36 inches diameter, into a service reservoir on high ground at Hornsey Wood Hill, and thence delivered either into the district for use or to replenish the increased storage in the valley of the Lee.

It is expected the works will be finished in 1871, and that they will cost, under the two Acts, about 450,000*l.* The capabilities of this company may then be estimated at about 30,000,000 gallons per day.

The *Chelsea Company* are empowered to draw from the Thames a quantity of 20,000,000 gallons per day; and they state (Appendix L.) they could pump, filter, and store this quantity without materially adding to their present capital. As, however, their present supply is only half this, we presume so great an increase might overtax the safe and efficient capabilities of the works, unless further mains and pumping and filtering power were provided.

The *West Middlesex Company* have also power to take 20,000,000 of gallons from the Thames. The pumping engines there are already calculated to pump 12,000,000, or more, if worked to their full power; but when this quantity is much exceeded duplicate engines would be required. A new main is already under construction from Hampton to Barnes, which, when finished, will with the present one convey the full quantity. The present reservoirs, filters, and distributing engines are equal to about 15,000,000, but land is provided for the necessary extensions. The mains from Hammersmith to the store reservoirs are of the full capacity.

The *Grand Junction Company* have power to take 20,000,000 of gallons. The present works are calculated to deliver 13,000,000, but are laid out so as easily to admit of extension. A large new covered store reservoir, to hold 10,000,000 of gallons, is now being constructed at Camden Hill.

The *Lambeth Company* are empowered to take 20,000,000 of gallons. They are now duplicating their main from the Thames to Brixton, which, with the former one, will safely deliver this quantity; and the additional pumping, filtering, and reservoir power will be added as required. The works have been laid out, and land provided, with a view to a still larger increase.

The *Southwark and Vauxhall Company* have power to take 20,000,000 of gallons. The works already in operation are capable of supplying about 15,000,000 gallons, but the company are now constructing additional engines at Hampton, with large new reservoirs and filter beds, and are laying down a new line of 30-inch main; and when these works are finished, the whole quantity of 20,000,000 gallons may be delivered when required.

The *Kent Company* state that their present wells will supply 14,000,000 of gallons 614*l.* per day, and that with their present machinery they could raise 10,000,000. One of the wells at Charlton is a duplicate, not yet used. They are now sinking another well and erecting new engines at Deptford, where more water is wanted.

Summary.

232. It appears from the above data that the various companies represent themselves as being prepared, with their present legal powers, and with only moderate additions to their present engineering means, to supply the following quantities of water:

	Gallons per day.
New River	35,000,000
East London	30,000,000
Chelsea	20,000,000
West Middlesex	20,000,000
Grand Junction	20,000,000
Southwark and Vauxhall	20,000,000
Lambeth	20,000,000
Kent	say 15,000,000
Total	<u>180,000,000</u>

Which is very little short of the quantity we have estimated as the highest demand that need be reasonably looked forward to for the metropolis, but which is still far below the limit of the quantity capable of being furnished from the Thames basin.

SECTION III.

ON THE SYSTEM OF CONSTANT SERVICE AT HIGH PRESSURE.

233. We have explained in Part III. of our Report that in the distribution of water in London, the water is not constantly laid on to the mains serving the houses, but is only supplied to them during an hour or two each day; this is what is called the "intermittent service" system, in contradistinction to that of "constant service," in which the service pipes are always charged under pressure, and the water may be drawn from them at all times by simply turning the taps in the houses.

234. This constant service system is now adopted in many country towns, and it has obviously many advantages over the other plan. It allows the water to be drawn always fresh from the main, free from the pollution often acquired in dirty receptacles (an evil of great magnitude among the poorer classes), and it ensures supplies at all times independent of cistern storage. It is also a great advantage to have the mains always charged in case of fire, without waiting for the intervention of the turncock, as on the intermittent plan.

Independently, however, of the advantages to the consumers, the constant service plan would seem to be so much more simple and easy to work than the intermittent (which requires much complexity of construction, and trouble of management), that one would think the companies would have adopted it for their own sakes, were there not good reasons to the contrary. In the various discussions that have taken place on the metropolitan water supply, the adoption of the system has been strongly urged; but the proposition has been met by statements of the causes which have led to the adoption of the intermittent plan, and of the difficulties that would arise in attempting to introduce the rival one.

235. In order to make the subject clear we may state at once what these difficulties are; and as far as we can learn, they appear to be five in number.

1. In the first place it is alleged that there is great leakage from the fittings in the houses, producing a waste of water which, though it can be met when it lasts only an hour or two a day, yet if allowed to go on for the whole 24 hours would amount to such an enormous quantity that the supply could not be kept up with the present means or at the present cost. This leakage always takes place to some extent even in the better class of houses, by inattention to the state of ball-cocks, watercloset apparatus, &c.; but it is in the poorer districts, where through carelessness and dishonesty it is impossible to keep the fittings in a respectable condition, that the chief difficulties arise.

2. It is also alleged that assuming all the fittings to be in good order, their strength, particularly that of the lead pipe, though suitable for the small pressure of the intermittent supply, would not be sufficient for the greater strain necessarily induced by constant service at high pressure.

3. The habits of domestic establishments lead the inmates to draw their larger supplies of water at one particular time of the day. During the morning hours the consumption is double the average. Now on the intermittent system this variable draught comes upon the store cisterns, and does not interfere with the power of distributing the quantity pumped uniformly over the day; but under the constant system it would come directly on the mains, and the increased draught at a particular time would lead to much inconvenience. For such of the companies as have no store reservoirs, but are obliged to supply entirely by pumping, the increased draught would require a much greater pumping power to be in readiness, a large portion of it, however, being used only for a short time in the day.

4. This greater draught at a particular time, when it occurred at low levels, would further have the effect of reducing the pressure in the mains and services to such an extent as to render them incapable of supplying at the same time the higher parts of the districts. The leakage also would powerfully contribute to this effect, and thus it would become necessary generally to increase the dimensions of the mains and service pipes throughout the entire metropolis. It is a part of the present system, enforced on the companies by Act of Parliament, to supply the better class of houses up to their highest floors; and as many of these houses are of great height, and stand on elevated ground, a great pressure is required for this purpose. Under the intermittent system this can easily be arranged, but under the constant system these high services would be entirely at the mercy of the draught going on at lower levels. And even in the same building no water could be had on an upper story while lower ones were drawing.

5. In case of any repairs or alterations to the mains, or of any accident whatever interrupting the flow in them (instances of which are said to be of almost daily occurrence in some parts of London), the whole district served by those mains must under the constant system be deprived of water, whereas under the intermittent plan the house cisterns keep up the supply. For this reason it is urged that it is advisable to retain the cisterns, even where constant supply is given, whereby one of the advantages alleged in its favour is done away.

236. Before remarking on the weight to be attached to these objections, we may review what has already been done in the matter, and state the evidence given before us thereon.

Nearly a quarter of a century ago it seems to have been established that on public grounds the system of constant service was the right one, for at the time of the passing of the "Waterworks Clauses Consolidation Act" in 1847 (10 Vict. cap. 17) the following provision was introduced:—

"XXXV. The undertakers shall provide and keep in the pipes to be laid down by them a supply of pure and wholesome water, sufficient for the domestic use of all the inhabitants of the town or district within the limits of the Special Act, who, as herein-after provided, shall be entitled to demand a supply, and shall be willing to pay water rate for the same; and such supply shall be constantly laid on at such a pressure as will make the water reach the top story of the highest houses within the said limits, unless it be provided by the Special Act that the water to be supplied by the undertakers need not be constantly laid on under pressure."

This Act was intended to be incorporated into all Waterworks Bills thenceforth introduced, and it became therefore the law of the land that the constant service system should be applied in all new works, unless special reasons could be shown for its inapplicability.

237. The Board of Health, in their report of 1850, strongly urged that the metropolis should be brought under this system, putting on record the following opinions on the point:—

"That the practice of intermittent distribution occasions, in the case of the better description of houses, the retention of the water in cisterns and butts; and in that of the poorest classes, in tubs, pitchers, and such other vessels as can be obtained; and as a consequence of such retention the water imbibes snot and dirt, and absorbs the polluted air of the town, and of the offensively close, crowded, and unhealthy localities and rooms in which the poor reside."

"That the annual cost of the construction and maintenance in repair of cisterns, and their supports and connected apparatus, in the houses of the middle and wealthier classes, often exceeds the annual water rate."

They also add the following remarks:—

Many practical difficulties have been urged against the substitution of the constant for the intermittent system of water supply in the metropolis, we have particularly examined into the working of the constant system in towns where it is established, and in some of which it has been in operation for 15 and 20 years, and we find—

That the waste of water is so far less, instead of greater, under the system of constant supply, that although the inhabitants have unlimited command of water, and use what they please, though the actual use of water by the inhabitants is greater, the quantity delivered by the companies is less, frequently less by one half, in consequence of there being less waste from the more perfect delivery.

That the water under the system of constant supply is delivered purer and fresher, of a lower temperature in summer, and that it is less subject to frost in winter.

That the inconveniences apprehended from the interruption of supply during repairs and alterations are never experienced, the work being executed under such simple precautions that no complaint has ever been known to have been made on this account.

That the interruptions of supply which are so constantly experienced on the intermittent system from the waste in the lower districts, from the neglect of turncocks, from limitation of quantity, from inadequate or leaky butts and cisterns, or from deranged ball-cocks, are scarcely ever known on the constant system.

That the system of constant supply admits of great economy in pipes, as they may, under that system, for the most part, be considerably smaller, and, not being subject to the violent hydraulic jerks of the intermittent system, are less liable to burst.

That the pipes for the house service may not only be considerably smaller and cheaper, but that the cisterns and apparatus connected therewith, which in the smaller class of houses now cost more than the whole public portion of the works, may be entirely dispensed with.

238. The subject was warmly discussed before the Committees on the Waterworks Bills in the Sessions of 1851 and 1852. The Government wished to carry out the constant service system, but were met by arguments urged by the companies against it, and the result was a sort of compromise, by the introduction into the Act of 1852 of a clause compelling the companies to give a constant service to any district when required by four-fifths of the inhabitants, on its being shown that the pipes and fittings in the houses were in a proper condition to receive such supply. The following is the clause:—

"XV. After the expiration of five years from the passing of this Act, every company shall, subject to the provisions of the Special Act relating to such company, provide and keep, in the district mains already laid down or hereafter to be laid by them, a constant supply of pure and wholesome water sufficient for the domestic use of the inhabitants of all houses supplied by such company, at such pressure as will make the water reach the top story of the highest of such houses, but not exceeding the level prescribed by the Special Act of such company: provided that no company shall be bound to provide a constant supply of water to any district main until four-fifths of the owners or occupiers of the houses on such main shall by writing under their hands have required such company to provide such supply, nor even upon such requisition, in case it can be shown by any company objecting to the same that more than one-fifth of the houses on such main are not supplied with pipes, cocks, cisterns, machinery, and arrangements of all kinds for the reception and distribution of water, constructed according to the regulations prescribed by the Special Act or by this Act, or which any company, with the approval of the Board of Trade, may from time to time make in that behalf; and after any such requisition as aforesaid shall have been delivered to the company, it shall be lawful for the surveyor, or any other person acting under the authority of the company, between the hours of nine of the clock in the forenoon and four of the clock in the afternoon, to enter into any house or houses on such district main, in order to ascertain whether the pipes, cocks, cisterns, and machinery of such house and houses are so constructed as aforesaid; and provided also, that any company may, with the consent of the Board of Trade, suspend the giving of such constant supply, or give the same in succession to the several districts of such company or to any parts of such districts as may be found to be convenient; and provided that it shall be lawful for the company, after due notice, to abstain from supplying, or to cut off the communication pipes, and withdraw the supply of water from any house whereof the pipes, cocks, cisterns, machinery, or arrangements as aforesaid shall not be in conformity with such regulations; provided that neither the Kent Waterworks Company nor the Hampstead Waterworks Company shall be required to give such supply at any height exceeding one hundred and eighty feet above Trinity high-water mark; nor the East London Waterworks Company be required to give such supply at any height exceeding forty feet above the level of the pavement nearest the point at which such supply shall be required."

It would appear that the companies convinced Parliament of the validity of the fifth objection we have given, namely, as to the necessity for the retention of the cisterns under the constant service system, for the following provision was added in clause 22:—

"Whenever water shall be constantly laid on under pressure in any district main, every person supplied with water under pressure by any company through such main shall, when required by the company, provide a proper cistern or other receptacle for the water with which he shall be so supplied."

And then follow provisions as to ball-cocks and fittings, and prevention of waste, &c.

We believe that cisterns are retained to a considerable extent in Manchester and many other towns where constant service is given.

239. The House of Commons Committee of 1867 devoted particular attention to this subject, and as they took a large mass of evidence, embodying the most recent experience on both sides, it may be useful to present at length the conclusions at which they arrived, as set forth in their report:—

67. The Act of 1852 is so framed that the introduction of any constant supply depends upon its provisions relating to the preparation of plans, and the proceedings consequent thereon, but these provisions have been too difficult of application to be carried into effect in a complete or satisfactory manner. With some trifling exceptions, therefore, the metropolis is now supplied by the water being turned on for a short time in each day, except Sundays, when no supply is given to the larger part of the metropolis. The occupiers are left to obtain and store as much of the supply as they may desire, or as the condition of their houses will admit.

68. The use of cisterns for the purpose of storing water for consumption is probably a more fertile cause of impurity than any pollution of the river from which the water is drawn. Decaying animal or vegetable bodies, or other impure matter, may easily find their way into a cistern, and are more likely to engender disease than any impurity existing in the water before it flows into the cistern. In well-regulated houses the cisterns are of course constantly drawn dry, and properly cared for; but as cleanliness decreases, it is found that the cisterns are allowed to become more foul until the lowest state is reached, when the water is stored in tubs and otherwise, under the most disgusting conditions, which cannot but be injurious to health, and a cause of the diseases which are found to prevail in the worst regulated parts of London. On the other hand, an intermittent supply of water without cisterns not only deprives the inhabitants of the supply they ought to receive, but from the want of adequate storage it is kept in pails and other small receptacles, in rooms and places where it is liable to much contamination.

69. For these and other reasons, which will be found in the Evidence, and in the paper of Dr. Farr, No. 7 in the Appendix, and the report of Captain Tyler, which are full of interest, your Committee have come to the conclusion that the Act of 1852 has failed to secure for the inhabitants the advantage which they ought to have long since enjoyed of a well-regulated supply of water in their houses for domestic purposes; your Committee therefore recommend that the Act should be amended by providing that every company should afford a constant supply of water to each house, so that the water may be drawn direct from the company's pipes at all times during the 24 hours, with the exceptions herein-after mentioned.

70. It is right, however, to observe that this recommendation cannot be carried into effect unless adequate provisions are also made to prevent the waste of water which may arise from its being constantly laid on in every house. To determine how far water may be and is in fact now wasted in the metropolis, much evidence has been given which is deserving of notice.

The Committee go on to investigate this matter, and come to the conclusion that out of 78½ millions of gallons supplied daily, about 17 millions are wasted. They then remark:—

75. From experiments made on several occasions in the metropolis, it has been found that where the supply was suddenly changed from the present intermittent system to a constant supply, without any alteration of the arrangements in the houses, there was an enormous waste of water. The experience derived from changes made from an intermittent to a constant supply in other towns, without suitable arrangements within the houses, leads to the same result.

76. Your Committee have therefore endeavoured to ascertain the precise causes of this waste, and the means by which it may be obviated.

77. With regard to the constant direct supply of water to a tap in the house, it appears that no waste is likely to occur if it be so placed and arranged that waste cannot take place without producing inconvenience, which will be immediately felt by the person permitting the waste, and that there are no real difficulties in fulfilling these conditions.

78. All other modes of supply afford opportunities of waste, which it is not so easy to prevent. The ordinary cistern is so liable to occasion waste, that it has been found requisite in other places to lead the waste-pipe into some exposed position, where any flow from it can be immediately detected. It would no doubt be necessary to make this alteration when a cistern is maintained, but as it would be easy to substitute a direct service, without the intervention of a cistern, except for hot-water services or closets, no difficulty need be apprehended on this account.

79. But with regard to the supply of waterclosets, it has been shown that in consequence of the practice of allowing the water to flow through them uninterruptedly for long periods, instead of merely flushing them, they are a frequent cause of great waste, which cannot be detected; there appears, however, to be no difficulty in guarding against this by making such arrangements for flushing, that the water cannot flow on continuously for an unlimited period.

80. It has indeed been objected by some of the witnesses, that it will be found impracticable to maintain any flushing apparatus in proper order in houses frequented by the most negligent people, and that it would be better in these cases to leave them to draw water and flush with a pail. If this were a question affecting the individuals only, such an arrangement might be tolerated, but the health of the public being greatly concerned in the rapid removal of all matters which may either engender the forms of disease, for the most part infectious, found in ill-regulated habitations, or may tend to spread such disorders when they arise from other causes, your Committee are of opinion that the introduction of a flushing apparatus where no water service now exists ought to be imposed on the owner of every house, without prejudice to his right to recover the cost from the tenant, if the latter be under an obligation to incur the expense.

81. The other special services provided with cisterns will be of a limited character, under conditions where the waste is not likely to be considerable, and it will be sufficiently guarded against by the arrangements recommended.

82. It has also been objected by some of the witnesses that there is no remedy for one of the chief causes of waste in certain localities, which is to be found in the tendency of evil-disposed persons to take away all fittings of brass or copper.

83. Your Committee have, however, been informed that it is not impossible to remove much of this temptation by reducing the present use of copper and brass in such fittings; but as the removal of the fittings undoubtedly causes great waste of water and loss to the companies, as well as great inconvenience and injury to the public, your Committee are of opinion that the unlawful removal of fittings should be made a specific offence, punishable summarily with imprisonment, and that the sale of such fittings, if marked with some certain initial letters, should be placed under the same restrictions as the sale of stores with the mark of the Crown on them, by which the unlawful traffic in such fittings would be repressed.

84. It has been further objected, that if the constant supply were laid on in each house, there would be great danger of the house pipes bursting in frosty weather; but it has been stated in reply, that this cause of danger may be easily obviated by the water being turned off at the stop-cock at night, and the house pipes being emptied by drawing the water off at the lowest tap in the house. This precaution is so simple as to render the objection undeserving of further consideration.

85. It has been urged by the water companies that a constant supply would endanger the pipes which have been laid down by the owners of houses between the house and the pipes of the company, called communication pipes; but as this would depend upon the arrangements which the company might think fit to make to regulate the pressure or height of the head of water supplied, which would involve much interference with the operations of the company, your Committee recommend that all the communication pipes under the

streets and pavements, up to and inclusive of the stop-cock, if any therein, should be vested in the company, and that all future communication pipes up to and including a stop-cock, should be laid down by the company at established rates of charge, at the expense of the owner, and then vested in the company, and that both those now and hereafter laid down should in future be kept in repair by the company; that it should be penal to use the stop-cock contrary to any rule of the company for cutting off the supply of water.

86. The companies would thus be left free to make their own arrangements so long as they deliver a sufficient supply of water for the upper storey of each house within the limits of height which are or may be prescribed.

87. It may be necessary to make an exception to meet the case of rows of houses of small value. It has been suggested by some of the witnesses that, for the sake of economy, these houses may be supplied by a small iron pipe, running through the houses, with a separate branch pipe and tap for each house. Your Committee recommend that in this case the companies should not be required to provide more than one communication pipe, with a stop-cock at the commencement of the through iron pipe; but it being impossible to define beforehand the occasions when this arrangement may be desirable, it should be left to the inspector to decide in each case in the event of disagreement between the owners or occupiers and the company.

88. Considering the improvements that are constantly taking place, both in economy and perfectness of construction in mechanical contrivances, and the difficulty of providing against inconvenience which may arise, your Committee do not think it desirable that any precise mode of effecting a constant house supply, or any particular kind of apparatus, should be enjoined in a statute, but that the companies should be required, in conjunction with the Metropolitan Board of Works, to frame rules, with power to alter them in like manner, for the purpose of prescribing the arrangements within the house to carry out the general principles above noticed, and that any violation of these rules should be penal.

89. To facilitate the application of these rules at the least possible expense and inconvenience to the owners and occupiers of houses, your Committee recommend that the companies should at the request of the owner or occupier provide all the fittings and apparatus required by their rules, and keep them in repair at established rates of charge, in estimating which due regard should be had to the fact that they would have to make a periodical inspection for their own protection at their own expense; and that when the fittings and apparatus are supplied by others, they should be put up in the prescribed manner, to the satisfaction of the water company, and that for this purpose standard patterns should be kept by the companies and by every local authority in the metropolis.

90. The constant supply of water to each house thus recommended will no doubt entail upon the companies a watchful supervision on the internal fittings and apparatus, for which sufficient powers are contained in the Acts above noticed; but as they will be relieved of the trouble and expense of turning-on the water, which they now have to do under the intermittent system, your Committee do not consider that the companies have any valid objection or claim to indemnity on this account.

240. We may now give a summary of the evidence we have ourselves received on this point.

Mr. Hawksley says that the question of having a constant high level supply in London

is a question of the magnitude of the pipes, and that only. The fact, as regards the piping and the constant supply, is this, that at certain periods of the day, generally between 9 o'clock and 11 in the morning, the quantity of water that is delivered is double the average quantity for the whole twenty-four hours, and consequently the main pipes must be made large enough for that purpose. Where the supply is given on the intermittent system the companies spread the delivery just as they think fit over a great number of hours, as much in one hour as in another, but on the system of constant supply they lose the command of the delivery entirely.

2558. What is your opinion with regard to the constant supply as compared with the intermittent system which is now in operation?—The constant supply is much more beneficial than the intermittent supply *per se*, the difficulty is in changing from the one to the other.

2559. Is that difficulty in the mechanical arrangement in the pipes and taps, and so on?—Chiefly so. Of course you must have a different organization from what you have now—in point of fact there is scarcely any organization—and people must submit to the inspection of their premises from time to time, but that need not be unpleasant nor need it be frequent.

2560. Under proper inspection, assuming always that the pipes are equal to the pressure and the taps properly formed for the constant supply, do you think that the health of the public would be promoted by having their supply of water constant instead of holding it in vessels that are unsuited to the purpose?—As regards the poor I have no doubt that it would be so, as regards the middle and upper classes I do not think there is anything in that point, because we all have in our own houses admirable receptacles for water; it is quite immaterial to us.

2561. Even under proper regulations is it not your opinion that there would be a waste of water with the constant as compared with the intermittent system?—No; that I can give the fullest answer to. On the contrary, where the constant supply is well managed the waste of water is less than upon the intermittent system. I can give you a very remarkable instance, one among a considerable number, but it is so remarkable in itself that it is worth mentioning to you. A few years ago the City of Norwich Waterworks were transferred from a very old-fashioned company to a new one, by whom the system of constant supply had been accepted under an Act of Parliament, that is to say, it was imposed upon them. They tried to work it upon the old principle, and the consequence was that in a very short time the delivery amounted to 40 gallons per head per diem, and that amount of consumption exhausted all their pumping power. They could do no more, and the consequence was that they were obliged to shut off the water at night, and the company fell into a state of ruin; all their efforts were insufficient to check the waste, and the work was very nearly being closed. I was called in amongst other persons, and they obtained a very good manager, and under my advice they applied for an additional Act of Parliament to enable them to correct the fittings. With some difficulty—for the bill was opposed, as is almost always the case, for there is great jealousy about internal inspection, and so on—the bill was carried and it was put into operation, and now and for many years past, although the constant supply has been unfailingly in use, the water is never shut off, and the consumption has descended to 15 gallons per head per diem as compared with 40 previously.

5100-5. Mr. Hawksley agrees that the poor ought to have an abundant and constant supply of water, but they ought to be prevented, by proper means, from wasting it. He says,—

A constant supply, with proper regulation and proper supervision, takes less water than an uncontrolled intermittent supply; but then you must have that regulation and supervision, and if the public will not submit to the expense and will not submit to the inspection, nothing can be done for them; but if the Legislature choose to empower the companies to make it compulsory upon the landlords, through some other authority, to put everything in a proper state of repair, and keep things in that proper state of repair, there is no reason at all why the constant supply should not be granted to-morrow. I do not think that there is any company in London that would think of resisting it; but they are all in a state of alarm now, because they know perfectly well that if they were to turn on the constant supply to-morrow, probably three-fourths of the houses in London would receive no water. I should not get any water myself, it would all be draughted off into the lower districts, and run away in waste. But that is not so in the towns where there is a constant supply, and where those powers are conceded and where they are properly acted upon.

2621-2. Mr. Simpson says the constant service would be a very difficult thing to apply, unless the companies have more power; in fact it must become a question of police, or he does not see how it can be applied. He adds,—

There is an immense difficulty in dealing with the supply of the poorer neighbourhoods, and one which I confess they have never been able to surmount. Some years ago I took great pains on behalf of the Chelsea Company, who were taunted with the want of supply to the inhabitants of Westminster, to lay down pipes from the mains and have water constantly on. Immediately that was done the middle men sold all the cisterns and leaden pipes, and in the next year they refused to pay the money. They said that their tenants had not the water and that they had a right to the water, and in the course of seven years the whole of that work was destroyed which cost the company 800*l*.

We have the greatest difficulty with those small properties. It is nobody's interest to preserve the fittings, at least nobody does interfere. It is a part of the pastime of the children to injure them, and the least thing that would fetch a penny they will steal. The stealing of anything in the nature of metal goes on constantly.

4699. There are such difficulties attending it, and I hear of them on all hands, that I think it is not only a large experiment to introduce, but it would require an amount of interference almost greater, I think, than we should carry out in the metropolis.

4699. 4717. He gives a long statement to show the great difficulties which have been found at New York and in Boston, through the waste of water; and further discusses the subject as will be seen in the evidence.

4055. 4065-76. Mr. Muir, being asked whether he sees any practical difficulties in the way of constant supply, says,—

In London there are no doubt great difficulties. In a town to be supplied for the first time I think everyone would admit the desirability of a constant supply, care being taken to have everything in reference to the fittings of the houses of a proper description, and means being taken to have such supervision as would keep everything in order. The difficulty in London will arise from the amount of change required to make *old* premises ready to receive the constant supply. The position of the New River Company has always been this, that if their consumers will only take the supply without waste there would be no objection to give it on the constant system, and the advantages of the constant system would be very great in the houses of the poor. I think that the one disadvantage of the intermittent system is its needing cisterns that are liable to become fouled; and in the houses of the poor it is a most difficult matter to have cisternage so placed as not to acquire some foulness by vitiated air or other contamination. The New River Company have repeatedly offered to furnish the houses of the poor with a constant supply if the landlords of such property would only take water in some way that would insure the company against waste.

Were a constant supply introduced it would be necessary to have very strict supervision indeed, for the purpose of preventing waste, and if that strict supervision could be borne by the inhabitants, and if the requisite power were granted to the companies or to local authorities to control the condition of things in houses, I think that the supply might be brought within more reasonable limits than it reaches to now.

You have been examined upon that point before Mr. Ayrton's committee, have you not?—I have. Do you advocate the entire abolition of cisterns in the case of a constant supply?—Not at all. I think it would be a very inadvisable thing. I believe the whole question was gone into in the years 1851 and 1852 before Parliament, and the result come to then was that cisterns should in all cases be provided, and it is so arranged in the Metropolis Water Act of 1852. I think in all houses of a better description, where there is a possibility of putting cisterns in proper places, cisterns should still be required, and only in the houses of the very poor should cisterns be dispensed with, and water taken on the constant system through some waste-preventing apparatus.

Although you would retain the cisterns, you would still have a constant pressure upon your mains?—There would still be a constant pressure upon the mains, and a constant pressure upon all mains would be decidedly an advantage, especially for fire purposes. When I speak of mains under a constant system I mean all the companies' pipes, because at present a portion only of the companies' pipes are always charged, and they alone are called "mains" by the companies. Other portions (the branch pipes of the companies) are intermittently charged, and they are called "services." The effect of giving a constant supply to all those pipes would be to enable a direct fire supply by a hydrant to be taken from the "services" as well as from the "mains." But I still say that the difficulty arising out of the enormous expense which would be thrown upon the owners of house property in making houses fit to receive a constant supply would be so great in London, that a general adoption of the constant system here appears to be almost impracticable.

Of what could that expense chiefly consist?—It would chiefly consist in laying down new lead pipes for those at present in use. Many of the lead pipes in London are very old and very feeble, and the least increase of pressure would cause them to give way. The fittings are also of a very imperfect kind. Under the intermittent system those pipes are all saved from the night pressure. The pressure of water at night, when no one is drawing from the mains, is very much greater than the pressure during the day, and as houses are now served, those lead pipes are only subjected to pressure during the day and are saved therefore from the higher

pressure of the night. Under the constant system they would come under that higher pressure, and in the great majority of cases they would give way.

If your view is correct that you could reduce the consumption per head from 30 gallons to 20, there would be a saving in that case of water to the water companies of 33 per cent.?—There would.

Would not that saving of 33 per cent. in the quantity of water that they supply enable the water companies to bear such an expense as would be involved in the alteration of the services to the houses?—I think not.

Would the system of constant supply entail a large expense upon the water companies?—To a certain extent. The New River Company has already incurred a very large expenditure in preparations for the constant supply. It was arranged by the Metropolis Water Act of 1852, that the companies should prepare themselves after an interval to give a constant supply, and that if four-fifths of the inhabitants on any district main should come to a company asking for a constant supply, and put themselves in order to receive it, the company should be bound to give it. Under those Acts of 1852, 1854, and 1857, which I mentioned, the New River Company laid out something like 800,000*l*. in the general improvement of their supply, providing filtering beds, laying down large new leading mains, and constructing high service covered reservoirs, all of which were in preparation for this improved constant supply. As yet no applications have been made for a constant supply, and a constant supply therefore has not as a general rule been given, though there are exceptional cases in the New River district where the supply is constantly on.

What do you understand by the householder putting himself in a position to receive the constant supply?—The lead pipes must be made of sufficient strength by him, that is, for his own sake. He must take the water for the watercloset use out of a service cistern with a double valve, so that there shall not be waste in the watercloset (one valve always being shut while the other is open). While the water is being drawn into the closet the water is prevented from coming from the main into the cistern, and so waste is effectually prevented. He would require to have all his ball-cocks and taps of the best description, and one thing which has been found almost always necessary in every house in which a constant supply has been given is to forbid overflow of waste-pipes from cisterns, so that consumers shall have a very good reason for taking care that ball-cocks are always in perfect working order.

What do you calculate the average to be per house for making those necessary alterations?—I have calculated that on the average, to do the thing properly, it would take something like 8*l*. per house all over London in order to put the houses in proper condition for receiving the constant supply.

That 8*l*. would lie between two extremes; what would it be for a small house, and what for a large one?—I think for a small house it might take 4*l*. or 5*l*., and in larger houses a very great deal more.

Would you say 12*l*. or 14*l*.?—Yes. Where the pipes are built into the walls and have to be cut out and the decorations made good, the expense might be 20*l*. and upwards. In some cases it has been said and often felt, I believe, that the companies obstinately stand in the way of a constant supply. I do not think that at all to be the fact. If a constant supply could only be carried out here in London as it is said to have been carried out in some other places, with a great reduction in the quantity of water consumed, the companies should hail it; it would be a great matter to them to be able to dispense with the services of many turncocks, and save water at the same time.

Mr. Greaves says:—

I myself am rather an advocate for a constant supply on the whole. Of course claiming to have the privilege of putting a reduced orifice somewhere on the pipe so as to prevent inordinate waste, I find no difficulty in giving a constant supply in my district. I have now 25,000 houses out of 92,000 who are continuously from year's end to year's end on the constant supply system. 5156-66.

Will you explain what you mean by a reduced orifice?—Somewhere in the pipe between the pipe which belongs to the company and the cistern which belongs to the consumer, a disc with a small hole in it is inserted so as to prevent the water being drawn beyond a certain speed. That limits the draught of the system, and it saves us from inordinate loss which we know we should suffer, because notwithstanding that we have 25,000 tenants supplied in this way we cannot leave them unguarded, we are obliged to visit and inspect continuously over and over again.

That limits the size of the supply pipe to the cistern?—Yes.

What class of houses do you supply in this way?—We supply without distinction now.

But does that include any of the poorer class of houses?—Yes; in fact seven-eighths, perhaps nine-tenths, of all the houses that we are laying on now we are laying on upon the constant system.

And all upon that principle?—Yes, all upon that principle.

With regard to the poor people your experience would be, I presume, that it is of vital consequence to them to have a good supply of water?—Yes, it is. I advocate giving a complete and good supply to the poor on every possible ground, moral, social, and physical, with reference to the ordinary comforts of life. I think the absence of a proper supply of water to the poor is one of the grievances of the day.

When you do adopt that system and apply a contracted disc for the water to pass through you have of course to assume that you will allow them to have a certain supply in 24 hours?—Yes, certainly.

What do you assume in that case?—I assume, say 180 gallons in 24 hours per house, that is the maximum, that is to say, if they have no ball-cock nor any check upon it and they were to rob me to the utmost they could only take to the extent of 180 gallons a day. A pint a minute is 180 gallons a day.

Have you found that the constant supply to the poorer class of houses has led to any greater waste of water than under the intermittent supply?—I do not think it has.

He also describes some contrivances introduced by him to prevent waste. 5202-5.

Mr. Beardmore considers that under any system cisterns must be used. He says:— 3347 et seq.

I do not see any possibility of dealing with the general humanity, as you may say, without them. If you have such waste as you have in the low districts in London no pipes can furnish water constantly and with high pressure. You cannot deal with it. If you have a fraudulent or a careless man in one house he is wasting water away, and of course he is diminishing the head to the person next door, that is the difficulty you have got—to protect everybody and to give an equal pressure. At this moment I have the general advising and management of a small board of health town near London, and we profess to give a constant service, but it is perpetually breaking down; one wrongdoer opens a cock, and there is the whole thing at an end, and we have perpetual difficulties, and now I am dividing the services. At Enfield, I have reduced the pressure from 170 feet for the low district to about 35, and the landlords of the houses have already thanked us for doing it. The expense of keeping up the fittings was so great that they liked the low pressure better.

He instances the rigid supervision necessary in towns where constant supply is given, and thinks it would be impracticable in London.

Being asked whether the health of the inhabitants would be promoted by the constant supply system, he says:—

I cannot say that, because I think the real evil is the iniquitous state of the poorer class of houses. They have no sort of cistern at all, and if you made it absolutely requisite to have a very moderate amount of cistern, and proper arrangements for taking in the water, and could keep the people from stealing the apparatus, you will be as well supplied by the present system as by the constant system. At present, in the low parts of London, in the east of London, you cannot keep a tap on a pipe at all; everything goes.

He adds further remarks on the subject.

5587-686.

Mr. McClean has adopted the constant service system extensively in waterworks in Staffordshire, and believes it is the proper system. He has found no difficulties in applying it.

3813-18.

Dr. Letheby says:—

As an abstract question, there can be no doubt that the constant supply is a very advantageous thing to the public, chiefly because they would get their water cooler, more grateful, less liable to the pollution to which it is now subject after it is delivered by the water companies, and, if the question really turned upon poor people's houses, I should say that the constant supply to them, whether it be in a court by a standpipe, or whether it be in their own yards by a standpipe, would be a boon, the good of which is hardly to be calculated.

2720-25.

Dr. Lyon Playfair expresses his opinion of the advantage of constant supply, which he says

Delivers the water always cool and in good condition; it obviates the necessity for a number of cisterns in badly ventilated houses, and especially in the houses of the working classes, and so prevents a great source of the danger of epidemics which arise from the solution of the polluted atmosphere in the water.

3162-8.

Dr. Parkes prefers the system of constant supply as doing away with the evils of house storage. He says,—

“There are great sanitary advantages in a constant supply, namely, in doing away entirely with the house storage. The house storage entails a great chance of the water being impure, either from the cisterns being allowed to get filthy or from substances finding their way in from the overflow pipes communicating with sewers and drains, and gases forcing their way back through imperfect traps. All these evils the constant supply entirely does away with, but the disadvantages of the constant supply are certainly the very great quantity of water that is wasted, and the occasional failure at times when it is very important indeed to have a large supply of water. For example, last year, in Southampton, in the time of the cholera, when it was extremely important to have the drains well flushed, and everything carried out, we had rather a failure in the supply of water in the low parts of the town. The population in the higher part of the town being nearer the reservoir used a very large quantity of water owing to the dryness of the season, also their gardens required a large quantity of water, and this was taken from their constant supply. At the same time there happened to be also some alterations going on in the pipes and in the machinery, which also lessened the quantity. The consequence was that we were unable in the low parts of the town for several days during the prevalence of the cholera to ensure a proper quantity of water passing through to the sewers.”

“Assuming that you have an ample supply for the whole population of a town, are you of opinion that the system of constant supply for all sanitary purposes is infinitely superior to that of an intermittent supply?—Quite so, if you can get over the practical difficulties and the enormous waste, but I think that if you have the constant supply it must be understood that there is to be no stint in the water in any part of the district at any time as there appears to be in some towns which are supplied with the constant service.”

2771 *et seq.*

Dr. Simon considers the system of intermittent supply to be a very bad one, for reasons he gives at considerable length.

“Do you consider the system of intermittent water supply to be a good or bad one?—A very bad one.

“What is the reason which induces you to consider it a bad one?—My opinions about it are substantially those which I expressed in 1849 and 1850, in the following passages of my reports then made. From report of 1849:—“I consider the system of intermittent water supply to be radically bad, not only because it is a system of stint in what ought to be lavishly bestowed, but also because of the necessity which it creates that large and extensive receptacles should be provided, and because of the liability to contamination incurred by water which has to be retained often during a considerable period. In inspecting the courts and alleys of the city, one constantly sees butts for the reception of water, either public or in open yards of the houses, or sometimes in their cellars, and these butts, dirty, mouldering, and coverless, receiving soot and all other impurities from the air, absorbing stench from the adjacent cesspool, inviting filth from insects, vermin, sparrows, cats, and children, their contents often augmented through a rainwater pipe by the washings of the roof, and every hour becoming fustier and more offensive. Nothing can be less like what water should be than the fluid obtained under such circumstances, and one hardly knows whether this arrangement can be considered preferable to the precarious chance of scuffling or dawdling at a standcock. It may be doubted, too, whether even in a far better class of houses the tenants' water supply can be pronounced good. The cisternage is better, and all arrangements connected with it are generally such as to protect it from the grosser impurities which defile the waterbutts of the poor, but the long retention of water in leaden cisterns impairs its fitness for drinking and the quantity which any modern cistern will contain is very generally insufficient for the legitimate requirements of the house during the intervals of supply. Everyone who is personally familiar with the working of this system of intermittent supply can testify to its inconvenience, and though its evils press with immeasurably greater severity on the poor than on the rich, yet the latter are by no means without experience on the subject.”

He goes on to explain the large waste which takes place on the intermittent system, and which, he conceives, reduces the average available supply for domestic purposes within the city to only a quarter of its alleged quantity.

Mr. Holmes, the borough surveyor of Sheffield, says he does not see any advantage 4884. in substituting the constant for the intermittent supply except in case of fire; there must be a great waste in the former, going on by night as well as by day. He adds, however, that with pipes capable of withstanding the pressure, he would prefer a constant supply.

Mr. Dale is arranging a constant supply to Hull. He has found no inconvenience; 1107-19. on the contrary, the leakage is less when the constant supply is given. The inhabitants prefer the constant supply. He says in reply to the question—

“Have you experienced any inconvenience arising from the constant supply?—None at all; far from it; there is far less leakage I should say, and I have tested it in fact. I should say that on the eastern portion of the town there is a saving of 25 per cent., or say 20 per cent. to be on the safe side, in the leakage, compared to what there is on the other side of the town.”

He explains how he tested the quantities supplied to each side of the town, and further adds—

“Have you had any complaint from the inhabitants with regard to the change of system?—The inhabitants are continually crying out for a constant supply, they prefer it to intermittent.”

Mr. Quick gives evidence as follows in regard to constant service:—

“I think that in the poorer districts it might be an advantage, but I think that practically the better class 6014-92. houses have the best constant supply that they can have by having a good cistern in their houses, by means of which, in the event of any interruption from the breaking of a main, or a conflagration in the neighbourhood, or anything of that kind, they have a supply of water which will last them two or three days in their own cisterns; whereas if they merely depended upon a pipe passing into the house, the moment that there was any interruption to the flow in the main they would be deprived of that accommodation.

Then are we to infer that you are not in favour of the constant supply system?—I think that it has its evils. Perhaps in a poorer neighbourhood it might be an advantage, but I think where cisterns are properly taken care of and cleansed, and so on, that is the best constant supply that anyone can have. In fact, I do not know how the constant supply system is to be arranged in a house, where the kitchen boilers, for instance, require constant filling; and with regard to waterclosets, again, it would be an exceedingly inconvenient thing to have water absent from the house probably for 24 hours in the case of an accident to a main, or anything of that kind.

Are the accidents to the mains of which you speak frequent?—The large valves want repairing occasionally, and the mains will break now and then, and alterations are necessary, such as putting on new branches to a main, and when the main has to be cut out and a connexion made to it to go down a side street during the whole of that time, which may occupy several hours, if there were no storage the people would be deprived of water.

Mr. Quick gives a statement of 4,300 different works done in the Southwark and Vauxhall Company's district during the year 1866, in each of which cases it was found necessary to keep the stopcock on the main or service pipe shut for periods varying from one to twenty-four hours.

Being asked whether the expense of keeping the pipes and fittings in repair would prevent the system being carried out, he says—

We find great difficulty in getting the owners of small property to lay out a single sixpence for benefiting their tenants in any way, and I am quite sure that any representation that the companies could make would never induce them to do it unless there were some legislative power to compel them.

Has your attention been directed to the principle of a constant supply in regard to its effect upon the public health?—I think, as I have stated before, that in the poorer districts there would be a great advantage from the constant supply, but in the better class of property I cannot conceive that there would be any advantage at all in respect of health.

A constant supply would have its advantages for the purposes of fire, would it not?—I think there is a great question whether it would or not.

I mean under proper pressure?—That is the difficulty. If there are so many thousands of taps in connexion with the mains, there will be always a certain amount of draught passing into the district which will lower the pressure. At the present time the whole of the trunk mains or principal mains of the district are kept under the full pressure all night, and in case of fire they have only to open one of the side cocks and direct the water to the particular place where the fire may be burning, and all the pressure can be directed by merely opening these one or two cocks, whichever it may be.

But I wish you to direct your attention not to such a pressure as that the fires might be extinguished from the hydrants by application of the hose, but to such a pressure as would keep the pipes charged and the supply sufficiently full to be pumped by means of a separate fire engine.—That can always be done by the mere opening of one of the side cocks leading from the trunk main.

The difficulty now is to find water, is it not, in case of a fire?—The water is always in the main. A recent case occurred where water was not to be obtained in any quantity for useful purposes for more than 20 minutes after the fire, and the destruction was pretty well completed, how do you account for that?—I think that that arises principally from a want of understanding between the brigade and the water companies.

Being asked what it would cost to put the fittings into proper order to receive the constant supply, as required by the Act of 1852, he says:

It depends upon the class of house, in some cases it might cost 2*l.* or 3*l.*, and in others 10*l.* or 15*l.* per house.

In the present system of supply is it not one of the great objections to the cistern system that those cisterns are not kept clean by the owners of the houses themselves?—That is so.

And if they got the water direct from the pipes, they would get it, would they not, in a purer condition?—There is no doubt of that.

Your view perhaps would be that it would be a necessary thing to have a combination of cisterns and a supply direct from the pipes in the same house?—Yes.

Up to the present time the practical effect of the clauses in that Act of Parliament has been, has it not, that no company has been called upon by the inhabitants to give them a constant supply?—That is so.

Do you think that the water companies themselves would object to it if they were called upon by the inhabitants, and if the inhabitants were to do their part of the duty?—I do not think they would. Of course the water companies would have to lay out a very large sum of money to enable them to do it, and I had perhaps better explain why that would be so. It is on account of the undulations in the districts. In the Grand Junction district there is some portion of it but little above the level of the Thames, whereas other portions are nearly 200 feet above the level of the Thames, and it is constantly rising and falling; and of course if the water is allowed to run to waste in any way in the lower portions of the district, unless there is a division of the trunk mains the high portions would never get any water at all.

Still there would not be an objection on the part of the companies to that outlay?—I think not, if proper provisions were made.

And it would necessarily be attended with much greater stringency of supervision on the part of the water companies?—Yes.

Do not you think that the result would be great economy in the consumption of water per head?—There might be an economy in the quantity of water pumped, but the difference of cost to the companies would not be any very great deal. You would not reduce the expense of management, or labour, or anything of that kind; it would be the mere expense of pumping.

Still there would be economy in the actual consumption per head?—Yes; there is no doubt there would be less water used, supposing that all the fittings were put in a proper state to prevent waste.

Mr. Morris's evidence is as follows:—

6155-60.

But you think that a constant supply would be a very good thing?—I do, if we could once prevent waste, or if we had power given to us to prevent it, or any mode were devised by which we could get rid of the enormous waste which is attendant upon a constant supply as carried out under the present system, we have no objection.

When you say if you could get power given you to do so, have you ever considered what powers would be satisfactory for preventing waste?—I think that the power which would be required must be vested in what we may call a water police; there should be a constant inspection, which I know that the public would not bear, but unless we had power to exert that, it is perfectly out of the question. I have made some experiments, and I know that people have wasted as much as 2,000 gallons a day per house for a twelvemonth together.

Having regard to a properly arranged system of supply, pipes of sufficient strength to resist the pressure, and an efficient supervision, you are of opinion in the first place that a constant supply would produce a great saving of water, and in the second place promote the health of the inhabitants?—I will confine myself to the saving of water. I have no doubt there would be a great saving of water, but the restrictions must be very stringent, otherwise it would completely absorb the whole of our power of supplying; you might pour water upon the sea beach with as little effect.

You think it necessary, if I understand you aright, to have some very stringent police regulations?—I do not say police, but something of that nature, persons armed with authority who could go into the houses and prevent waste.

6269.

Dr. Frankland says:—

“With regard to the deterioration of the water by storage in cisterns and in tanks, I think that too strong an opinion can scarcely be expressed. In my own house, when I first went to it, I found that the waste pipe from the cistern which was to supply us with water was not furnished with a trap at all, but that there was free communication between the sewer and the interior of my house through this pipe, and sewer gases were brought just upon the surface of the water in the cistern, and I believe that is the condition of most of the houses around me at Haverstock Hill.”

6589-6604.

Mr. Bateman has given us a paper he wrote on this subject a short time ago, and which, as it is well worthy of attention, we have reprinted in Appendix I. He advocates the constant service system, but it will be seen that he is by no means insensible to the great difficulties that would be met with in making the change in London. He adds, in his evidence, remarks as follows:—

“I may state that my own opinion is that a constant water supply under high pressure in the existing state of the plumbing in London would be almost impossible, and that it is necessary that very stringent powers be given to the companies or to a corporation, if it had the administration of the water, to compel all the parties to put their water fittings into perfect order before the constant supply was given. Even the Welsh district would be almost insufficient to supply London under the constant system, as the fittings are now; but if proper care be taken that the fittings be all properly put in order, and a very strict supervision exercised, I find as a matter of experience that towns supplied under the constant system do not take more water than those which are supplied under the intermittent system. The consumption of water in Glasgow is 50 gallons per head per diem, where water fittings are as bad as they can be, as bad as they are in London (and that is about saying the worst thing for them), and the waste is very great indeed; I forewarned them against this, and for a time very active supervision reduced the waste after the introduction of the Loch Katrine water; but they consider that they have an inexhaustible supply and that it tends to sweeten the Clyde and flush out the sewers, and they allow the waste to go on, but all that might be corrected.”

He further adds particulars as to the advantage of constant supply in cases of fire, as illustrated in Manchester. He says:—

“The per-centage of property destroyed from 1846 to 1850, before the introduction of the water, was 21·3 per cent. of the value of property attacked by fire. The amount saved out of such property was 78·6 per cent. From 1851 to 1855, Manchester, for half the time at least, not having advantage of high pressure, and for the latter two years of the time having it, and therefore it would be partly under the old system and partly under the new, the per-centage of property destroyed was 12·9 per cent., and of that saved 87 per cent. Then came the advantage of the constant supply and high pressure, with a full water supply, and from 1856 to 1860 the per-centage destroyed was only 7·7 per cent., being only one-third the amount which was destroyed

before the introduction of the fresh water supply, and the amount saved was 92·2 per cent. From 1861 to 1865 the amount of property destroyed was 6·7 per cent., and the amount saved was 93·2 per cent.”

He believes that the expense of alterations in the houses, to receive the constant service, has been much overrated as regards the better class of dwellings.

Mr. Rendle, a medical gentleman who has been very active in promoting sanitary improvements in Southwark, gives examples of the defects in the London supply, for which he believes constant service is the only remedy. 6749 et seq.

Mr. Heron, town clerk of Manchester, states that no difficulties of importance have been found in introducing the constant service into that city, and that in the small houses cisterns are dispensed with. There are, however, no waterclosets in the small houses. The arrangements for extinguishing fires are very complete and efficient. Cisterns are useful in cases of stoppage of the supply in the main, though such accidents seldom occur. 7330-41. 7349-53. 7367-70.

His impression is in favour of the economy of the constant supply, but the regulations to prevent waste must be very stringent. He says:—

“We have most ample powers with reference to fittings, and also for the purpose of inspection.

“7388. Would not a similar power be a matter of absolute necessity in the case of London being put upon the constant supply system?—I should think it absolutely necessary in any case. I think it is quite right that whoever is supplying water, whether it is a corporation or a company, should have ample power to see that the water is not being improperly wasted.

“7389. Do you find any complaints from owners of property of such supervision being at all inquisitorial?—Not at all; I never heard a complaint of the kind, and we have found it to be most necessary.”

He gives, in answer to question 7390, a list of the regulations provided by Acts of Parliament for this purpose.

Remarks by the Commission.

241. We are of opinion that the mode of distribution is a most important point, particularly as bearing on the health and comfort of the poorer classes; and we agree with the conclusions arrived at on previous public inquiries, that earnest and prompt efforts ought to be made to introduce the constant service system to the farthest extent possible, in the supply of the metropolis.

242. The provisions of the Act of 1852 in this respect appear to have been ineffectual, and we are not unimpressed with the difficulties of the case, which we fear would be beyond the power of being successfully dealt with by the present companies. The legal powers they now possess would not be sufficient to enable them to control the house arrangements, or to check the enormous waste that would arise on the introduction of the new system. And we do not see our way to recommending that they should be invested with new powers which, if they are to be effectual, must be of too inquisitorial a character to allow of their exercise in private hands.

We cannot adopt the suggestions of the House of Commons' Committee of 1867 as to how the details of the arrangements should be carried out, believing that such technical details can only properly be dealt with by competent professional skill, and that they must be carefully determined under the guidance of the experience gained in the process of change. The same Committee recommend, among other things, that the companies should combine with a metropolitan public body to frame rules for controlling the house arrangements, any violation of such rules being penal; but we believe it would be difficult for any such complex arrangement to be made to work satisfactorily.

243. After mature consideration of this important question, we have come to the conclusion that the constant service system cannot be effectually carried out in London so long as the supply remains in the hands of private companies, and we have explained, in Section IV. of this part of our Report, in what manner we conceive the change may be effected.

In any case, however, such a change must be introduced very gradually, and with the greatest precautions, particularly in the poorer and lower districts; and even with all possible care preparations must be made for meeting considerable loss of water in the earlier periods of the alteration.

COMPULSORY SUPPLY TO THE POOR.

244. Connected intimately with this subject is that of furnishing a compulsory supply to the poorer districts.

It has been established by law that the supply of water, being a necessary of life, must not be left optional; for though every arrangement may be made for affording a

proper supply wherever it is demanded, experience has shown that it is necessary in many cases to enforce its reception.

We have reason to believe that the companies honestly do their best to supply the poor, and are inclined to be liberal in their arrangements for this purpose; but they complain of the great difficulties they have to encounter.

The Committee of 1867, after reciting the legislative provisions applicable to this purpose, say:—

“These various provisions of the law would seem to be ample for the purpose of ensuring a due supply of water for all purposes for the inhabitants of the metropolis in every house, but your Committee regret to state that they have hitherto failed to effect this desirable object, more especially in the cases where a proper supply of water is most essential.”

They recommend an improved system of inspection, under the auspices of a metropolitan public body, and certain alterations in the manner of levying the rates; but we are of opinion that in this case also, the same complete change is called for as in the case of the constant supply.

SECTION IV.

GENERAL CONTROL OF THE WATER SUPPLY.

245. In a matter of such vital importance to the health of a large population, we consider that it becomes a serious question in what hands the control of the water supply should be placed.

246. The duty of supplying the inhabitants of a city with water has from a very early period been regarded as a peculiarly municipal function; and the supersession of the municipalities by joint-stock companies is a comparatively modern innovation, assuming the New River Company to be the earliest case in point.

Since this case the private companies have very generally exercised the functions in question; but of late years many towns in England have come to the conclusion that the new practice was a fundamental error, and have resumed the ancient principle by taking the control of the water supply again into their own hands. Manchester, Glasgow, Liverpool, Dublin, Bolton, Bradford, Halifax, Leeds, Rochdale, Preston, and many other towns, are instances where this has been done.

247. We have had Mr. Heron, the town clerk of Manchester, before us, and he has given evidence as to the circumstances under which the water supply was taken into the hands of the corporation. The following are extracts:—

7270. “In 1845 the attention of the corporation was more especially directed to this subject; we were in a most lamentable condition, and it was quite clear that some complete change was necessary. Perhaps I may be allowed to state that about that time the second report of the Health of Towns Commission was published—a commission over which the Duke of Buccleuch presided—and which I have no doubt is familiar to this Commission, for in that report it seems to me the subject is almost exhausted; we found it stated that ‘the importance of an ample supply of good water, accessible at a price within the reach of the poorer classes of society, and in far greater quantities than have hitherto been furnished, is a subject worthy of the greatest attention.’”

7276. The report states: “It appears to be generally admitted by witnesses examined before us, who, being themselves connected with existing water companies, have had every opportunity of observing the effect of the opposing interests of the companies and their customers, that a copious supply of pure water cannot be secured to the poorer classes of the community, unless the duty of providing it is placed under the management of some independent body. It should be the duty of the local administrative body not only to secure a sufficient supply for all the inhabitants, but, by contracting with or purchasing it of the water companies, to ensure its regular distribution at a fair remunerating price.” Another recommendation was—“With a view of ensuring a sufficient supply and proper distribution of water to all classes, we recommend that it be rendered imperative on the local administrative body charged with the management of the sewerage and drainage to procure a supply of water in sufficient quantities not only for the domestic wants of the inhabitants, but also for cleansing the streets, scouring the sewers and drains, and the extinction of fire. For this purpose we recommend that the said body have power to contract with companies, or other parties, or make other necessary arrangements.” A further recommendation was—“We recommend that as soon as pipes are laid down, and a supply of water can be afforded to the inhabitants, all dwelling houses capable of benefiting by such supply be rated in the same way as for sewerage and other local purposes, and the owners of small tenements to be made liable to pay the rates for water, as we already recommended in respect to drainage.” The corporation at that time felt so satisfied that it was desirable to carry out those recommendations within the city of Manchester, that we determined to go to Parliament to take power to purchase the works of the existing company, and to go for a large scheme which we believed would be sufficient for our present and prospective wants. But we determined also to go beyond those recommendations, because we determined, believing that it was only right and just, to introduce the principle of a public rate, and I believe it was the first time that the application was ever made to Parliament to obtain power to levy, in addition to a compulsory domestic water rate, a compulsory

public rate, payable in respect of all property of every description within the city. We applied to Parliament in 1845, and then and by subsequent Acts obtained power to carry out a scheme which is not yet, I am sorry to say, completed. In 1848 we went for a second Act, which was simply to enlarge the scheme which was proposed by the Act of 1847 and since then we have had to go for other Acts of Parliament to obtain additional power, both with regard to the scheme itself, and also for carrying out in detail works within the city and the adjoining districts which we supply.”

Mr. Heron remarks that one result of this has been that the corporation have been enabled to carry out a plan of water supply of such magnitude as could not have been accomplished by any private company. He says:—

“I feel perfectly satisfied that we should never have had such a scheme carried out unless we had 7314. undertaken to do it ourselves. Besides, the expenditure which we undertook was such an expenditure that it is quite certain no private company would ever have dreamt of encountering; nor was it one which they would have been justified in undertaking. A private company could not have acquired the money. If it had asked Parliament they would not have granted them the powers that we obtained; and it is only by the exercise of those powers that we have been enabled to incur such an expenditure, and to supply, as I think I can show you we do supply, water at a very low price to the inhabitants of the city.”

He then goes on to speak of the advantages to the town:

“You are of opinion, are you not, that the supply of water and of gas to any large town should be in the hands of the municipal authorities?—I think the experience that we have had in Manchester has shown to us most clearly that the advantages are very great indeed of the supply being in the hands of the corporation. 7316-8.

“Are you now supplying water, not only more abundantly, but of a much purer quality, to the inhabitants of Manchester at a less cost than that at which they obtained their supply prior to 1845?—At a very much less cost, and we are giving them an unlimited supply of, as we have always thought, as pure water as is obtainable.

“Does that reduction in cost arise from your mode of spreading the burden of supply over all the rateable property as compared with the charge made by a private water company on domestic dwellings only?—In the first place the public rate goes necessarily in reduction of the charge that is to be made for the domestic supply within the city. That is the first important item, and which is obtained by the power which we possess to rate all property within the city. In the second place, no doubt as the question suggests, we can rate all dwelling houses, whether they take the water or not, (but they do take it, every house within the city takes it,) and this power diminishes considerably the amount which would otherwise have to be charged if you were only supplying, say, half or two-thirds or three-fourths of the houses; the cost is the same, the water is there, the water has been obtained, and it costs no more to supply the whole, assuming that we have got the water, which is the fact, than it would to supply three-fourths or one-half of the dwelling houses.

“I gather from your own experience in the case of Manchester that you are thoroughly convinced of the advisability of all corporations undertaking the water supply themselves?—I am perfectly convinced of it. 7355. I think the reasons are unanswerable, and one of the strongest reasons is, first of all, that they may obtain power to rate the inhabitants, which I do not suppose would be granted to any private company; they get power to rate everybody whether they take water or not, so as to spread the expense over the largest possible area, and they get that which after all is one of the objects of greatest importance, and I think so reasonable and so just—they get power to tax the whole of the property within the area with a public rate, which is in reduction of the expense of distributing water amongst the domestic consumers.”

The corporation are stated to have the power of levying two rates, one a public or 7277-88. general rate on all property, which is fixed at 3*d.* in the pound, and secondly, a special or domestic rate upon all dwelling houses, which is 9*d.* in the pound, making in this second class of property 1*s.* in the pound on the rateable value, or about 10½*d.* on the gross rental. For the 3*d.* rate no water is specially supplied, but the rate is a contribution for the advantages secured to the whole community by their protection in case of fire, cleaning streets, flushing sewers, &c. The 9*d.* rate is for water actually supplied for 7395. domestic use. Water is further supplied for manufacturing and trade purposes at prices agreed upon with the corporation.

Mr. Duncan, the acting engineer to the Liverpool Corporation Waterworks, says that 2429. his experience is most decidedly in favour of the corporate bodies in large towns having the entire charge of the water supply. He considers the question is so mixed up with the general health of a town that it is almost impossible to separate it from that view of the subject. In all those towns in England where this has been done the tendency has been altogether in the direction of improvement. Corporations are more easily influenced than companies who have dividends to draw from their supply of water.

Mr. Hawksley, however, the consulting engineer to the same works, is not favourable 2564-6. to corporation management, public bodies being he thinks more under external influences, and less inclined to be liberal in their expenditure. He admits that a large scheme of improvement for such a city as London could not be carried out by divided companies, but he would prefer amalgamation.

Mr. Bateman, as we have noticed in our description of his scheme, relies on the assumption by the public of the water supply as the only possible means of carrying out any great measure of improvement. He suggests that for such a purpose London App. E. has only to follow the example of various towns, where of late the waterworks of companies have passed into the hands of corporations; and he instances Manchester and Glasgow as the two most prominent cases of success.

2838.
7127.

Mr. Simon speaks of the great power which water companies hold in regard to the health of the populations supplied by them; and states that he feels very strongly that the public requires more protection than it yet has against their occasional malfeasances. He says:—

“This power of life and death in commercial hands is something for which, till recently, there has been no precedent in the world, and even yet the public seems but slightly awake to its importance.”

248. The expediency and advantage of consolidating the water supply under public control are manifest on many grounds.

In the first place such a measure affords, we consider, the only effectual means of carrying out, in the metropolis, the system of constant supply. We have stated, under the last head, that we conceive the difficulties of introducing this system would be too great to be efficiently overcome by private companies; inasmuch as the great powers necessary for the purpose could only be confided to some public body who would be responsible for their proper application. The unity of action, and the extent of command that would be possessed by such a body, would enable the difficulties to be grappled with far more effectually than could be done by divided and private companies; the divisions of districts would disappear, and hence the store reservoirs and mains might be re-arranged with a special view to the new system of distribution; and the inhabitants would be much more likely to fall in with rules and arrangements established by a public body having no independent interests, than with those made by commercial companies.

Secondly, this measure would offer the best mode of ensuring a proper supply of water to the poor, which, as already stated, has been found impracticable under the present system. For a public control would involve compulsory rating, under which all difficulties of a financial nature, which are the only ones really formidable, would necessarily disappear.

Thirdly, we believe that the consolidation of the various present interests would tend largely to economy. The fusion of the districts; the more convenient re-arrangement of the distribution; the abolition of the several and widely dispersed centres of action; the uniformity of management; and many other beneficial effects of the measure, would all result in saving.

Fourthly, the transfer would tend to improve the quality of the supply, not only by checking the tendency to general abuses, but in particular by ensuring more effectual filtration, which is greatly needed, and which it appears difficult to enforce under the present system. We have already remarked on the neglect of the companies to comply with the provisions of the law in this respect, and may here add that this neglect calls either for more stringent control, or for a more effectual change. If the frequent examination and testing of the water, under public management, showed at any time that the filtration was inefficiently carried out, the public, instead of uselessly complaining, as heretofore, would have the remedy in their own hands.

Fifthly, the change of ownership would increase the probability of beneficial results from the measures already enacted, or any further ones to be enacted, for the purification of the Thames. It is possible there may be some difficulty in effectually carrying out these measures; and we believe that a public body having charge of the water supply would be far more likely to stimulate efficient action on this point than individual commercial companies, who have little power to interfere in the matter. And if, at a future time it should be found desirable to undertake any large and comprehensive measure for increasing the quantity of water, whether from the Thames basin or elsewhere, or for further improving its quality, such a measure could only be carried out by combined action, of which the consolidation under public control would be the most advantageous mode.

Sixthly, this measure would much facilitate the provision of water for all public and municipal purposes, and in particular for the important object of extinguishing fires. The documents we have printed in Appendix BL. furnish an appropriate illustration of the urgent necessity of some change in the latter particular.

249. But independently of these advantages, we believe the public management to be far more correct on general principles than the supply by joint-stock organization, which is obviously only applicable to those cases in which a fairly remunerative return may be anticipated for the capital expended. But a sufficiency of water supply is too important a matter to all classes of the community to be made dependent on the profits of an association.

We are hence led to the conclusion that future legislation should restore the ancient practice. The various important considerations above mentioned;—the increase in wealth

and rateability of the great centres of population;—and the facility and advantage with which, in the cases brought to our notice where the requisite powers have been conferred, these powers have been exercised;—all point to such a solution of the problem.

250. Under this system it would be necessary to abolish the voluntary buying and selling arrangement now subsisting between the consumers and the companies, and to adopt the plan of compulsory rating as at Manchester, Glasgow, and elsewhere. Two rates should be enforced; one a special or domestic rate on all dwelling houses, the other a public or general rate upon all rateable property.

Such rates would assess all property much more equitably than the present tax upon consumers. The cost of the supply of water for extinguishing fires, and for general public objects, ought clearly to be borne rateably by all ratepayers; and to assess such burdens solely on the customers of the water companies is a manifest violation of all equitable commercial principles.