Of

Telb on the Serpentine
Rumsey's Report on Supp
Leicester
Clay on the Supply of
Board of Health Report
Homersham on Metrop
Hassall's Microscopic
of Water of Lond
Robertson on the Buxton Water
Napier on the Safe Sewage of
the Surrey sands
Aitken & Taylor West Middx Report
Rowlandson on Napier's Scheme
Rumsey on Southampton Water Supply
Wicksteed's Reports on the
Leicester Supply & Sewage

Report

ON

THE WATER

OF THE

WEST MIDDLESEX WATER-WORKS Company.

BY

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AND

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APRIL 1851.

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REMARKS.

Having been requested by the Directors of the West Middlesex Company to make a complete analysis of their Water, we here publish a summary of the results. It is proper to state that the Company left it entirely to ourselves to fix the time for taking the samples. The localities selected embraced various points from the Thames inlet to a private dwelling-house in the Regent's Park; and therefore presented the water in all those conditions in which it was likely to undergo any change in quality. The samples were taken in our presence, and they were retained in our custody until the analysis was completed. The subjoined report contains the facts, and we here offer a few preliminary remarks for the information of those who are not accustomed to the perusal of scientific documents.

Water to be *wholesome,* and fit for dietetic use, should be free from colour, taste, and smell. It has also been considered indispensable that it should be free from vegetable, animal, and mineral matter: but universal experience is adverse to this view. All terrestrial water, or that which has once reached the earth, dissolves some organic and mineral matter: but the properties of the water for dietetic use are not thereby injured, provided the quantity dissolved do not exceed a certain proportion, and the substances dissolved are not of a nature to render the water noxious or unwholesome. The special object of a chemical analysis is to determine these two points.

Water may be free from colour, taste, and smell, and yet contain so large a proportion of carbonate and sulphate of lime as to render it unsuitable for household purposes. The shallow well-water of the chalk district is of this kind: it is in general much impregnated with carbonic acid, so that the calcareous salts are in a great measure concealed by its cool and fresh taste. The quantity of saline matter varies from fifty to one hundred grains in the imperial gallon: such a water is invariably hard, and causes a thick curd with soap. Other kinds of water are found to contain so small a proportion of saline matter that not more than four or five grains of solid residue are obtained by the evaporation of an Imperial gallon. This kind of water is pre-eminently soft; but as a general rule it cannot be safely transmitted through leaden pipes, or stored in leaden cisterns. The water of the Bagshot sands is of this description: its great freedom from saline matter led to its becoming impregnated with lead, and caused the poisoning of the Queen's hounds, as well as an attack of painter's colic in one of the huntsmen*. In another case, the same description of water led to the poisoning of thirteen out of thirty-eight persons in the establishment of the Royal Family of France, at Claremont†. Under the present mode of distribution and stowage, therefore, a water may be so pure as to endanger health and life by its action on lead. It is necessary that this fact should be fully impressed on the mind, or otherwise the excessive *purity* of water may become an unsuspected source of injury to health. Although all *soft* water does not necessarily act upon lead, the above facts, as well as the analyses of Messrs. Brande and Warington, prove that the Bagshot water is beyond doubt exposed to the risk of noxious impregnation by contact with this metal.

The WEST MIDDLESEX WATER occupies an intermediate position between very hard and very soft waters. The saline contents do not exceed twenty grains in the Imperial gallon, and the salts are not of a nature to affect health injuriously. They are in much smaller proportion than in a large number of potable waters, including all the varieties of well-water. The water has also this property: when boiled it becomes as soft as the very soft kinds of spring water, and is then well fitted for washing, cooking, brewing, tea-making, and other household purposes for which soft water is required. The statements to the contrary have been made by persons who have assumed that the *boiled* water retains all the hardness of the cold water, when our experiments, and those of other chemists, have clearly proved that it is reduced at least one-half‡.

The allegation that this water occasions a great and unnecessary waste of *soap* and *tea* is altogether unfounded. A water containing less calcareous matter would dissolve soap much more readily;

* Dr. Clark's evidence, Appendix No. III. on the Supply of Water to the Metropolis, page 157.

† Report by Dr. Gueneau de Mussy, Dublin Quarterly Journal of Medical Science, May 1849, p. 417. The Hon. W. Napier, in a recent pamphlet on "Soft Spring Water from the Surrey Sands," refers this lamentable accident to the presence of an excess of carbonic acid. The comparative absence of saline matter and exposure to air satisfactorily account for the poisoning of the water, without reference to the supposed excess of carbonic acid, concerning which nothing is said in the authentic report of the case.

‡ See Dr. Clark's evidence, Append. No. III. on the Supply of Water, p. 161.

and, in our apprehension, lead to a much greater waste of this article than now occurs, unless the quantity assigned for a given use were strictly limited by weight. Absolutely pure water will dissolve soap to an almost unlimited extent; and it has been erroneously inferred that when the solvent power of the water is increased, the quantity consumed will be less. The hardness of the West Middlesex water is not such as to create unnecessary waste in order to produce detergency; while it prevents that unlimited solution of the soap which must happen with pure water when no restriction is placed on the quantity used. In reference to the effect of boiling, we shall only remark that the water is so much softened by this process that any objection on the ground of hardness for washing purposes, cannot exist.

In our Report, we have sufficiently dwelt on the effect of this water in extracting the flavour and strength of *tea*. It cannot be denied that very hard water interferes with the process of tea-making. The infusion is not so strong as it should be, considering the quantity of tea employed. While we admit this to be true of hard well- and spring-waters, we deny its application to the West Middlesex Water. Direct experiment shews that there is no appreciable difference in the strength of the infusion of tea, whether absolutely pure or *boiled* West Middlesex water be employed; and the statements to the contrary must have arisen from the hardness of the water in its unboiled state, being taken to represent its condition when used for the making of tea. This, however, is a manifest error which it is unnecessary to expose further.

It will be seen from the Report that the West Middlesex Water is not liable to acquire any noxious impregnation from *lead*. When the saline substances which it contains, and which give to it its moderate degree of hardness, are separated from it by distillation, the water acquires a well-marked impregnation from lead by a few minutes' contact with the metal. It is, therefore, evident that this saline matter confers on it the property of resisting this chemical action on lead. We have further ascertained, by diluting this water with variable proportions of absolutely pure or distilled water, that the action on lead became more and more apparent, until the water contained so little saline matter that the point of danger was reached. The innocuousness of this water supplied through lead, is inferred from direct experiment with the metal immersed in the water for long periods under circumstances favourable to chemical action, as well as from the observation that no injurious effects have followed from the constant use of the cistern-water (No. 7) during a period of seventeen years. The statements which have been published respecting the action of some kinds of *hard* waters on lead, do not apply to the West Middlesex Water either in a chemical or medical point of view.

Another property assigned to good water is *pure aeration*. The only gaseous constituents found in this water, were oxygen and nitrogen (air) with carbonic acid. Of the two former, water dissolves but a very small proportion, while the latter is dissolved by it in large quantity. The quantity of the latter was sufficiently large to give freshness to most of the samples. In this respect, therefore, the water may be regarded as pure and wholesome.

Lastly, we may remark, that the proportion of *organic matter* contained in this water is so exceedingly small that in our judgment it cannot affect health. It would be scarcely possible to procure potable water in large quantity entirely free from organic matter: and when the proportion is so small as not to affect the colour, taste, or smell of the water, there is no reason to believe that injury to health can result from its presence. We have submitted the clear and sedimentary portions of the whole of these waters to a *microscopical examination*, and have found vegetable matter with a few living infusoria (paramecia and monades) *only in the brown sediment*, which had been allowed to accumulate from about sixty ounces of Nos. 1 and 7. The clear water of the seven samples presented, under a high magnifying power, no specimens of living animalcula. These minute organisms are, however, liable to be found in the very purest waters, as well as in every variety of hard or soft water, in which vegetable matter has been infused.

With respect to *mechanical impurity*, this chiefly consists of fine sand, chalk, oxide of iron, and vegetable matter. After heavy and long continued rains, the water, owing to the admixture of these substances, is liable to become opalescent, and to acquire a yellowish colour. Although there is nothing unwholesome in such an admixture, it is repulsive to the eye; it is an accident to which all river-waters, and all surface-waters, flowing through alluvial or chalk districts, are exposed. The West Middlesex Water has occasionally presented this appearance, and a sample taken early in February 1851, had it in a remarkable degree. To a certain extent, this sedimentary matter is got rid of by subsidence: the remedy, however, is filtration through a sand filter. This is more effectual when performed on a small scale in every household, than when carried out on a large scale, in which case the water passes through too rapidly to admit of the perfect separation of the mechanical impurity. The filtered water of the Southwark Company, supplied to Guy's Hospital in February 1851, was just as turbid and coloured as the unfiltered water supplied at the same time to the West of London by the West Middlesex Company.

REPORT,

&c. &c.

Five sets of samples were collected by ourselves on Wednesday, March 12, at the places undermentioned. These samples were respectively labelled Nos. 1, 2, 3, 4, and 5. The weather was rainy, but excepting in the Reservoirs, the clearness of the water did not appear to be materially affected. 1851

1. Taken at the inlet from the river, near Lord Lonsdale's, at Barnes.
2. From the eastern end of the Western Reservoir, near Chiswick Ferry.
3. From the eastern end of the Eastern Reservoir, at the Stage.
4. From the Shaft or Sluice in the Eastern Reservoir connected with the Well of the Engines, at the opposite side of the River.
5. Sample from the Reservoir at Kensington Gravel Pits.

Two other samples were taken by us on Friday, April 11th.

6. From the Company's Reservoir at Barrow Hill, Regent's Park.
7. From the Cistern which supplies the house of Dr. Alfred S. Taylor, 3, Cambridge Place, Regent's Park.

Physical Properties.

The samples Nos. 1 to 5 were clear, but not bright. They were quite colourless, with the exception of No. 5, which had a slightly yellowish tint. No. 1 presented a slight opalescence, as if from the diffusion of a minute proportion of chalk. This sample also had a flat taste. There was no taste of animal, vegetable, or mineral matter to be perceived in any sample. The mechanical impurity diffused through these waters was so small in quantity as not to affect their taste or appearance. No. 5 owed its yellowish tint to the presence of a yellowish-brown substance diffused through it which was readily separated by filtration. The water then became clear, but not quite bright. The mechanical impurity thus separated was chiefly of a vegetable nature. It amounted to no more than 0·27 gr. (*i. e.* about a quarter of a grain) in the imperial gallon of 70,000 grains; or, in other words, it constituted 1-260,000th part of the water by weight. The mechanical impurity contained in the other samples was in much too small a proportion to admit of its separation and quantitative estimation by weight. No. 6 had a slightly yellowish colour. No. 7 was colourless and without taste. The quantity of sedimentary matter deposited from these two samples was too small for accurate estimation.

Gaseous Constituents.

The samples Nos. 2, 3, 4, and 5, were fully aerated, so that, on standing for a short period, the interior of the glass vessels containing them was covered with a number of air bubbles like those observed in spring or deep well water similarly exposed. Nos. 1, 6, and 7, presented this appearance in a less degree than the other samples. By the application of various tests and chemical processes it was found that the waters did not contain sulphuretted hydrogen, phosphuretted hydrogen, or any of the foul gases which constitute the effluvia of drains and sewers. The only gaseous bodies contained in all the samples were carbonic acid, oxygen and nitrogen (air): the carbonic acid in rather large proportion. These gases are always found in good and wholesome waters used for drinking; and the result of our experiments on this part of the analysis is, that the samples of water were *well* aerated, and in a state of *pure* aeration.

Solid Contents.

A qualitative analysis of each sample shewed that the principal ingredient in all was carbonate of lime held dissolved by carbonic acid. There were traces of carbonate of magnesia. The other chemical ingredients were sulphate of lime and common salt, but these were in comparatively small proportion. There was scarcely any perceptible difference in the action of the tests on the different samples.

An imperial gallon (70,000 grs.) of each sample was very slowly evaporated, and the weight of solid contents obtained in each case was respectively :—

No.	Grains in Imperial Gallon.	Fractional Proportion by Weight.
1	20·3	1-3448th part.
2	18·4	1-3800th "
3	18·8	1-3723rd "
4	19·	1-3700th "
5	17·4	1-4070th "
6	18·5	1-3780th "
7	19·4	1-3600th "

The solid contents thus obtained, by evaporation had the form of a light brown powder, containing the salts, mechanical impurity, as well as the organic and other matters diffused through the waters. The total weight, it will be perceived, bears but a small proportion to the weight of the water. The colour and physical properties of the residues obtained from the whole of the samples, presented no perceptible differences.

When equal proportions of these various residues were heated to low redness, they became darker from the partial combustion of organic matter, the carbon of which was left in the residue. During this combustion, there was no perceptible odour of an animal nature: the vapour had the smell of burnt *vegetable* matter. On analysis, nitrogen was found to be present in each residue, but there was no trace of sulphur. Hence we conclude, that the organic matter contained in these samples was of a nitrogenous nature and probably of vegetable origin. There was not the slightest indication of the presence of sewage matter.

The chemical constituents of these samples, as mentioned below, were separated from each other and weighed. They were found to be in the following proportions :—

An Imperial Gallon of 70,000 Grains contains in Grains—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Carbonate of lime*	13·13	11·90	12·67	12·72	11·09	10·78	12·41
Sulphate of lime	2·73	2·64	2·47	2·204	2·308	2·93	2·84
Common salt	1·56	2·30	2·12	2·28	2·55	2 09	2·03
Organic matter	2·37	1·22	1·25	1·27	1·275	1·97	1·48
Residuary carbon	0·11	0·037	0·037	0·101	0·046	0·12	0·13
Silica	0·27	0·127	0·15	0·164	0·046	0·49	0·38
Oxide of iron	0·13	0·12	0·10	0·25	0·081	0·12	0·13
Total grains in gallon	20·3	18·344	18·797	18·989	17·396	18·50	19·40

* The carbonate of lime was combined with slight traces of carbonate of magnesia; and with the common salt there were traces of the chlorides of magnesium and calcium and nitrate of lime. The quantity of these salts contained in a gallon is, however, too small to admit of computation by weight.

The proportions of the saline constituents contained in these various samples differ slightly. The presence of a larger proportion of chalk (carbonate of lime) in No. 1, may have been owing to the fact, that the River had recently before received surface washings from the Chalk Districts; a fact which would account for and explain the opalescence observed in this sample. The other samples, Nos. 2, 3, and 4, in respect to this constituent (carbonate of lime), do not differ from each other so much as a grain in a gallon, *i. e.*, less than the 1-70,000th part. Nos. 3 and 4, taken from nearly the same spot, fall within 500ths of a grain of each other in the Imperial gallon. The difference between the Reservoir Water, No. 5 and No. 4, may have arisen from the fact either that the water susbsequently received from the River was a little more charged with carbonate of lime, or that contained in the Reservoir may have lost a little by subsidence.

The differences in the proportion of sulphate of lime (a salt which gives hardness to water, but at the same time greatly prevents water from acquiring a poisonous impregnation by distribution through leaden pipes) are so slight, as to call for no special observation. The quantity generally found in river-water varies from two to four grains in a gallon. In these samples it is in about the average proportion for river-water, but in much smaller proportion than in ordinary well- or spring-water.

The common salt appears in smaller proportion in No. 1 than in the other samples. The difference, amounting to half a grain in the gallon, may have been owing to accidental circumstances. The reservoir-water shows the largest proportion. As this salt is not deposited by evaporation, the longer the water remains in a confined space exposed to air, the greater is the proportion likely to be found. The quantity contained in No. 1 is so small as to show that the water received from the Thames at the inlet, is certainly not liable to any undue impregnation with *salt* from tidal influences. This water had been admitted into the inlet at flood-tide.

In estimating the relative proportion of organic matter in the different samples, it is necessary to include under this head the residuary carbon which is derived from the combustion of organic matter. The proportion in the seven waters would, therefore, stand thus—

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
2·48	1·26	1·29	1·37	1·32	2·09	1·61

The largest quantity is obviously contained in No. 1, the water received from the Thames. A large proportion (nearly one-half) is deposited or removed by oxidation before the water reaches the eastern end of the western reservoir. It undergoes but a very slight increase in passing on to the eastern reservoir,—probably from the accidental admixture of grass and weeds; but the differences are so slight, when considered in relation to the Imperial gallon of 70,000 grains, as scarcely to require special notice. In each sample the quantity is small: it is, so far as we can form an opinion, entirely derived from the *vegetable* kingdom, and is not by its nature or proportion likely to disturb health or to affect the water in any way injuriously. It is exceedingly difficult to find any terrestrial water entirely free from organic matter; and the samples Nos. 1 and 6 contain no more than the average, while the other samples contain less.

The proportions of silica and oxide of iron in the samples do not exceed the average of river-water. These ingredients partly constitute the mechanical impurity, giving to water turbidness and colour. The largest quantity of oxide of iron was found in No. 4: it amounted to a quarter of a grain in a gallon. This slight excess may be due to the water being there strained through an iron grating, and to iron pipes being immersed in it.

Taking the whole *solid contents* of each sample, it appears that No. 1 contains the greatest, while No. 5 contains the least proportion. The difference may be explained by the fact that the Thames water becomes deprived of some of its salts by subsidence, amounting on the whole to three grains in the gallon, in passing from the inlet to the Kensington reservoir. In regard to dietetic and domestic use, this difference is so small as to be scarcely appreciable: still it must be regarded, chemically speaking, as an improvement in the quality of the water.

Hardness.

There are two methods of estimating the relative hardness of water:—1. By noticing the quantity of soap required to produce a well-marked froth in the sample under examination, compared with the quantity required to produce a similar froth in an equal measure of distilled or absolutely pure water in which there is no mineral or other ingredient to produce any counteracting influence. 2. By adopting the plan of Dr. Clark; *i. e.* using a standard solution of soap, of a particular strength, and comparing the quantity of this solution required to produce froth in a given measure of the water under examination, with the quantity required by an equal measure of certain artificial solutions representing degrees of hardness. The former is the preferable method, not merely from its simplicity, but because we thereby get rid of many sources of fallacy to which, in our judgment, Dr. Clark's mode of testing is unavoidably exposed. In the subjoined table, the degrees of hardness are given both on the principle of distilled or absolutely pure water being taken as unity, and according to Dr. Clark's artificial scale. The results must be taken as approximate :—there is no process which will enable a chemist to register, with accuracy, minute differences.

DEGREE OF HARDNESS.

No.	Distilled Water as unity.		Dr. Clark's Scale of Degrees.
1	9°·16	less than	15°
2	9°	"	$14\frac{1}{2}$°
3	9°	"	$14\frac{1}{2}$°
4	9°	"	$14\frac{1}{2}$°
5	9°	"	$14\frac{1}{2}$°
6	9°	"	$14\frac{1}{2}$°
7	9°	"	$14\frac{1}{2}$°

The differences with respect to the quality of hardness among the samples were scarcely appreciable. The average hardness of the water may be taken at 9° in considering distilled water as unity; *i. e.* it would require nine parts of soap to produce in a gallon of this water the effect produced by one part of soap in a gallon of distilled or absolutely pure water. The degrees on Dr. Clark's scale are arbitrary, and have no intelligible meaning. The degrees of hardness here refer to the water while *cold.* If the water be *boiled* for only *ten minutes,* so much carbonate of lime is precipitated, and so much of the hardness is thereby removed, that in an experiment with No. 5 (the Reservoir Water taken as a type of the West Middlesex supply), the boiled water was found to have a hardness of 5°·3, or on Dr. Clark's scale of about 9°. Hence the effect of boiling for a very short period is to reduce the hardness of the water by nearly one half: and as for washing, cooking, tea-making, and brewing, all water must be boiled, it follows that any estimate based on the hardness of the water while *cold,* and before it has been boiled, is quite irrelevant to the question at issue. One of us (Dr. Alfred Taylor) having used the water (No. 7) of the West Middlesex Company for these various purposes since the year 1834, can speak confidently on this point, not merely from the result of chemical analysis, but from effects actually observed, and from comparisons instituted with numerous other waters during that interval.

An experiment was performed with No. 5 in order to determine the actual *weight of soap* required to produce a frothiness or a softening effect. The result was, that 160 grains of the common washing or yellow soap were found to be taken by a gallon of the water before a lather was produced. After the water had been boiled, a gallon would be equally softened by 90 grains. A gallon of distilled or absolutely pure water would be equally softened by from 18 to 20 grains of the same soap. Water so soft as *that* last mentioned (distilled water) cannot, of course, be procured for ordinary domestic use. From the above results, it thus appears that one pound of yellow or washing soap would suffice to soften 44 gallons of unboiled, and 78 gallons of boiled, West Middlesex water.

The hardness of the unboiled water is also greatly reduced by the addition of a small quantity of carbonate of soda. A pound of common soda will suffice to soften 90 gallons of unboiled water: it reduces its hardness in nearly the same degree as the act of boiling.

Effect of Filtration.

The samples Nos. 3 and 5 were filtered; No. 3 through sand, and No. 5 through paper. All mechanical impurity was thereby entirely separated: the waters were rendered clear and colourless, but not perfectly bright. It was not found that filtration had reduced the proportion of solid contents, or had diminished the hardness of the water. The only observable improvement was in the removal of the turbidness or mechanical impurity.

This process of filtration through sand would be found chiefly serviceable when the water had acquired much mechanical impurity from long-continued rain, or other causes. Under ordinary circumstances, subsidence appears to clear the water to as great a degree as filtration on a large scale would be likely to clear it.

Action on Tea—Use in Cooking, Brewing, &c.

Equal measures of No. 1 (containing the largest quantity of mineral matter) and of absolutely pure (distilled) water were boiled for ten minutes, and then poured on equal weights of tea. When examined at different periods, there was no perceptible difference in the strength of the two infusions. Of the two, the infusion from the boiled West Middlesex water appeared stronger. There was not the slightest advantage obtained, either in taste or colour, by the use of pure or distilled water.

The allegation that the Thames water (taking these samples as representing the water) is unfitted, by reason of the calcareous salts contained in it, for the making of tea, is hereby proved to be altogether unfounded. In the unboiled water, there are only *two grains* of calcareous salts (No. 1, the maximum proportion) in the Imperial pint of *twenty ounces*. The act of boiling for a short time causes a deposition of from one-half to three-fourths of this calcareous matter; and it is highly probable that the water, *as it is used* for the making of tea, does not really contain the 1-9000th part of its weight of calcareous matter, a quantity wholly insufficient to affect the qualities of the water in producing an infusion, or to cause any waste of tea. The statements to the contrary must have arisen from exaggerated views of the hardness of Thames (West Middlesex) water, or from a forgetfulness of the fact that the water is rendered considerably softer by the necessary act of boiling.

The same remarks apply to the use of this water for brewing and cooking. We have found that good beer may be brewed with it; and, with respect to cooking, it is as capable of acting on the fibre of the meat, and rendering it palatable, as absolutely pure or distilled water.

Action on Lead.

A most important question regarding all kinds of water intended for dietetic use is, whether it is liable to acquire a noxious impregnation from lead, by reason of its contact with this metal, either when collected in leaden cisterns, or distributed through leaden pipes. Bars of bright lead, exposing eight square inches of surface, were placed in contact with the 20th part of a gallon of each sample, under the free access of air, for a period of *nineteen days*. The lead in each sample had become rather duller on the surface, and there were streaks of a brownish colour, as if from the deposit of sedimentary matter adhering to the metal. There was no appearance on any part of the metallic surface, of white oxide or carbonate of lead. The water in each vessel was quite clear: there were no white particles of a salt of lead to be perceived in any sample, either as a sediment or otherwise.

Chemical tests were then applied to the various samples in which the bars of lead had been immersed, in order to determine whether any salt of lead had become *dissolved* in the water. In Nos. 3, 4, and 5, there appeared to be a very minute trace of lead in a soluble form, but according to a comparative estimate, the quantity thus dissolved could not have amounted to so much as the 1-280000th part of the weight of the water. There are probably few waters which would not act on lead to this extent. We attribute this slight action on the metal to the accidental presence of some soluble nitrates. The proportion of lead present was wholly insufficient to render the water injurious in a dietetic point of view. One of us (Dr. Alfred Taylor) can testify from *seventeen years'* observation in his own family, that the water supplied by the West Middlesex Company, taken from the same cistern as No. 7, has not, in a single instance, produced effects injurious to health, or indicative of the action of lead on the body. No other water is or has been used in the house.

Conclusion.

As a summary of the results of our analysis of these seven samples, we beg to state that the West Middlesex Water, whether as taken at the Thames inlet,—as collected in the reservoirs previous to distribution, or as contained in leaden cisterns kept properly cleaned,—is a *good, wholesome,* and *potable water,* free from all noxious ingredients, containing no more than the usual small proportion of mineral matter found in terrestrial waters; and that it is admirably adapted for the supply of a town population. In a cold state, it occupies a position intermediate between hard and soft waters; and, after boiling, it becomes as soft as most kinds of natural water which owe their softness to comparative freedom from saline substances. The proportion of organic matter, even in the water received from the Thames inlet, is small, and not sufficient to give it injurious properties. In the Reservoir-waters, the proportion is still smaller. In not one of the samples have we found any trace of sewage or other offensive substances.

This water, unlike many waters which are called *pure,* may be safely stored in leaden cisterns, or distributed through leaden pipes.* We do not find that even under the most favourable circumstances the West Middlesex water acquires any impregnation from lead which would have the effect of rendering it injurious or noxious to health.

* Cisterns, or other receptacles, should be placed in a cool situation, kept covered, and cleansed occasionally.

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April 19, 1851.

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