

The result of the ammonia test was as under: (a.) The west branch and the supposed leak did not show decided signs of ammonia, but there was a slight indication of it, so small, however, as to be within the limits of error; and it must therefore be neglected. The conclusion, so far as this ammonia test is concerned, is, therefore, that there is no connection between the west branch of the supposed leak and the reservoir. (b.) Both the middle and east branches of the supposed leak showed decided indications of ammonia on the morning of the 18th, and more decided still on the 19th, lessening on the 20th and subsequent days. The increased indications on Monday morning, the 19th, I was not expecting, because the water was let into the reservoir from the upper reservoir on the evening of the 18th; so that there must have been something like a million gallons of water, if not more, in the reservoir when the middle and east branches showed most strongly the ammonia coming through.

The result, however, clearly and conclusively establishes the theory that the middle and east branches communicate with the reservoir.

The oxide of iron yellowish slime collecting on the stones over which the water from the middle and east branches flows is another indication in support of the same theory. This yellow scum and deposit, however, point to the probability that the water does not all (even if any) come through the puddle-wall, but that it works a passage for itself down through the sediment in the bottom of the reservoir, and then along the old bed of the creek below the puddled wall altogether; and this theory is supported by the absence of any trace of clay in these flows.

There is a continual diminution of flow from the west branch during the whole period of eight days, quite irrespective of the depth of water in the reservoir. This depth was slowly increasing from Thursday the 15th to the afternoon of Sunday the 18th, at which time the water was turned in from the upper reservoir. From the 18th to the 24th the depth had increased from 11ft. 8in. on Monday the 19th, to 17ft. on Thursday the 22nd, at which depth it has remained since.

In the middle and east branches there is very considerable fluctuation in the amount and flow—reaching the maximum in the middle branch on the 22nd, four days after the water from the upper reservoir was turned into the lower reservoir, and maintaining itself nearly the same, but not quite so great, ever since.

In the east branch there is a sudden fall from 33 gallons to 17·8 gallons per hour between the 16th and 17th; a gradual increase from the 17th to the 20th; nearly the same, but a shade less on the 21st; and then a rapid decline to the 24th, on which day it did not amount to one-third the quantity found on the 16th.

It is outside my province to pronounce an opinion on the amount of flow as depending on the depth of water in the reservoir, and on the amount of rainfall lately. I might, however, point out the constant but slight diminution of the flow from the west branch (which is chiefly from springs probably) and the irregularity of the flow from the middle and east branches, as if the flow from these latter was in a state of disturbance, in some kind of sympathy with the disturbed state of the reservoir and the varying depth of water in same.

The opinion I have formed from the tests and observations as a whole is—(1) That the greater part of the flow from the middle and east branches of the supposed leak is derived from the reservoir; (2) that a small proportion of the water from the west branch is also derived from the reservoir; and (3) that it is chiefly under or round outside the puddled wall, and not through it, that the flow travels.

Mr. Mirams (the City Engineer) and Mr. Gillies (the caretaker) gave me every facility and assistance in my investigations.

Tables and tests and observations are attached.

His Worship the Mayor and City Council of Dunedin.

I am, &c.,

JAMES BLACK.

Sub-Enclosure No. 1 with Enclosure No. 4.

TABLE I.—Statement of Flow in terms of Gallons per Hour from Supposed Leaks and Lower Pool; also, separately, Number of Gallons per Hour from Middle and East Branches, and from all three Branches at Foot of Walls taken together.

Dates on which Flow was measured.	Number of Gallons per Hour from West Branch of Supposed Leak.	Number of Gallons per Hour from Middle Branch of Supposed Leak.	Number of Gallons per Hour from East Branch of Supposed Leak.	Number of Gallons per Hour from Lower Pool.	Sum of Gallons per Hour from East and Middle Branches together	Sum of Gallons per Hour from all three Branches together.
July 16 ...	168·4	20·6	33·1	...	53·7	222·1
" 17 ...	166	22·3	17·8	...	40·1	206·1
" 18 ...	163·5	21·6	20·2	...	41·8	205·3
" 19 ...	163	26·2	24	220	50·2	213·2
" 20 ...	162·5	27	25·9	227·8	52·9	215·4
" 21 ...	157·7	26	25·1	216	51·1	208·8
" 22 ...	156·5	27·8	17·6	213	45·4	201·9
" 23 ...	152·5	26·9	16·9	224·5	43·8	196·3
" 24 ...	149·5	25·7	10·8	220·4	36·5	186

The flow for the 16th July was measured by Mr. Mirams, assisted by Mr. Gillies, in my presence. The flow of the 17th, 18th, and 24th was measured by me, assisted by Mr. Gillies. The flow on all the other days was taken by Mr. Mirams and myself together, assisted by Mr. Gillies. In several cases the result recorded is the average of several trials.