In studying the effect of sheet-piling at the toe, it was observed that the pressures in the foundation, before and under the heel of the structure, were reduced, under the central portion they were but little changed, and under the toe they were increased. The flow lines were forced to go deeper and come to the surface at a greater distance from the structure.

In the matter of seepage it is stated that with each pressure observation the temperature and discharge per minute were recorded. These discharges, when corrected for temperature, afford a partial means of comparing the effects on the quantity seepage for different floor lengths and sheet-piling conditions, but are of no use in determining the law that governs the underflow. This law depends, not only on the length of the overlying impervious layer, the enforced length of flow, and the head of water, but on the porosity, the effective size of the sand grains, the uniformity co-efficient, and the viscosity of the water. These factors are all very complicated, and at present are so little understood that an accurate formula is impossible.

The writer attempted to determine this law, in connection with his work, but was unsuccessful. The method used imitated that used by Schlichter for determining the velocity of underground water. Through the centre of each of sixteen tubes scattered throughout the box a rubber insulated wire was passed, from the end of which the insulation for about 2 in. was cleaned. This bared wire, with the end of the pipe, formed two electrodes. The circuit was completed by connecting it with the lighting system, in one lead of which an ammeter was introduced.

The operation, as arranged and carried out, consisted of making readings of all tubes at 5-min. intervals. After two or three readings had been made, ordinary rock salt was introduced into the water above the dam. The 5-min. observations were continued until all traces of the salt had disappeared. These observations were then plotted, with times as abscissas and currents as ordinates, the peaks of the curves being taken to indicate the time required for the salt solution to reach the tube. The time required for the flow to pass from Tube *a* to Tube *b* would be $t_b - t_a$, and the velocity of flow over the distance, *d*, would be $\frac{t_b - t_a}{d}$.

In many of the readings this gave very high velocities under the toe of the dam, where the flow lines were well distributed; in fact, it frequently gave negative results, showing that the solution had passed by one tube and reached the second before influencing the reading of the first tube. After several attempts, these electrical observations, because of the unsatisfactory results and the undesirability of interfering with the pressure experiments, were discontinued.

However, the trials were sufficient to point out a more satisfactory method of attacking the problem. Each tube carrying an electrode should be arranged so that the salt solution could be charged at that point. Then, by charging one tube at a time and making readings as before, the time required for the flow to pass 1, 2, or 3 ft. could be determined. In arranging the tubes, care should be taken to make it unnecessary to trace any one charge for a greater distance than 3 ft.

The conclusions resulting from this investigation are stated as follows:

1.—The loss of pressure head of water in passing from above to below a dam may be divided into three stages: (*a*) A relatively large loss of head, occurring where the water enters the sand; (*b*) A quite uniform and comparatively small loss of head per foot of length through the body of the sand; (*c*) A larger loss of head, occurring where the water leaves the sand.

2.—The first stage or entrance loss is increased as the length of floor is decreased.

3.—The rate of flow decreases very rapidly with depth below the floor of the structure, being more concentrated for shorter floors.

4.—The flow lines, once established in a porous medium, tend to continue horizontally as such, and come to the surface only after travelling a relatively great distance.

5.—The pressure decreases with the depth in front of the dam, and below the structure it reverses itself, increasing with the depth.

6.—The porosity, effective size, and uniformity co-efficient have little influence on the upward pressure exerted against the floor of a dam.

7.—The pressure curve for the condition of no piling closely resembles the probability curve, having the general form.

$$y = \frac{h}{\sqrt{\pi}} e^{-h^2 x^2}.$$

8.—Piling at the heel of a dam reduces the pressure on the floor, and piling at the toe increases it.

9.—With sheet-piling at the heel, the pressure increases less rapidly than the hydraulic slope. With no piling, and with piling at both heel and toe, the pressure increases more rapidly than the hydraulic slope.

10.—With sheet-piling at the heel, the flow of greatest density approximates the shortest distance from the end of the piling in the toe of the structure.

11.—The centre of pressure, with no piling and with piling of any length at the heel, is $\frac{L}{3}$, measured from the heel of the dam. With piling at both heel and toe, the centre of pressure is $\frac{5L}{11}$ from the heel of the dam.

12.—For the condition of no piling, the total pressure (in pounds) exerted on 1 lin. ft. of floor is:

$$P = 62.5\ b\ s + 62.5\ c\ (d^s - 1).$$

13.—For the condition of impervious piling at the heel, the total pressure, in pounds, on 1 lin. ft. of floor is:

$$P' = [62.5\ b\ s + 62.5\ c\ (d^s - 1)]\ k\ p.$$

14.—Piling at the heel of a dam, to be effective, must be tight, very small leakage destroying its action.

15.—Piling at the toe of a dam should be loose, in order to prevent increasing the upward pressure on the floor of the structure.

16.—An impervious cut-off wall of comparatively shallow depth, say 5 ft., at the heel of the structure will greatly increase its stability by reducing the upward pressure on the floor.

17.—Variation in the weight or downward pressure against the floor of a dam has little effect in changing the intensity of the upward hydrostatic pressure.

18.—The law of seepage or underground flow cannot be ascertained by treating an area as a unit. It can be best studied by breaking the area up into very small elements.

19.—The law, $P = a\ 10^{-kx^n}$, when corrected for gravity, will probably apply equally to pressures in a vertical or horizontal plane.