

loss. The writer has, unless otherwise instructed, capitalized the yearly loss at 5 per cent.

A privilege which produces a variable power and has no supplementary power is not damaged any more than if it were so supplemented, and it should be treated in the same way as though it were supplemented.

The writer has generally used the following method of determining the damage to an established property, due to the diversion of some of the water.

- (1) Determine the flow, including the effect of storage and pondage, before and after the diversion.
- (2) Determine the net head.
- (3) Determine the horse-power which can be economically developed and used before and after diversion.
- (4) The difference between the power used before and after diversion is the power diverted which causes damage.
- (5) Estimate the additional yearly cost of running caused by the taking away of this power, of coal, attendance and supplies.
- (6) If any permanent power has been taken, that is, power which can be relied upon in the lowest flow of the stream, estimate the cost of a steam plant or portion of plant necessary to make good the amount taken in the dry month.
- (7) Estimate the fixed charges on this cost of additional supplementary plant.
- (8) Add the extra cost of running and additional fixed charges and the sum represents the extra yearly expense.
- (9) This extra expense capitalized at a proper rate represents the damage.

If it is necessary for the mills to maintain a steam plant of sufficient size to run the whole mill under the conditions existing before the taking, it is clearly not necessary for the defendant to furnish or maintain any further addition to the plant, and the damages consist of the increased expense of running the plant, already installed, due to the diversion.

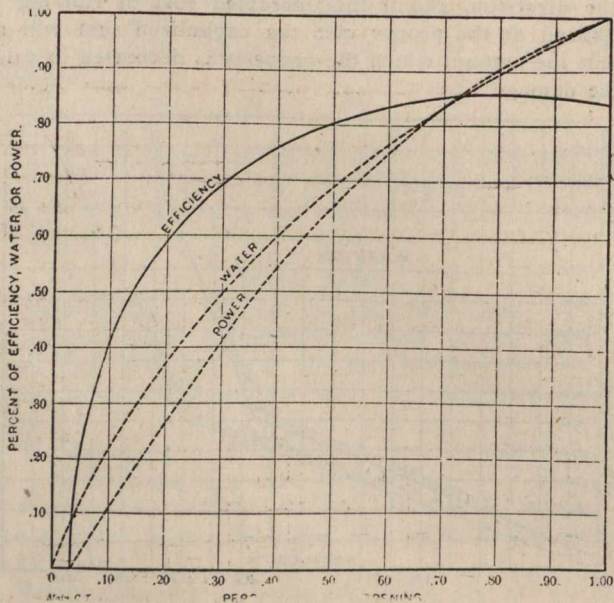


Fig. 2.

Diagram showing relation which gate opening bears to power developed, water used, and efficiency of turbine water wheels.

If the total power required to run the mill is so large that the steam plant must be run all of the time, then there is no extra expense for attendance or supplies due to the diversion.

If the total power required is such that wheel plant can run the whole work for a portion of the year alone, and for the remainder must be supplemented by steam power, the time during which the engine must run may be extended by reason of the diversion, and in such case there is an addition to the expense of running for labor and supplies for such extra time, which should be added to the extra cost of coal, and the total extra expense capitalized at a proper rate will represent the damage.

Water Shed and Run-off.

Too much stress cannot be placed upon the importance of determining the flow of the stream under consideration.

If careful gaugings have been made extending over considerable time, they are the most reliable information which can be had. If no gaugings have been made, an examination of the water shed should be made to ascertain its character, all existing rainfall records in the vicinity should be collected, and an estimate made of the run-off. Assistance may be had by comparison of similar rivers, the run-off of which is known.

The amount of data on the flow of streams which is available is increasing each year, as careful records are being kept on many rivers by persons or corporations who are interested in these matters, and by the United States Geological Survey.

The amount and uniformity of the run-off are two items which enter very largely into the value. The uniformity of flow depends largely upon the storage capacity and location of reservoirs on the water shed. The areas and capacities of such reservoirs should be ascertained and the net amount which can be drawn from them.

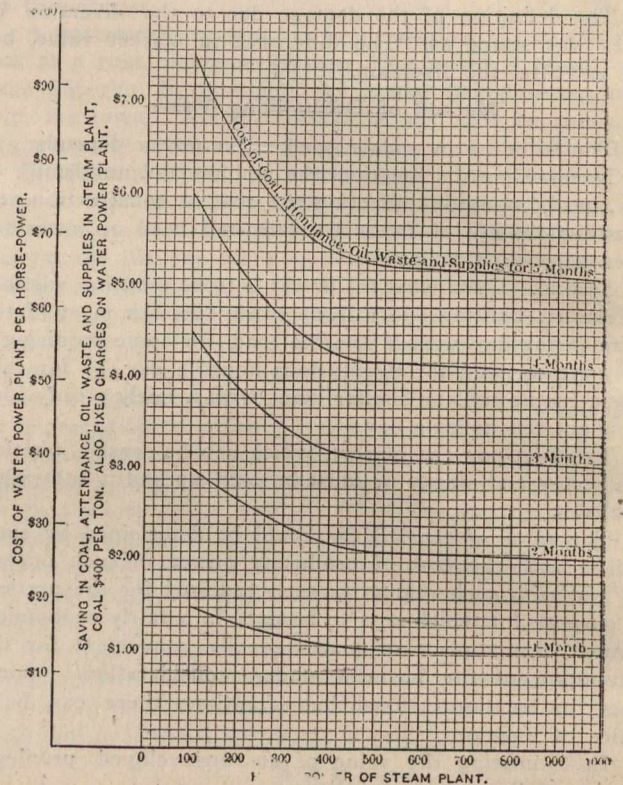


Fig. 3.

Diagram showing number of months when water should be allowed to waste with different sizes of steam plants and different costs of water power.

In estimating the average flow-off the months should be averaged in order of their dryness instead of in calendar order. If the flow is averaged by calendar months a great many irregularities in the flow are smoothed out and some of the flow is averaged in, which could not be held and used. By averaging all the dry months, all the second dryest, and so on, some of this evening up is eliminated, but it cannot be altogether avoided. The average flow by months in the order of their dryness will be less uniform and nearer the truth than when arranged by calendar months.

The average year is the one used in estimating the available power or power diverted, but the effect during the year when the flow is less than the average must not be lost sight of.

Flow Used During Working Hours.

The flow at any given privilege is usually given in cubic feet per second for twenty-four hours a day and seven days a week.

If the power is used twenty-four hours a day and there are no disturbing influences above to break up the uniformity of flow during the whole day, a small mill pond will answer. If, however, there are mills above using all the water in ten hours a day, a large pond would be necessary to store and use it all in twenty-four hours.

In a great majority of cases the water is used during the day for say ten hours a day and six days a week. If