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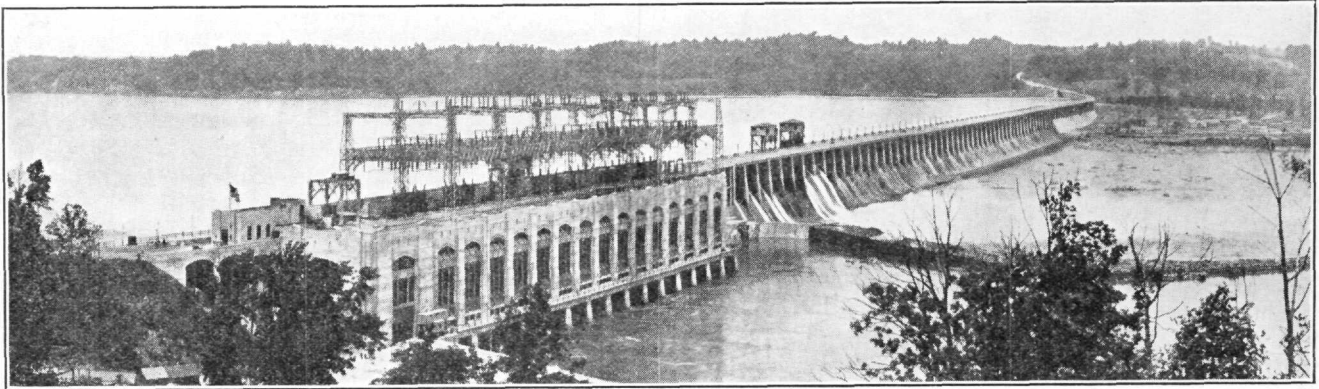
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CONOWINGO; A POWER PROJECT

By WILLIAM FOWLER, Cer.E. 1



Conowingo Power House and Dam from West Bank.

One of the most recent power projects is the Conowingo hydroelectric development built for the Philadelphia Electric Company System. This development, which supplies Philadelphia and vicinity with electricity, is the largest steam or hydro project ever constructed in one step in the history of the power industry. It is situated on the Susquehanna River at the crossing of the Baltimore "Pike," forty miles from Baltimore, seventy from Philadelphia, and twelve from Havre de Grace, Maryland, where the Susquehanna empties into Chesapeake Bay.

As it now stands the project consists of a power house adjoining the west bank of the river and a dam extending to the east bank. The power house, at the present time, is made up of seven water wheel units of 54,000 horse power each, but the ultimate design provides for the future installation of four additional units. The dam is almost a mile long with a maximum height of 105 feet from the foundation to the floor of the highway bridge which was built upon it to replace the one on which the Baltimore "Pike" formerly crossed the river. About one-half of the length of the dam consists of a spillway designed to pass a flood greater than has occurred on the river in the last hundred years. The remainder consists partly of a non-overflow section and partly of the head-works section which is designed as a continuation of the dam and which is located directly upstream from the powerhouse.

Because the flow of the Susquehanna is "flashy," that is, there are rapid changes in flow from day to day as well as wide seasonal differences, it was found necessary, in order to fit the varying amounts of power available in such a stream to the more constant demands of the consumer, to incorporate a steam-electric system into the project. During the time of high flow the hydro system is the principal source of power, the steam stations operating only during the hours of heavy demand. During low flow periods the procedure is reversed; the steam plants carry the base load and the water wheels operated only during the peak hours. By this method of combining steam and hydro operation the capacity of the project is large even during low flow seasons. The steam plants are located in the city of Philadelphia.

Although it had long been realized that Conowingo possessed many possibilities as a source of power, it was not until three years ago that the demand of the nearby markets became large enough to absorb the amount of power available and to make the project practical financially.

Construction at Conowingo was begun in March, 1926, and completed in the summer of 1928. The construction program required that the river be restricted by two cofferdams so that the power house might be constructed and the tailrace excavated from the west bank of the river while the dam could be started from the east bank.

These cofferdams were completed by the summer of 1926 and then while the water was at its lowest level the foundations of the first and alternate 52-foot sections of the dam were laid. At the same time in the following year the second or closure sections were constructed. During the periods of high water the 52-foot sections were brought to their final height of 105 feet, while 38-foot notches were left at a low level to permit the passing of the flood flows. In this manner the work was continuous regardless of high water.

The building of the dam required the placing of 433,000 cubic yards of concrete. This operation presented the problem of handling and transporting an almost unprecedented amount of material. To solve this problem a steel bridge was built parallel to the downstream face of the dam. On this all materials were transported from the concrete plant and storage yards.

The spillway section of the dam is equipped with fifty steel gates, each 41 feet wide by 22½ feet high and weighing 42 tons, which, raised or lowered by three cranes, regulate the level of the lake created by the dam. These gates were delivered by barge to within six miles of the project and then placed on special cars from which they were hoisted directly to the top of the dam. Their size necessitated the clearing of all nearby railway tracks during their movement.

Work on the power house and tailrace was carried on at the same time that the dam was being built. These units of the project required the removal of 280,000 cubic yards of granite from the

river bed, which in places was excavated to a depth of forty feet.

The upstream excavation was finished first to allow the early completion of the headworks section. When this section was fully constructed the intake openings in it were sealed to provide upstream protection and the power house proper was begun. The concrete required for the headworks and power house brought the total amount used in the project to 664,000 cubic yards.

The power-house plant has many noteworthy features. The water wheels and generators are in physical dimensions the largest in existence. The revolving parts of the water wheels and generators combined are suspended from a single thrust bearing located above the generator. About seven feet in diameter, this bearing carries a load which, including the force of the water against the wheel, totals about 1,200,000 pounds. Another unusual feature of the plant is the large circular valves, called butterfly valves, which shut the water from the wheels when they are not in use. When closed each valve withstands a maximum pressure of three million pounds.

A high-tension substation is located on the top of the power house, where switching facilities are provided to control the delivery of the current from any combination of generating units to the transmission lines. The electricity is generated at 13,800 volts and is stepped up to 220,000 volts. It is transmitted from the power house to Philadelphia and into the entire area served by the Philadelphia Electric Company throughout New Jersey and eastern Pennsylvania.

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