

contractors have met with a considerable amount of difficulty owing to the amount of water that has been encountered in the excavation of the tunnel, particularly in the vicinity of the central shaft. Judging by the experience with the original tunnel it was not anticipated that so much water would be met with. Had it not been for this difficulty considerably better progress would have been made.

After the centre shaft had been sunk and exploratory drive put in at the foot of the shaft it was decided to alter the location of the central portion of No. 2 tunnel, as it was considered that a large amount of water encountered came from No. 1 tunnel. The contractors were then instructed to sink a new shaft approximately 1,000 ft. distant from the old one. The excavation of this shaft was completed to water-level in November, and a cross-drive approximately 20 ft. above the level of the tunnel was driven from the shaft to connect with the exploratory drive previously mentioned. In this drive a pumping-main 1,300 ft. in length was laid, and two 8 in. centrifugal pumps were installed in a chamber near the new shaft. This enabled water to be pumped from the new shaft into the centre shaft of the existing tunnel. Much trouble was experienced in opening out into the tunnel proper, on account of the water. Eventually the difficulties were overcome, and present indications are that the maximum amount of water being pumped to date, which is approximately 1,000 gallons per minute, will not be exceeded. The length of tunnel excavated from the centre shaft by the 30th June was 3.75 chains towards the lake and 3.25 chains towards the surge-chamber. The deviation of the tunnel decided upon resulted in approximately an additional 500 ft. in the length of the tunnel.

At the intake end of the tunnel the excavation and lining have been proceeded with steadily. The excavation in rock terminated much sooner than was anticipated, and it became necessary to install pumps. The maximum amount of water being pumped is yet small, amounting to only 40 gallons per minute after excavation had proceeded a length of 3 chains in shingle. The junction of rock and shingle occurred at 0 m. 16 ch.

At the outlet end a bad slip was encountered at the end of July. This resulted in a considerable delay and loss of excavated tunnel. Otherwise steady progress has been made. Practically no water has yet been encountered at this face. The total length of the completed tunnel will be 111 chains.

The excavation of the surge-chamber has been completed with the exception of a circular core approximately 30 ft. in diameter. This core was left in so as to assist in holding the profiling for the concrete walls of the surge-chamber, which have been completed to a height of 22 ft., 750 yards of concrete being deposited. Two of the pipe-tunnels leading out of the surge-chamber have been fully excavated, and the other one partially so.

The excavation of the pipe-bench has been completed, and the excavation for anchor-blocks and supporting-piers has been completed. Concrete anchor-blocks Nos. 1 and 8 have been completed to within 6 in. of pipe invert. All concrete supporting-piers between anchor-blocks Nos. 1 and 8 have been completed.

The excavation of the power-house site was completed by the Department early in the year, and a contract for the erection of the power-house extension was then let to Messrs. P. Graham and Son. This work is proceeding very satisfactorily. The walls of the power-house building are now practically completed, and the roof-beams and slab are at present being placed. To date 811 cubic yards of reinforced concrete have been put in. It is anticipated that the contract will be completed in September next.

A start has been made with the excavation of the tail-race by means of a drag-line excavator, and so far approximately 4,000 cubic yards have been taken out. Prior to this work the weir-basins were completed by the same machine. No concrete has yet been placed.

A contract has been let for the manufacture and erection of the pipe-line, and a portion of the material has been delivered, and is in the course of erection.

A contract has also been let for the supply and delivery of the new unit, consisting of a 12,650 h.p. turbine and a 7,500 k.v.a. generator.

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At the start of the period the principal work which had been carried out on the above scheme consisted of the concreting of the main portion of the power-house extension, the foundations for the transformer-house, and portion of the tail-race deepening. The power-house extension has now been completed, involving the placing of 5,876 cubic yards of concrete, mostly reinforced, including the head and tail-race walls. The head-race slope has been excavated to the correct batter to conform with the existing slopes, and sown down in grass, while the excavation of the tail-race batters is in hand.

The two new units (Nos. 7 and 8) of 3,100 h.p. turbines and 2,500 k.v.a. generators have been erected and fixed in position. No. 7 machine has been supplying power since the 14th April, and No. 8 is at present drying out preparatory to testing.

The new concrete bay in the transformer-house has been completed, and minor alterations were carried out to the electrical workshop.

The deepening of the old tail-race was continued and completed. This work necessitated the removal of 8,753 cubic yards of material, over which there was an average depth of 7 ft. of water travelling at an average velocity of 3.5 ft. per second. The total area requiring deepening was approximately 7,000 square yards, and the depth of material to be removed varied from 2 ft. to 7 ft. The bottom of one-third of the area was composed of hard volcanic tuff necessitating drilling and blasting, and the remainder of sand and river shingle. All drilling was operated from a barge by pneumatic drills, holes being at 5 ft. spaces and charges fired electrically. After the ground had been loosened the excavation was carried out by means of a drag-line, which was erected in such a position as to command the whole of the area requiring deepening. The average lead was 570 ft., and while digging in broken tuff the output per twenty hours was 100 cubic yards, and in shingle 200 cubic yards.