

Head-works are constructed by having a concrete weir across the stream to be used for supply, having a box laid in the bed of the stream above the weir with an iron grating on the top, the bars being from $\frac{1}{4}$ in. to $\frac{3}{4}$ in., apart. This keeps the coarse shingle from getting into the box, which leads the water into a concrete tank or chamber, made on the bank of the stream, where a sluice-gate is fixed to admit and regulate the quantity of water into the pipes or concrete sewer which leads from the tank to a point where an open channel can be made. Wherever these pipes or sewers are used they are placed at such an inclination or fall as to secure a velocity of at least 3ft. per second. The system of distributing is by constructing branch races through the properties of those requiring water; and, the water being kept continually flowing, these branches very soon present the appearance of natural streams. The rate charged for water from these water-supplies varies in the different districts: From the Malvern Water-race—water for a head-race, £25 per annum; for supplying any hundred acres, £1 5s. per annum; license to take water in vessels from the water-race, £1 per annum; for water supplied into tank through a race, 6d. per 1,000gal. The rates from the Greendale Water-race are the same as those for Malvern District; but from the Waireka Water-race no charges have yet been decided on. The rates from the Hororata Water-race are £1 per annum for taking water in vessels for domestic or other use, and £1 per annum for each hundred acres of land that is supplied with water. Since the construction of these water-supplies the value of the land has been increased to the extent of £1 10s., and in some instances £2 per acre.

Ashburton County.—The length of artificial water-races in this county is 800 miles, of which there is a length of thirty miles for main channels and 770 miles of distributing-channels; the main channels having various carrying capacities, from 10,000gal. to 15,000gal. of water per minute, having a width at the bottom from 6ft. to 15ft., and a depth of from 12in. to 18in. They are constructed with a fall or inclination, varying according to the natural slope of the ground, of from 12ft. to 40ft. per mile; but in all cases in the main channels the velocity of the current is reduced by a fall, at intervals, to such an extent as to prevent a scour taking place. There are seven sources from which water is taken. These supply, in the aggregate, about 55,000gal. per minute. Head-works, where the supplies are lifted, generally consist of concrete weirs, constructed across the beds of the streams in the gorges near the base of the mountains; but in some instances the supply is taken direct from the rivers, and where this is done protection-works of a simple kind are constructed. The distributing-races are at distances apart varying from three-quarters of a mile to a mile and a half, and so placed as to pass through almost every property on the plains. These distributing-races are generally about 9in. deep, and from 15in. to 18in. wide at the bottom, with side-slope of 2 to 1. They run on gradients approximating to the natural declivity of the ground (about 50ft. per mile near the mountains, and 20ft. per mile near the sea). The total cost of construction is £22,500, and the land benefited by this supply comprises an area of about half a million acres. The rate charged the owners and occupiers of the land is merely a mileage-rate, to cover the cost of maintenance. Where sites are suitable the occupiers are allowed, under the Council's direction, to utilize the races for water-power, on a small scale, for chaff-cutting purposes, &c., without charge.

Water-supplies for Cities and Towns.

These comprise supplies for cities of Auckland, Wellington, and Dunedin, and the towns of New Plymouth, Nelson, Timaru, Oamaru, and Rotorua.

Auckland Water-supply.—The supply for the City of Auckland is obtained from a series of springs, situated about three miles from the city. These springs are from a district composed of beds of scoria (lava), which at some period has been discharged from the adjacent extinct volcanoes, Mounts Eden, Albert, and the Three Kings, comprising an area of about 2,370 acres, having a watershed of 5,760 acres. The water percolates through the beds of scoria, which form an excellent filter, and is collected at the springs, which are situated 25ft. above the sea-level. The supply is pumped direct from these springs into a high-level reservoir at Kyber Pass, and a low-level reservoir at Ponsonby, within the city. The former reservoir has a capacity of 1,750,000gal., and the latter 3,000,000gal.; the heights that the water is lifted being 284ft. and 209ft. respectively. The reservoirs are constructed of earthwork, the dams being composed of clay, consolidated, with a wall of puddled clay in the centre, extending all round the reservoir. The slopes of the water face are coated over with concrete 9in. in thickness; and the whole of the reservoirs are covered over with a corrugated-iron roof, in spans of 35ft. The Kyber Pass reservoir has a maximum height above the city of 306ft., and the one at Ponsonby 231ft.; the former being only used as an auxiliary, and for giving extra pressure in case of fire. The pumping-mains are turned off at Ponsonby, and only connected to the reservoir at Kyber Pass in the case when fires occur. The pumping-engines are of the compound beam type (rotative), working up to 180 horse-power, and are capable of pumping 2,250,000gal. of water in twelve hours into the reservoirs. The pumping-mains are 21in. in diameter and about three miles in length. The mains for supplying the city from the reservoir are about fifty-one miles in length, and varying in their dimensions from 4in. to 12in. in diameter. These works were designed and constructed by W. Ewington, M.I.C.E., at a cost of £125,000. The rate charged for water for domestic purposes is $2\frac{1}{2}$ per cent. on the rateable value of property, and 10d. per 1,000gal. for working machinery.

Dunedin Water-supply.—This city has two supplies, known respectively as the northern and the Southern supplies. The northern supply is obtained from a stream known as Ross's Creek, which has a watershed of about 1,000 acres. The head-works are situated one and a quarter miles from the city boundary, and comprise a main reservoir capable of holding 51,000,000gal., and a reservoir with a capacity of 6,000,000gal. of water. The main dam or reservoir is constructed with an earthwork embankment, having a puddle-trench in the centre, across the bed of the stream, the length of the embankment being 363ft., and 12ft. in width on the top. The slope on the breast is 3 to 1,