

II. The Water Supply and Sewerage of Country Towns.

BY W. F. NEVILL, B.C.E.

Engineer for Waterworks and Sewerage Trusts, State Rivers and Water Supply Commission.

EARLY GOLDFIELDS SUPPLIES.

In the earlier years succeeding the discovery of gold, there was considerable concentration of populations in the auriferous districts of Victoria without any adequate provision for water supply, either for domestic use or for mining requirements. Neither was there any local municipal authority capable of dealing with a question of this character nor was the mining population sufficiently settled to warrant its investiture with the necessary powers.

Under these circumstances there appeared to be no course open but for the Government to take the matter in hand as a public one and construct, at all events, such reservoirs as would serve the most pressing wants. This was done, and, prior to 1865, twenty-four of these reservoirs were constructed. Many of these supplies have since been made over to local bodies. These works were for the most part constructed by the Water Supply Branch of the Mines Department at a time when the Water Supply Department had no separate existence.

Later, under the *Local Governing Bodies Loan Acts*, Municipal Corporations were enabled to obtain from the Government loans of money to construct waterworks to supply their districts, and many townships, that before the passing of the Act had been dependent on sources wholly inadequate, were enabled to construct works of permanent utility, capable of affording satisfactory supplies.

The financial results of these loans were, however, not altogether satisfactory owing mainly to the decline of the mining industry—the cost of the works in some instances being far in excess of the means of the reduced populations.

The earliest of the more important water supplies was installed to supply the thriving centres of Bendigo, Ballarat and Geelong. Prior to 1858 Bendigo, then known as Sandhurst, was poorly supplied with local water which was both inferior in quality and insufficient in quantity—the best being rainwater stored in tanks. In dry weather water was supplied by carters at from 5s. to 8s. per 100 gallons—the water being obtained mainly from mining dams.

The first public movement for a more efficient supply took place in 1858 when the Bendigo Waterworks Company was formed. This company had constructed a storage reservoir of 60 million gallons capacity filtering works and 12 miles of mains when the works were purchased in 1872 by the Municipal Council which added another reservoir. These reservoirs, which were known as the Big Hill and Crusoe reservoirs, are still in use.

The Government then took over the whole of the works including 63 miles of reticulation mains and included them in what became known as the Coliban scheme.

THE COLIBAN SCHEME.

The Coliban scheme, which is a very extensive one, was initiated in 1865 by the Government, as a national work, to supply water to the mining centres of Bendigo and Castlemaine. These works are now under the control of the State Rivers and Water Supply Commission.

Very briefly the principal works of the Coliban system, which supplies an area of 280 square miles, consist of the Malmsbury and Upper Coliban reservoirs on the Coliban River, of total capacity 10,000 million gallons, 387 miles of main and branch aqueducts and water channels, 26 subsidiary reservoirs and service basins, and cover 300 miles of reticulation mains.

Upon this scheme, which has to date cost £1,633,000, are dependent for their water supplies the City of Bendigo, the important towns of Castlemaine, Eaglehawk and Maldon and six smaller towns—the population served being 61,000.

Water not required for domestic and industrial purposes is used for the irrigation of some 9,000 acres of orchards and market gardens, and any surplus is sold for sluicing at very low rates.

THE BALLARAT SCHEME.

A move for an improved water supply was next made by Ballarat. From the digging days until 1860 the residents drew their water supplies from the Wendouree Swamp, now known as Lake Wendouree, on which the Ballarat

and Ballarat East Councils had expended some £9,000.

The first step towards the present comprehensive scheme was the purchase by the Government of a privately constructed mining storage known as Kirk's dam. This was later handed over by the Government to the Councils free of charge, and an 18 in. pipe main was laid from the dam to the town: Beales, Pincotts, and the Gong Gong dams were then constructed. In 1872 the works were placed under the control of the Ballarat and Ballarat East Water Commissioners which was merged in 1880 into the present corporation known as the Ballarat Water Commissioners. With the construction of the Wilson and Moorabool reservoirs by the commissioners the total storage capacity was increased to 2,215 million gallons.

The largest of these reservoirs—the Moorabool—is an earthen dam 2,560 feet in length with a reinforced concrete core. It has a capacity of 1,365 million gallons—the depth of water being 34 feet.

The scheme, which has cost £589,000, provides for a reticulated supply to Ballarat City, Sebastopol Borough and portions of Ballarat, Buninyong and Bungaree Shires and serves a population of 45,000. An interesting feature of this scheme is the extensive plantation of pines and the beautification of the reserves.

GEELONG AND SUBURBS.

The third of the more important early water supplies was that of Geelong, commenced in 1865 by the Government for the supply of Geelong and suburbs. In the early scheme the towns were dependent on the Upper and Lower Stony Creek reservoirs—the upper reservoir being constructed of earth and the lower of concrete. The combined capacity of the two reservoirs is 895 million gallons.

The supply to the Upper Stony Creek reservoir was however, supplemented later by means of a channel from a weir on the eastern branch of the Moorabool River.

From the Upper Stony Creek reservoir the water was conveyed by an expensive aqueduct, 6 miles in length, to a pipe head basin at Anakie and thence by pipe mains to the service basin at Lovely Banks. The water from Lower Stony Creek was piped direct to the service basin and thence both supplies were conveyed by 8 miles of 16 inch pipe mains to Geelong.

These works, which were taken over by the Geelong Waterworks and Sewerage Trust in 1908, have since been improved and considerably enlarged by the construction of two additional storage reservoirs on Stony Creek and the Korweinguburra reservoir on the Eastern Moorabool River. Including 8 service basins the storage capacity is now 2,737 million gallons.

The supply to Geelong has recently been supplemented by some 500 million gallons per annum from the State Rivers and Water Supply Commission's Bellarine Peninsular Scheme which draws on the headwaters of the Barwon River.

The Geelong works including 270 miles of reticulation mains cost approximately £700,000 and supply a population of 45,000.

WATER SUPPLY LEGISLATION.

The first act dealing comprehensively with the question of water supply to country districts was passed in 1881,

viz:—the *Victorian Water Conservation Act, 1881*. Prior to that however a number of municipalities had obtained advances under the *Local Governing Bodies Loan Acts* for the purposes of enabling them to carry out works of water supply.

Under the 1881 Act, the constitution of Trusts throughout the colony for the purpose of constructing works for the supply of water for domestic and stock use was authorized.

Public water supplies in Victoria are in general now controlled or supervised by the State Rivers and Water Supply Commission under the provisions of the *Water Act, 1928*, which is the consolidation of the 1905 *Water Act* and later amendments.

The outstanding exceptions are the water supplies of the Cities of Melbourne and Geelong which are administered under special statutes vesting the control of water supply and sewerage works in the Melbourne and Metropolitan Board of Works and the Geelong Waterworks and Sewerage Trust, respectively.

The principal controlling authority under the Water Act is the State Rivers and Water Supply Commission which is empowered to construct and manage irrigation, domestic and stock supplies and town water supplies.

Where the Commission does not undertake the construction of works for a town water supply, provision is made in the Act for works to be carried out and managed by local bodies under the general supervision of the Commission.

Normally the local body would be a Waterworks Trust, but provision is also made for a town water supply to be controlled by a municipal council which may be constituted a local governing body under the *Water Act*—the council being vested with the same powers as a waterworks trust.

The moneys required to finance the construction of approved works are advanced by the State as loans on long terms at favourable rates of interest.

WATERWORKS TRUSTS.

In addition to 98 towns supplied directly by the Water Commission, there are at the present time 122 Trusts and Local Governing Bodies controlling 125 town water supplies throughout the State of which 73 are gravitation schemes and 52 either pumping or combined gravitation and pumping schemes.

Many of these schemes were initiated for mining purposes and in some cases, such as Clunes, were installed by mining companies and afterwards taken over by local authorities.

The source of supplies is mainly surface waters, the catchments of the streams in many cases being unpopulated and free from pollution. In general, these waters are fairly soft, but a few are subject to excessive turbidity and require clarification. Only 3 towns controlled by trusts obtain water from underground sources, viz.:—Nhill, Portland, and Kaniva.

Generally speaking the quality of the water supplied by the trusts is good and in only three cases is the water filtered—at Shepparton, Orbost and Rochester.

Clarification of the turbid waters by coagulation and sedimentation has been adopted in several instances, but with the development of the country and the difficulty of

keeping the catchment areas free from pollution, the question of the purification of water supplies will become of increasing importance.

The practice of the trusts in waterworks construction is fairly well standardized. Concrete gravity dams or earthen banks with reinforced concrete cores are generally adopted for storage reservoirs. With few exceptions elevated tanks are constructed of reinforced concrete—the exceptions being steel tanks on brick or concrete towers. A considerable variation exists however in the use of pipes, almost every class of pipe manufactured locally having been used with satisfactory results. The types most commonly used for mains are cast iron and steel—both plain and concrete lined—wood, reinforced concrete and more recently, fibrolite.

MORNINGTON PENINSULAR SCHEME.

Two interesting and important schemes recently developed by the State Rivers and Water Supply Commission are the Mornington Peninsular and the Bellarine Peninsular water supplies.

The former scheme was initiated to supply the Flinders Naval Base. It now provides a reticulated supply to a large number of bayside towns situated on the Mornington Peninsula situated between Port Phillip and Western Port Bays from Mordialloc to Frankston and Mornington as well as to Dandenong and other important inland towns.

The supply in the first instance is drawn from the Bunyip River and conveyed 40 miles by race to the Beaconsfield storage of 200 million gallons capacity.

From the Beaconsfield reservoir the water is conveyed by pipe mains to several distributing reservoirs.

From Langwarrin a main branches south to the Flinders Naval Base and serves several towns on the shores of Western Port Bay.

The total storage capacity of the works is 1,400 million gallons including the recently constructed reservoir at Lysterfield of 924 million gallons capacity which considerably augments the supply to the Dandenong and Carrum districts.

This reservoir, which is designed for an ultimate capacity of 15,000 million gallons, will assure an ample supply of water for many years.

The Mornington Peninsula scheme, which already provides a supply for 23 towns and for a large area of market gardens, will eventually be extended as far as Sorrento and Portsea.

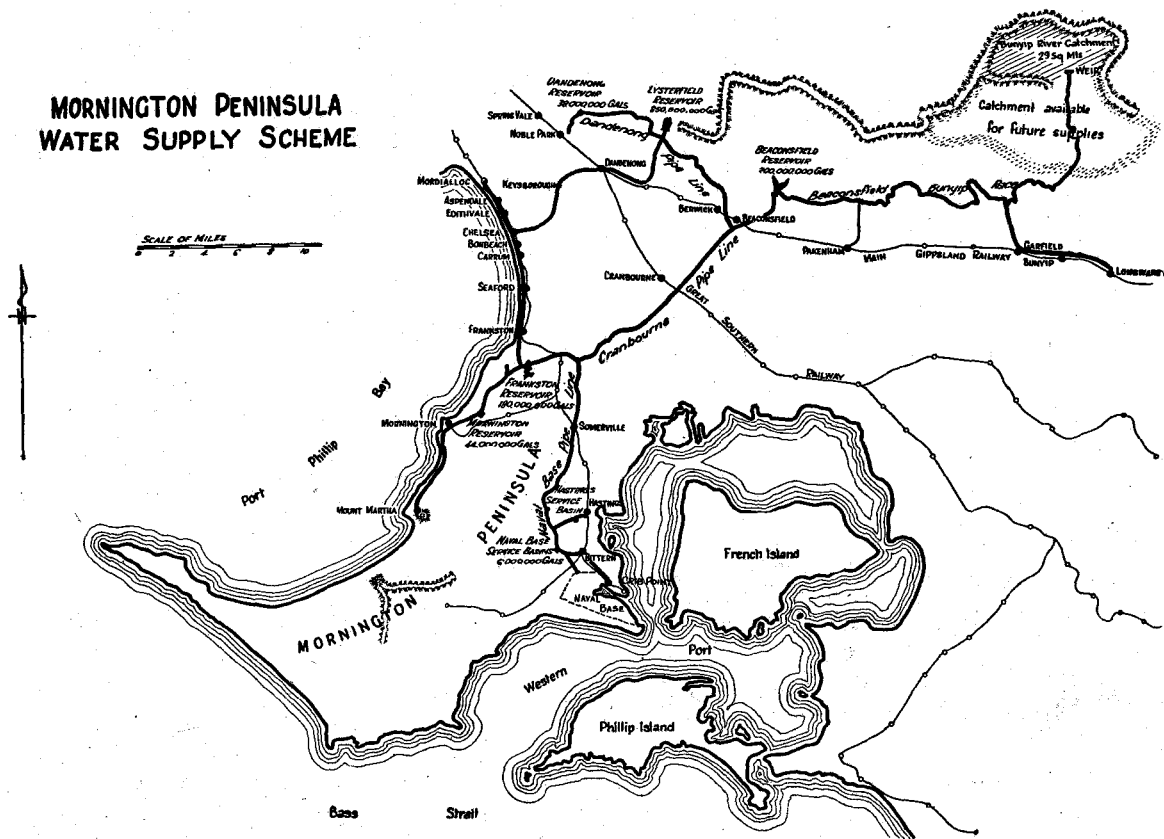
The cost of the works to date is approximately £900,000.

THE BELLARINE PENINSULA SCHEME.

The Bellarine scheme, in addition to supplementing the Geelong supply, serves the seaside towns on the Bellarine Peninsula from Portarlington to Queenscliff, Point Lonsdale Barwon Heads and Torquay and also the inland town of Drysdale.

The source of supply is the headwaters of the Barwon River and its tributaries, the water being conveyed by an open channel for 30 miles to a storage basin at Wurdee Boluc near Winchelsea.

MORNINGTON PENINSULA WATER SUPPLY SCHEME



Mornington Peninsula Water Supply Scheme.

The present capacity of this storage is 2,720 million gallons but it can readily be increased to 6 times this amount when required.

From the Wurdee Boluc storage the water is brought by open channel 14 miles to a pipe head basin at Wauron Ponds near Geelong.

From this pipe head a 24 in. main extends for 3 miles to a point where it divides into two branches. One of these branches carries a supplementary supply to the City of Geelong and the other proceeds to a pipe head basin near Drysdale. From this pipe head a short channel leads to the Bellarine storage of 80 million gallons which serves Queenscliff, Point Lonsdale, Ocean Grove and Barwon Heads. A pipe line is also taken to the Drysdale storage supplying the townships of Drysdale and Portarlington.

This scheme is also capable of supplying the towns of Birregurra, Winchelsea and Anglesea.

The scheme has cost approximately £430,000 to-date.

SEWERAGE.

Public sewerage systems in Victoria are in general constructed and controlled by local sewerage authorities constituted under the *Sewerage Districts Act, 1928*. The exceptions, as in the case of water supplies, are those of the cities of the Melbourne metropolis and Geelong where the control is vested in the Melbourne and Metropolitan Board of Works and the Geelong Waterworks and Sewerage Trust, constituted and operating under special Acts of Parliament.

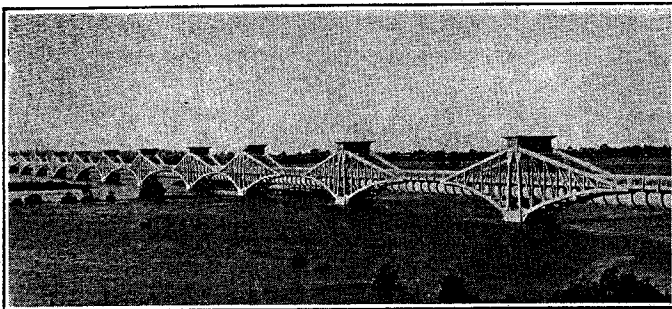
The *Sewerage District Acts* which are administered by the Minister of Water Supply through the State Rivers and Water Supply Commission, provide for the construction, maintenance and management of sewerage systems by sewerage authorities and in every case the control of a system is vested in a local authority which also constructs the works subject to the general supervision of the Commission.

To defray the cost of the works, provision is made in the acts for an authority, with the consent of the Governor-in-Council, to borrow in the open market by the assignment of rates and charges or by the issue of debentures.

Provision is also made for Government loans to sewerage authorities on favourable terms.

GEELONG WATERWORKS AND SEWERAGE TRUST.

Prior to the passing of the *Sewerage District Act* in 1915, the only country sewerage authority was the Geelong Waterworks and Sewerage Trust, already mentioned.



Geelong Sewerage Aqueduct.

The works of this authority provide for the sewerage of the City of Geelong and suburbs, and the disposal of the

sewage by means of an outfall sewer 4 ft. 3 in. × 3 ft. 3 in. to the ocean—a distance of 9 miles. A feature is the spectacular reinforced concrete aqueduct, 2,400 feet in length, across the Barwon Valley.

The cost of this scheme, which serves 11,000 tenements, was approximately £700,000.

BENDIGO SEWERAGE AUTHORITY.

The first scheme initiated under the *Sewerage District Act* was carried out by the Bendigo sewerage authority and completed in 1931 at a cost of £332,000.

The principal works consist of an outfall sewer, 24 inches in diameter, and 5 miles in length, leading to treatment works consisting of sedimentation and sludge digestion tanks—the effluent being used for the irrigation of permanent pastures.

BALLARAT SEWERAGE AUTHORITY.

The Ballarat sewerage authority was the next to be constituted and the sewerage of the city and environs is practically completed. These works include an outfall sewer, 33 inches in diameter, and treatment works consisting of rough screens, sedimentation tanks, separate sludge digestion tanks and trickling filters.

The cost of these works to-date is approximately £400,000 and when completed the scheme will serve a population of 38,000.

OTHER SCHEMES COMPLETED.

The example of these two cities was quickly followed by several important country towns, and to-day sewerage schemes have been installed at Colac, Echuca, Mildura, Swan Hill and Warrnambool, all of which were financed by loans from the Government.

In addition, works are in course of construction at Horsham and Wangaratta, and several other authorities are contemplating the early installation of sewerage schemes.

GENERAL DESIGN.

All these schemes have been designed on the separate system and in no instance is storm water permitted to enter the sewers.

Both concrete and glazed stoneware pipes are used for the construction of sewers—the general practice being to use concrete for the larger and deeper sewers and stoneware for the smaller sewers and house drains.

The flat nature of the country has occasioned considerable difficulty in obtaining suitable grades and has involved the use of pumping stations in all but three of the towns seweraged.

In two cases only, viz. :—Geelong and Warrnambool, has it been possible to obtain ocean outfalls—the other towns relying on some form of disposal works.

The form of treatment generally adopted is sedimentation of the raw sewage—with or without screening—digestion of the sludge in Imhoff or separate tanks, the oxidation of the effluent by aeration tanks or trickling filters, and the final disposal of the effluent on the land.

The effluent from the treatment works is not permitted to pass directly into any water course used for domestic purposes.