On the Melbourne & Metropolitan Board of Works

Water Supply, Sewerage, &c.

Photographic Views

THE MELBOURNE & METROPOLITAN BOARD OF WORKS

WATER SUPPLY, SEWERAGE, ETC.

... PHOTOGRAPHIC VIEWS ...

MELBOURNE:
OSBOLDSTONE & CO., PRINTERS AND PUBLISHERS, TEMPLE COURT PLACE, LITTLE COLLINS STREET.
1908.

Contents

INTRODUCTION

THE MELBOURNE AND METROPOLITAN BOARD OF WORKS, which is the administrative Council of the twenty-two federated Municipalities of the Metropolis of Victoria, incorporated for certain purposes conducive to the better management of the Metropolis, has, since its creation in 1891, been principally occupied with two great undertakings of primary vital importance to the health and comfort of the 530,000 inhabitants, viz.,—Water Supply and Sewerage.

Upon the Melbourne Water Supply System there has been expended up to the 30th June, 1908, a total sum of £3,836,848. Of this amount £448,602 has been spent by the Board; and the balance by its predecessors, the Melbourne Water Supply Department of the Government. The Water Rate is 7d. in the £, and the charge by measure 1s. per 1,000 gallons. There are 9 storage reservoirs in the system, situated respectively at Yan Yean, Toorourrong, Morang, Preston, Surrey Hills, Essendon (2), Caulfield, and Kew.

The average supply of water per head of population has for years ranked amongst the highest in the world, exclusive of leading American Cities, and for 1907 was 66 gallons *per capita*. Measures are now being adopted to take in additional sources of supply from the Coranderrk and O'Shannassy Rivers, owing to the stress caused in the Metropolis by abnormally dry seasons. The entire watershed areas comprise about 70,000 acres, the whole of which is under the Board's control and free from settlement. There are 73 miles of aqueducts and syphons, and about 1,200 miles of reticulation mains and pipes.

The expenditure upon sewerage to the 30th June, 1908, amounted to £5,718,329. There are 934 miles of reticulation sewers, 101 miles of mains and branches, and 1371 miles of house connection drains. The connection of the first property with the sewers was made on August, 1897, and since then 94,067 tenements have been connected.

All the sewerage gravitates to the Pumping Station at Spotswood. It is then raised by powerful pumps (see illustrations within) about 125 feet through 2¾ miles of 6 ft. and 4 feet rising mains to the head of the Outfall Sewer, from whence it gravitates to the Farm at Werribee. It is there spread over properly prepared blocks of land by a series of main and lateral carriers. The effluent, after filtering through the land, is discharged into Port Phillip Bay in a clear and transparent condition.

The present indebtedness of the Board is as follows:—

Owing to Government for Waterworks	£1,688,663
Owing to Debenture Holders	8,251,000
TOTAL	£9,939,663

The total valuation of the Metropolitan area is £5,004,083. The Board's income for the last year was £475,033, and the expenditure, including interest, £472,448.

The water supply sources and head works are in many cases situated in remote places, and the sewerage works are chiefly underground. The Board has therefore resolved that these photographs of some of the scenes and works should be collected and bound for general information.

AUGUST, 1908.

THE MELBOURNE & METROPOLITAN BOARD OF WORKS.

Members of the Board and Postal Addresses, August, 1908.

Chairman of Board: W. J. CARRE RIDDELL, Esq., 150 Spencer Street, Melbourne.

City of Melbourne:
Sir ARTHUR SNOWDEN, 4 St. Heliers Street, Abbotsford.
WILLIAM STRONG, J.P., 33 Park Street, Brunswick.
WILLIAM COOK, 797 Drummond Street, North Carlton.
JACOB MARKS, J.P., 430 Little Collins Street, Melbourne.
FRANK STAPLEY, 101 Swanston Street, Melbourne.
JAMES H. GARDINER, 139 Leveson Street, North Melbourne.
ARTHUR L. CRICHTON, Rankin's Road, Kensington.
WILLIAM W. CABENA, 465 Lonsdale Street, Melbourne.
JOHN G. AIKMAN, J.P., M.L.C., "Langrigg," Holmes Road, Moonee Ponds.

City of South Melbourne:
JOHN SLOSS, 241 City Road, South Melbourne.
JOHN BARAGWANATH, J.P., 21 Bank Street East, South Melbourne.
JOHN S. WHITE, J.P., Greensborough.
WEST O. STRANGWARD, J.P., 413 Collins Street, Melbourne.

City of Prahran:
EDWARD NAYLOR, Beach Road, Hampton.
HENRY UPTON, J.P., 48 Queen Street, Melbourne.
JOHN R. G. NICOLSON, Punt Road, South Yarra.

City of Fitzroy:
JOHANN G. YAGER, J.P., Kerr Street, Fitzroy.
GEORGE R. JEFFRIES, J.P., 23 Brunswick Street, North Fitzroy.

City of Richmond:
EDWIN CRAWCOUR, 81 Swan Street, Richmond.
GEORGE W. FREEMAN, J.P., "Gowar," 323 Church Street, Richmond.

City of St. Kilda:
SIGISMUND JACOBY, J.P., "Lissa-Thorn," Redan Street, St. Kilda.
GEORGE CONNIBERE, J.P., "Southdean," Irving Road, Toorak.

City of Collingwood:
JOHN GAHAN, J.P., 281 Victoria Street, Abbotsford.
WILLIAM RAIN, J.P., "Lindaville," Gipps Street, Collingwood.

City of Footscray:
FRANK E. SHILLABEER, 74 Buckley Street, Footscray.

City of Hawthorn:
JAMES S. RIDDELL, J.P., 100 Power Street, Hawthorn.

City of Brunswick:
THOMAS PASSFIELD, 401 Sydney Road, Brunswick.

Town of Brighton:
THOMAS WILSON, J.P., "Florencegart," William Street, Brighton.

Town of Essendon:
ALBERT EDWARD YOUNG, 34 Puckle Street, Moonee Ponds.

Town of Northcote:
CHARLES MITCHELL, 13 Helen Street, Northcote.

Town of Port Melbourne:
GEORGE S. WALTER, 93 Heath Street, Port Melbourne.

Town of Williamstown:
WILLIAM H. TREGANOWAN, J.P., Johnston Street, Newport.

Town of Malvern:
THOMAS CARROLL, Llanaast Street, Malvern.

Town of Caulfield:
ROBERT L. PHILLIPS, "Koora," Murrumbeena Road, Murrumbeena.

Town of Camberwell:
ROBERT BECKETT, J.P., 420 Little Collins Street, Melbourne.

Borough of Kew:
EDWARD A. ATKYNS, 418 Little Collins Street, Melbourne.

Borough of Coburg:
ELI WILLIAMS, J.P., Kendall Street, Coburg.

Shire of Heidelberg:
THOMAS LATHAM, J.P., "Alan Brae," Ivanhoe.

Shire of Preston:
CHARLES T. CRISPE, J.P., King William Street, Preston.

EX-MEMBERS OF THE BOARD.

The following gentlemen, whose names are arranged alphabetically under their respective Municipalities, have at various periods occupied seats upon the Metropolitan Board of Works, viz.

Melbourne—
*AMESS, S.
*ANDERSON, J.
BAXTER, J.
*CARTER, G. D.
DAVIES, F.
GILLOTT, SIR SAMUEL
HENNESSY, D. V., J.P.
*IEVERS, W.
*LANG, M.
MOLONEY, J.
*MOUBRAY, T.
*PIGDON, J.
*SMITH, C.
TAIT, A.
*WALKER, J.

South Melbourne—
ASHWORTH, T. R.
BOYD, J.
GITTUS, T.
HARTLEY, F. G., J.P.
HEATHER, E. D., J.P.
LARKIN, M.
MILLS, R. J.
*MOUNTAIN, W. J., J.P.
*OWEN, W. H.
PALMER, W.
PARKER, A.
*STEAD, J.
STOCKDALE, R.
TOFE, H.

Fitzroy—
*BROOKS, E.
GROSS, M., J.P.
McMAHON, J., J.P.

Prahran—
ELLIS, T., J.P.
*FULLER, W.
FURNEAUX, J. H.
LUXTON, Hon. T., M.L.C.
MADDOCK, J. H.
MUNTZ, T. B.
*OSMENT, H., J.P.
TURNER, J.

Richmond—
AMESS, J.
DAVIES, C. J.
HARVIE, J. C.
ILOTT, J.
JAGO, C. J.
*McRAE, J.
O'CONNOR, P. J.
WEATHERILL, S. W.
WILLIS, S. J.

St. Kilda—
LEMME, V.
MOORE, A. E., J.P.

Collingwood—
*CODY, W.
DWYER, M., J.P.
PITT, W., J.P.

Boroondara—
DILLON, F., J.P.

Brighton—
*BURROWS, W., J.P.
HAMILTON, J. F.
*WALSTAB, A.

Brunswick—
BALFE, M.
FLEMING, J. W.
FRASER, D.
HENNESSY, D. V., J.P.
*KING, S.
TALBOT, R. J. de COURCY

Coulfield—
RIDDELL, W. J. C.
(now Chairman of the Board)

Coburg—
VORCE, A., J.P.

Essendon—
*COWAN, J. C. M.
DANGERFIELD, E.
*JORDAN, H. T.
MOUNTAIN, W. J., Jun.
*TAYLOR, J.

‡Flemington and Kensington—
DAVIES, C. J.
*HARDIMAN, M. J.
RAISBECK, J.

Footscray—
CUMING, J., J.P.
FRASER, J. W.
GALLANT, W.
MITCHELL, W., J.P.

Hawthorn—
*COWPER, W., J.P.

Heidelberg—
FORD, A., J.P.
McCALLUM, S. C.

Malvern—
BAILEY, W. V.
*BENSON, R. G.
CAMERON, A.
KNOX, W., J.P.
MUNRO, D.

Northcote—
DENNIS, W. H., J.P.
VERSO, C. J., J.P.
*YEOMANS, C., J.P.

‡North Melbourne—
CARTER, GEORGE, J.P.
*FOGARTY, T.

Port Melbourne—
EDWARDS, H. N., J.P.
*PLUMMER, J. K. B.
*TARVER, W. R.

Preston—
BAYLISS, F. R.
CRAWLEY, G.
HOWDEN, C.
STORY, G. R.

Williamstown—
HICK, H.
STYLES, J.

**Deceased.* *‡Included with Melbourne since 1st March, 1906.*

OFFICERS OF THE BOARD.

Secretary: GEORGE A. GIBBS
Treasurer: ROBERT RICHARDSON
Chief Clerk: HENRY S. HIGGINSON
Clerk of Committees: F. H. VINCENT
Solicitors: Messrs FINK, BEST, & HALL.

Engineer-in-Chief: CALDER E. OLIVER, M.C.E., M. Inst. C.E.
Designing Engineer: CHRISTIAN KUSSMAUL, M. Inst. C.E.
Surveyor: GEORGE H. GRANT, C.E.
Engineer of Sewerage: WILLIAM WILSON, Assoc. M. Inst. C.E.
Engineer of Water Supply: E. G. RITCHIE, Assoc. M. Inst. C.E.

Board's Offices, Spencer Street, Melbourne.

THE OFFICES occupied by the staff of The Melbourne and Metropolitan Board of Works are situated at the corner of Spencer Street and Little Collins Street, and cover a superficial ground space of 18,540 feet.

The building—formerly used as the Sailors' Home—was purchased by the Board for £10,000 in February, 1903; was altered, added to, and more than doubled in capacity, at an additional expense of £15,950, and occupied in August, 1903.

Accommodation is provided for 292 employés, distributed as follows:—

Secretary's Department	54
Treasurer's "	129
Engineer's "	109

In addition to the housing of the staff, there are a Board Room, Committee Room, Chairman's Office, and Commissioners' Room.

The Offices constitute a valuable asset, and are conveniently accessible by train and tram.

Board's Offices, Spencer Street, Melbourne

Interior of Rates and Accounts Office.

THE space occupied by the Rates and Accounts Office represents 3,500 square feet, and formerly comprised the large yard of the Sailors' Home.

The whole of the work connected with Rates, House Connection Accounts, and Meter Accounts is transacted in this Hall, which is specially well lighted.

The concentration of business under Municipal Divisions is productive of economical results in time and labor to the public and the Board.

Interior of Rate and Accounts Office

Board Room.

THE BOARD consists of 40 members, representing the 22 Municipal Councils of the Metropolis, and its ordinary meetings are held fortnightly.

The Board Room is 60 feet long by 29 feet in width. Accommodation is provided for representatives of the press and for the public.

The Meeting shown on the opposite page was held on the 17th December, 1907, and was attended by 39 of the members.

Board Room

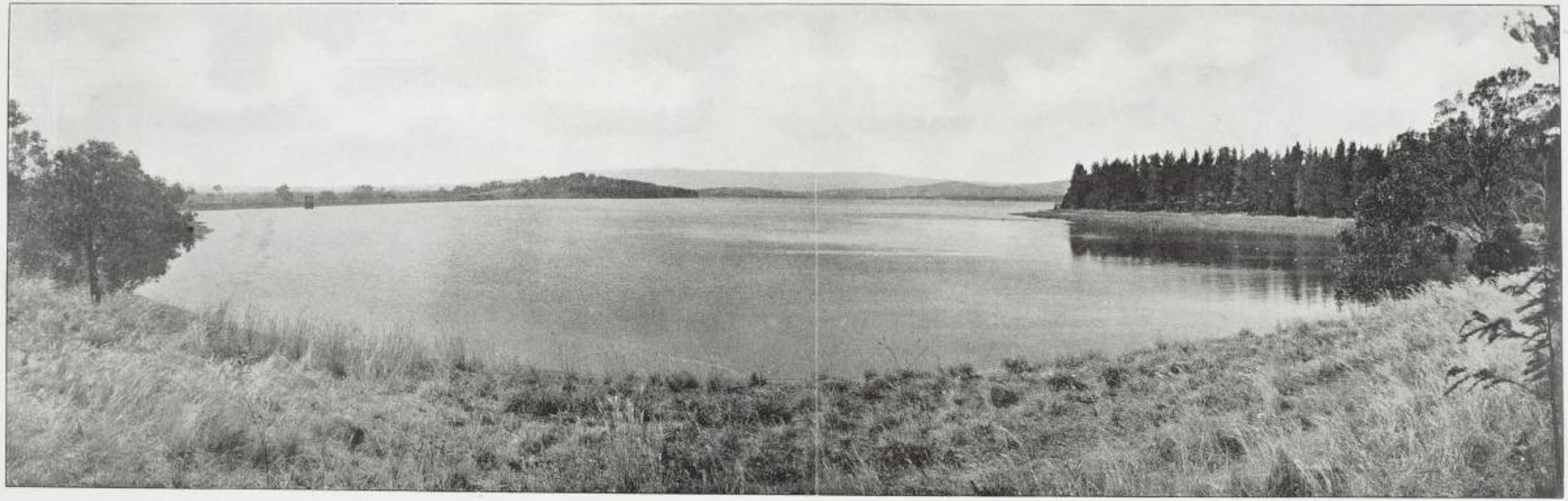
Yan Yean Reservoir.

THE YAN YEAN RESERVOIR is 1,360 acres in extent, and is formed by an embankment, 49 chains in length, constructed across the western extremity of a natural depression formerly known as Ryder's Swamp. The first sod was turned by the Lieutenant-Governor, Charles Joseph La Trobe, on 20th December, 1853, and the water was turned on in Melbourne on the 31st December, 1857.

The capacity of the lake, when full, is 6,4[illegible],000,000 gallons, of which about five-sixths are capable of being drawn off into consump[illegible]on. The average depth is 18 feet. The longest reach across the surface of the water is about 2 miles, but the irregularities of the hights make the length of its shores about 10 miles.

The reservoir is supplied from its own watershed, and by water conveyed in the Clear Water Channel from the Toorourrong Reservoir. The total watersheds of Toorourrong and Yan Yean are 29,000 acres.

In summer an average daily quantity of 24,294,000 gallons is sent to Melbourne from Yan Yean, and in winter 5,900,000 gallons.



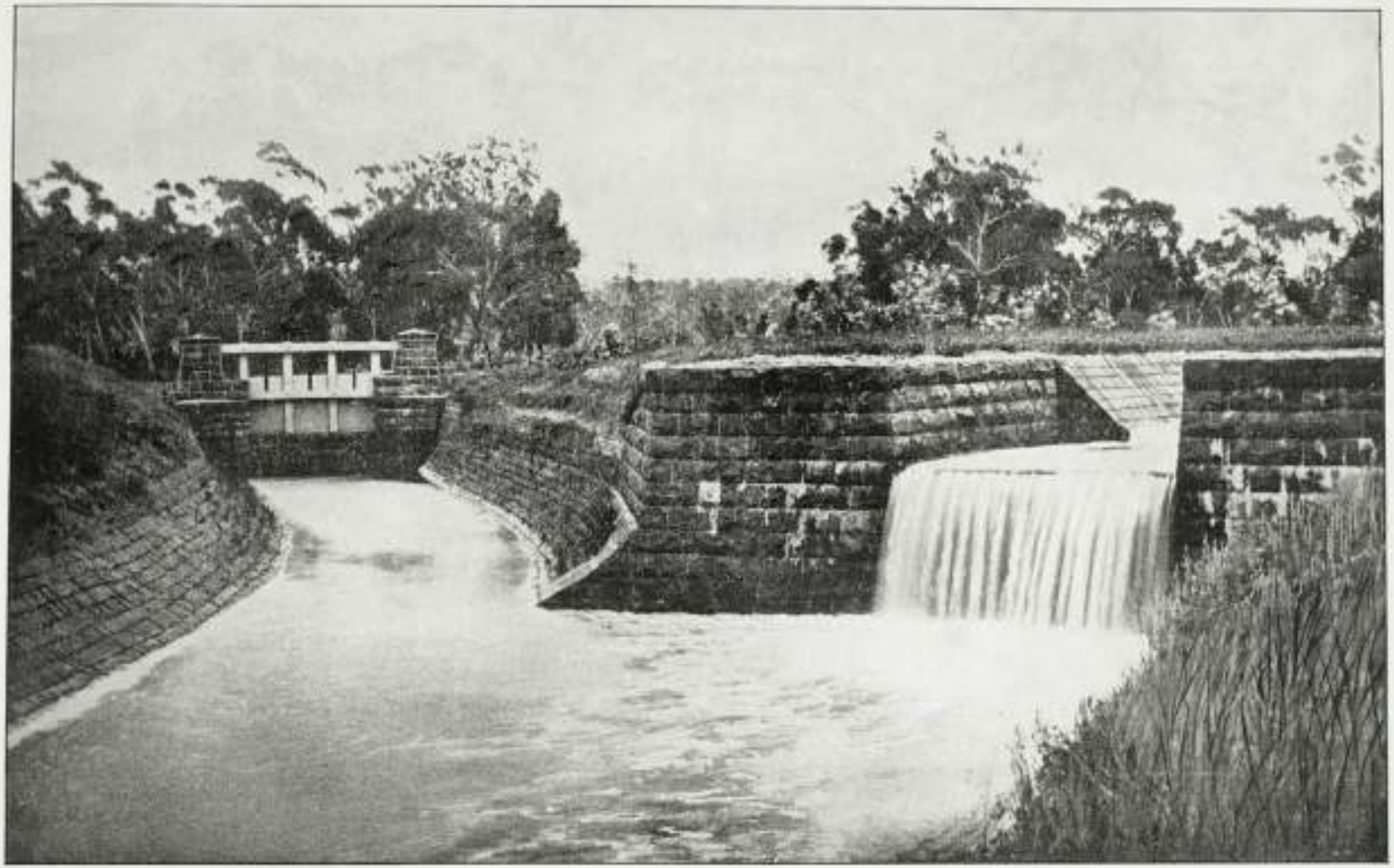
Yan Yean Reservoir

Former Inlet from the Plenty River, and the present Clear Water Channel.

UP TO 1885 the Yan Yean Reservoir got its supply from its own catchment area, supplemented, when necessary, by water from the Plenty River, admitted through the sluice gates here shown. But this additional supply, having flowed for some miles through settled country into and through the township of Whittlesea, had been fouled by drainage, and in times of flood was heavily discolored.

It was consequently a cause of complaint as to the impurity and discoloration of Yan Yean water, and of much trouble in constant attention to the gates.

To remedy this, and render further recourse to so objectionable a source of supply unnecessary, the Toorourrong Reservoir was constructed, to impound the waters of the eastern branch of the Plenty River and of Jack's Creek, which flowed direct and uncontaminated from the mountains. From Toorourrong the Clear Water Channel was built in such manner as to carry the water undefiled into Yan Yean, and since then the sluice gates have been permanently closed.



Former Inlet from the Plenty River and the Present Clear Water Channel

Clear Water Channel Connecting Yan Yean and Toorourrong Reservoirs.

THE CLEAR WATER CHANNEL is $4\frac{3}{4}$ miles in length, $13\frac{1}{2}$ feet wide, and $4\frac{3}{4}$ feet deep, with a fall of $7\frac{1}{2}$ feet per mile. It is lined with pitchers throughout.

The carrying capacity is 120,000,000 gallons per day, and the supply is controlled by sluice gates at Toorourrong.

Along its course there are several drops, or artificial waterfalls, the greatest being 17 feet. There is one short inverted syphon, constructed of 36-inch cast iron pipes.

The cost of this channel was £68,000.

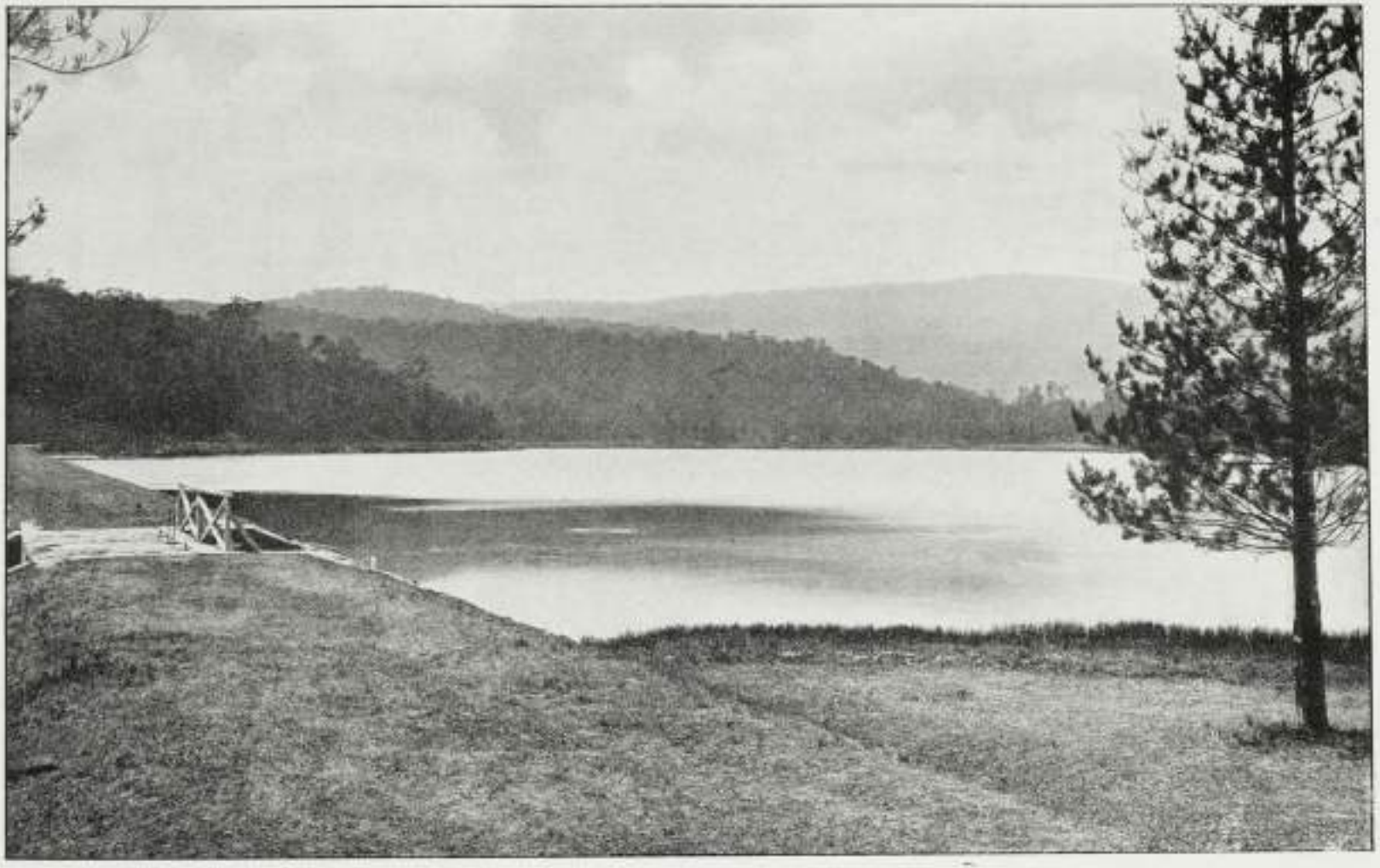
Clear Water Channel, Connecting Yan Yean and Toorourrong Reservoirs

Toorourrong Reservoir.

THIS RESERVOIR occupies a most picturesque position on the southern side of the Plenty Ranges. Its superficial area and holding capacity are relatively small, being 36 acres and 60,000,000 gallons respectively; but it is well adapted as a settling basin for the waters brought down from the hills, and for screening their outflow into the Clear Water Channel. The Reservoir has been formed by the construction of an embankment across the valley of the eastern branch of the Plenty River, immediately below the river's junction with Jack's Creek. The earthwork embankment is 15 chains long, with a puddle wall in the centre, and the inner slopes are protected with rough pitching.

The cost of this Reservoir was about £11,000. The construction of it and of the Clear Water Channel to Yan Yean, in 1885, rendered unnecessary the further use of the waters of the western branch of the Plenty and of Bruce's Creek, which were fouled by drainage from settled country which they flowed through, and they were then excluded from the Metropolitan supply.

A large area of land in the immediate watershed of the Reservoir, which had been in private occupation, has been purchased by the Board.



Toorourrong Reservoir

The Cascades

AT the lower end of the Wallaby Creek Channel the water which has flowed along on the northern slope of the Great Dividing Range is diverted into Jack's Creek, a tributary of the Plenty River, and thereby of the Yarra, by an oblique extension of the Aqueduct, the fall down which is called "The Cascades." The channel is cut well into the schist rock, and is lined with granite blocks set in cement.

The fall is divided into three slopes, the last being the steepest; these are further broken by numerous steps, which have the effect of aerating the water and checking its velocity. At the foot is a basin forming a water cushion. The length of the Cascades is 683 feet, and the fall 153 feet. This portion of the work was carried out by day labour.

The waterfall is very beautiful and interesting, especially when viewed from the fern enclosed basin.

The Cascades

View along Wallaby Creek Aqueduct.

THE WALLABY CREEK AQUEDUCT was surveyed and laid out by the late Engineer-in-Chief of The Melbourne and Metropolitan Board of Works, Mr. William Thwaites, M.A., M.C.E., M.I.C.E., in 1880, when an officer of the Public Works Department.

It was constructed at a cost of £54,000. It is 5½ miles long, with a fall of 3 feet to the mile. It is 12 feet wide, and 4 feet 6 inches deep. It is lined throughout with granite pitchers, set in cement, and has a carrying capacity of 33,000,000 gallons per day.

This channel diverts the waters of the Wallaby Creek, by contouring along the principal northern spur of Mount Disappointment to a low saddle in the Dividing Range, and discharging into the Cascades as shown and described with the photograph of the latter.

Some of the views to be obtained along the course of the channel are very beautiful; but at intervals of a few years, and during exceptionally hot weather, much destruction is caused by bush fires, which break out and spread through the surrounding forests. Such was especially the case in the month of January of the year 1905.

View along Wallaby Creek Aqueduct

Board's Cottages and Grounds, Wallaby Creek

THE LARGER BUILDING shown in this picture is the house of the caretaker, and the smaller structure is used by members and officers of the Board when upon official visits of inspection.

The caretaker patrols the watershed in the vicinity (consisting of about 12,000 acres), and also has to give close and active supervision to about 15 miles of aqueducts, and two large and three small weirs.

The Board has caused an orchard to be planted round the houses, and, notwithstanding the heavy falls of snow in winter, the trees have thriven well.

The elevation at this point is about 1,750 feet above sea level.

Board's Cottages and Grounds, Wallaby Creek

Wallaby Creek Weir.

THE WEIR at Wallaby Creek impounds the waters flowing down the Creek, and also those which are led into it by the Silver Creek aqueduct.

The Weir is constructed of granite masonry upon a good rock foundation.

The Wallaby Creek takes its rise in the northern slopes of Mount Disappointment, and, after flowing over the elevated plateau which comprises the greater part of its watershed, falls rapidly towards the valley of the King Parrot Creek until impounded by the Weir, and in its course passes over granite boulders, forming the "Nimmo Falls."

Wallaby Creek Weir

Silver Creek Weir

THIS WEIR is situated in the Plenty Ranges, at a distance of about 50 miles from Melbourne.

It is built of granite masonry, and is 125 feet long and 11 feet high. The foundations are of concrete, kept in position by sheet piling.

Three smaller weirs contribute their waters to the larger weir at Silver Creek, which is also fed by the stream from which it takes its name.

The combined supplies are led into a contour channel 8 miles in length, which forms the connecting link with Wallaby Creek. This channel is 7 feet wide, 2 feet 7 inches deep, with a fall of 3 feet to the mile, and a daily carrying capacity of 12,000,000 gallons.

There are two tunnels on its course, 29 chains and 6 chains long respectively.

The cost of the Silver Creek system was £55,000.

Some lovely views are obtainable along the route of this Channel. It was constructed in 1886, the survey having been carried out by Mr. William Wilson, the Board's present Engineer of Sewerage.

Silver Creek Weir

Formal Opening of Maroondah System.

THE formal ceremony of turning on the water from the Maroondah system was performed on the 18th February, 1891, by His Excellency the State Governor, the late Marquis of Linlithgow, then Lord Hopetoun. The function was attended by about 300 persons, including members of the Ministry and of Parliament, Municipal Councillors, and leading citizens. A banquet was subsequently held in the bush, near the present site of the Donnelly's Creek Weir, and was presided over by the Hon. J. H. Wheeler, Minister of Public Works.

The picture shows the assemblage around the weir, just after the opening of the sluice gates, and the re-christening of the "Watts" River as "Maroondah" River by His Excellency.

Formal Opening of Maroondah System

Maroondah Weir

THIS WEIR is constructed of cement concrete, with stone coping. It is 100 feet long by 7 feet deep.

It serves to raise the water sufficiently to divert it into the pipe forming the first portion of the aqueduct.

The water is conveyed from this point to Melbourne along open channels, and through syphons and tunnels, a total distance of about 50 miles.

The quantity of water sent to Melbourne from this source varies from 15,000,000 to 25,000,000 gallons per day.

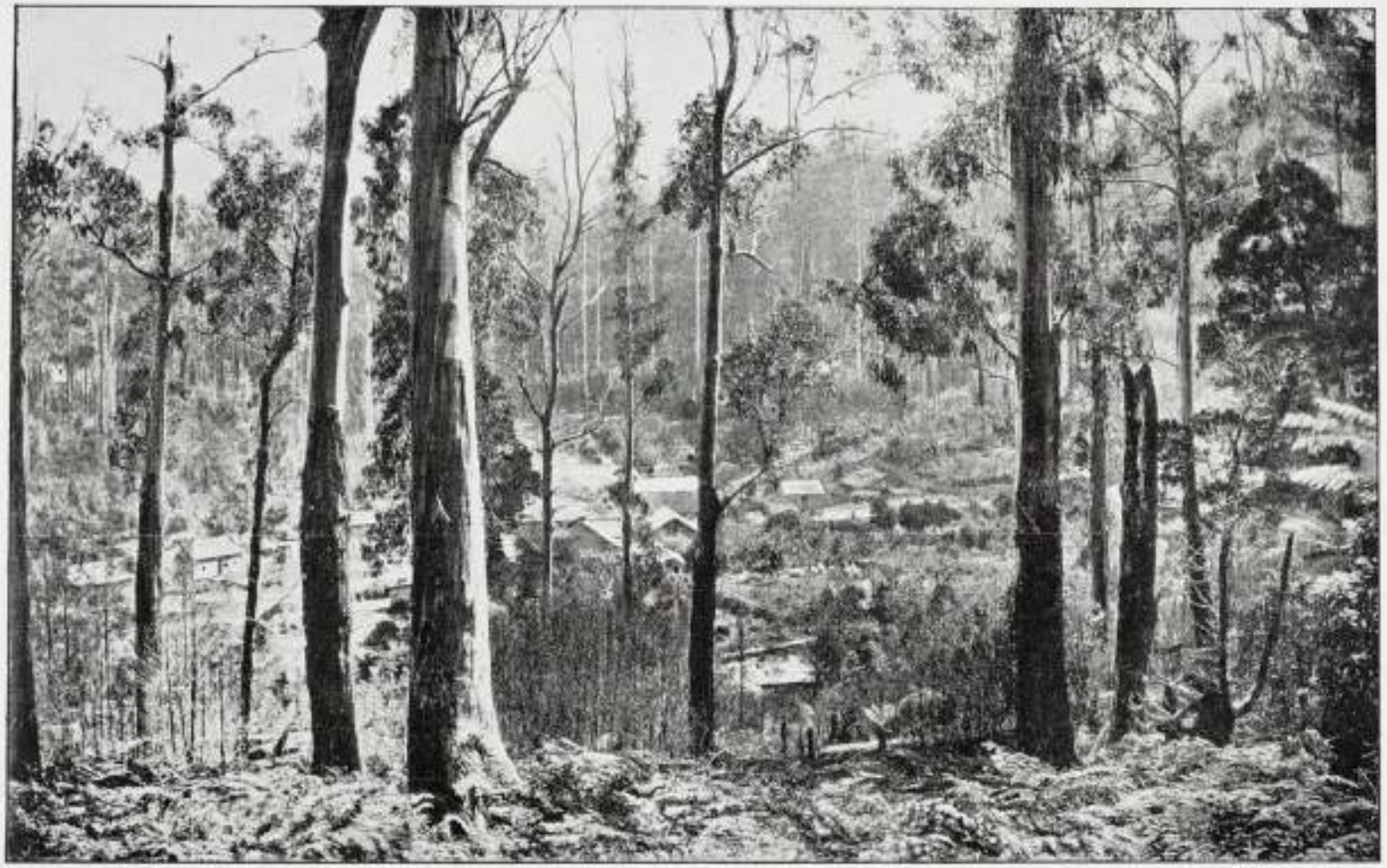
Maroondah Weir

Fernshaw Before Demolition.

FERNSHAW was one of the prettiest villages in Victoria, distant seven miles from Healesville, picturesquely situated on the bank of the Watts, now called the Maroondah, a considerable and rapidly running stream, at foot of the Black's Spur, with Mounts Juliet and Monda h rising on either side; its detached houses in orchards and raspberry gardens, spreading up into the forest of mountain ash, sassafras, graceful fern trees, and undergrowth; with stores, accommodation houses, and two hotels for the entertainment of travellers and tourists, for whom it was a favorite resort.

But it drained into the Watts, the waters of which, pure and undefiled, were indispensable to supplement the water supply of the Metropolis; and to so obtain them it became imperative to prevent their pollution, which could be done only by abolishing the township. That had been recommended by a Royal Commission, which reported with regard to the sanitary condition of the Metropolis, and acting upon that recommendation the Metropolitan Water Supply Department of the Government, in 1885-6, bought all the habitations in Fernshaw, and razed them to the ground. The cost was £30,000 0s. 1d., and that sum is part of the debt which the Board has to repay to the Government.

The Melbourne and Metropolitan Board of Works, in pursuance of the same policy, has bought every private holding which existed within the watershed at date of its creation—1891, so that in all the areas so purchased and added to the unalienated Crown land vested in the Board, and aggregating 63,000 acres, there is not one habitation draining into the watershed, and horses, cattle, sheep, goats, pigs, and dogs are excluded. The watershed will preserve the native flora and fauna.



Fernshaw Before Demolition

On the Black's Spur Road.

THE road up the Black's Spur—3 miles in length—is within the water shed, and is a continuation of the road from Healesville. From an elevation of 600 feet above sea level at Fernshaw it rises to 1,850 feet at summit of the Spur, whence it continues in a gradual downward slope to Narbethong, and extends to places beyond. In bygone years it was the chief route to the Wood's Point gold district, *via* the Yarra Track.

The views from it are very varied and beautiful. The picture is one of the bends of the road, and it gives a fair representation of one of the forest tree giants, which was known as "Uncle Sam" prior to its fall. These trees, of the "Mountain Ash" or *Eucalyptus Amygdalina* variety, which the surrounding forest is principally composed of, are amongst the tallest timber known. One of them, near this road, measured 295 feet in height, and 53 feet round the trunk 6 feet from the ground and above the buttresses formed by the roots. Taller trees, and of greater girth, are not uncommon.

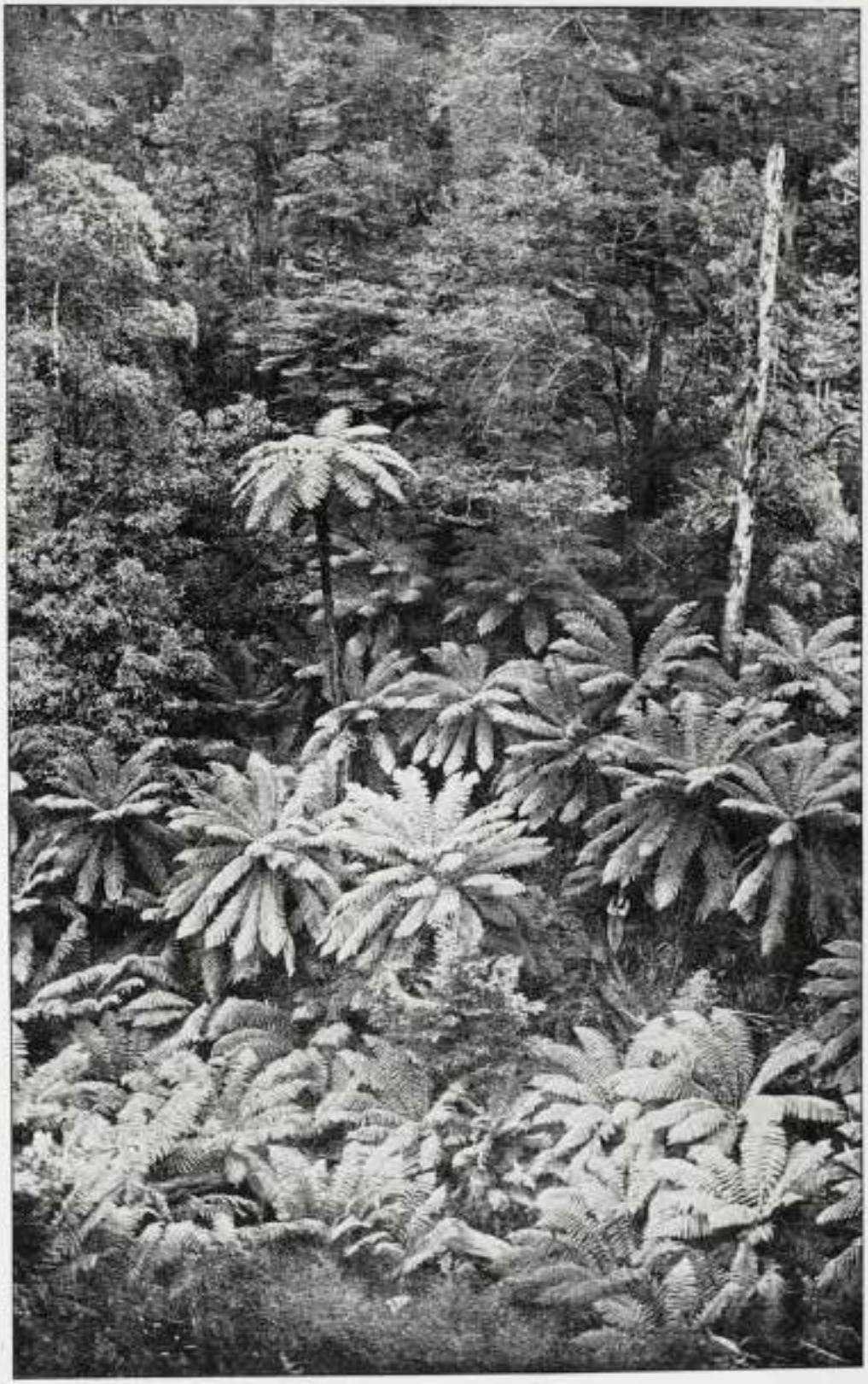
The slopes and gullies are beautiful with trees of other species, graceful tree ferns, and dense undergrowth.

On the Black's Spur Road

Fern Scene, Black's Spur.

FERN TREES abound in profusion along the Black's Spur Road and vicinity, and the cluster shown is only one of many that are observable, and present such a charming aspect.

In abnormally hot weather the dense under-growth in the ranges here, as elsewhere, causes the spread of bush fires over large areas; but in a remarkably short time the hills and valleys are again overspread with verdure, and the ferns especially seen to suffer little, if anything, by the visitation.



Fern Scene, Black's Spur

Lower Mathinna Falls.

THE MATHINNA FALLS are situated about 3 miles from the main Maroondah Weir, and are formed by the waters of the Mathinna Creek on their way to the Maroondah River. There are the Upper and Lower Falls, both passing over granite rock formations. The picture shows the Lower Falls.

Lower Mathinna Falls

Track to Condon's Gully.

THE part of the Maroondah watershed known as Condon's Gully is unsurpassed by any other portion for beautiful scenery. The groups of fern trees and surrounding foliage make a series of charming views.

Although forming part of the water reservation, this locality does not directly contribute to the general supply.

Track to Condon's Gully

View in Condon's Gully.

THIS is another picture which indicates the nature of the country constituting the Maroondah watershed areas, and gives a good general idea of some of the other valleys which are remote from observation.

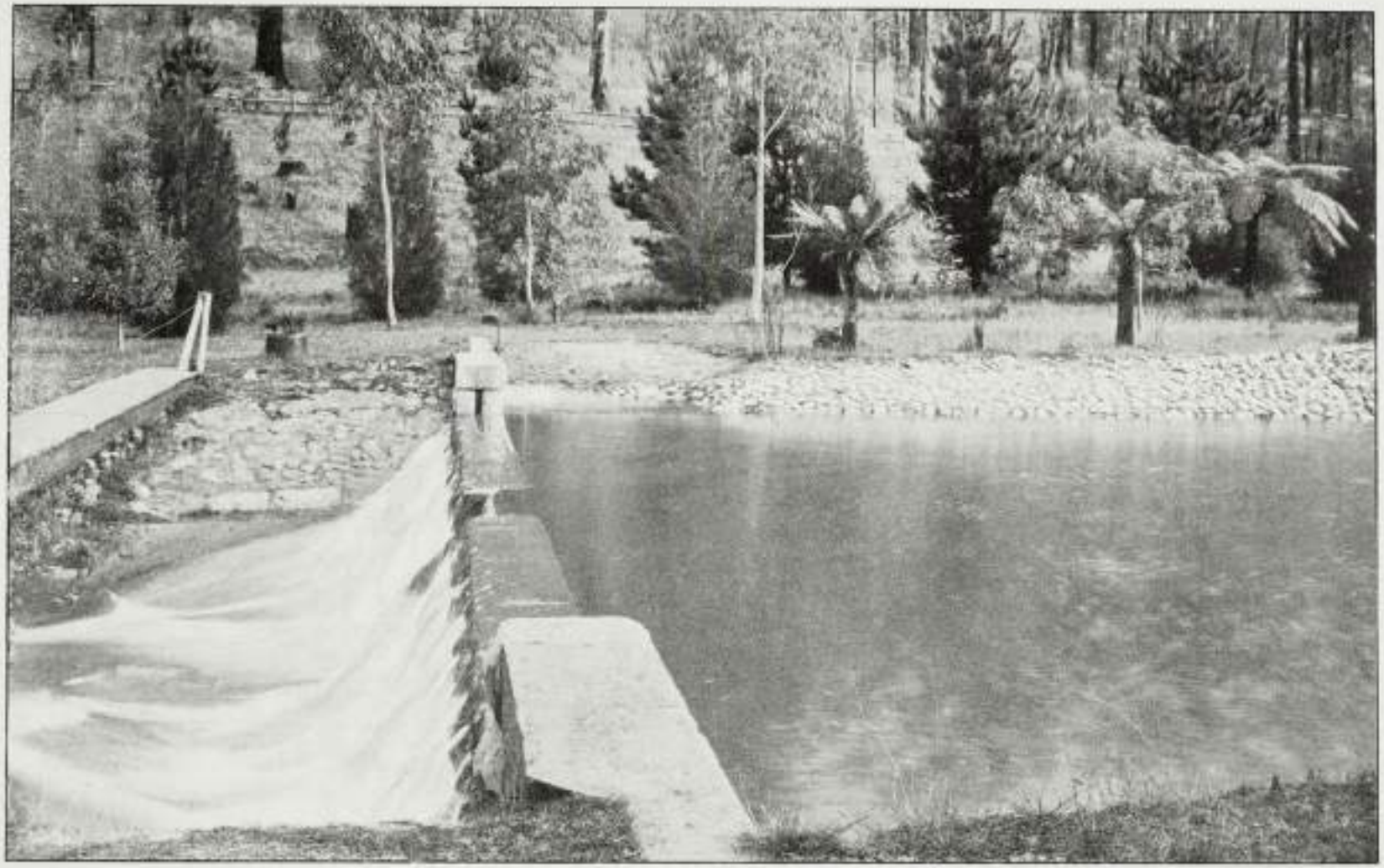
View In Condon's Gully

Donnelly's Creek Weir.

THIS small weir and connecting channel form another of the auxiliary feeders of the Maroondah system. Its contribution is about 4,000,000 gallons per day.

The waters from this source were turned on by the late Chairman of the Board, Mr. E. G. Fitz Gibbon, C.M.G., in 1893.

The works cost only £940.



Donnelly's Creek Weir

Graceburn Aqueduct.

THIS AQUEDUCT is about three-quarters of a mile in length, and leads from the weir of the same name to an 18-inch wrought-iron syphon, 1¼ miles long, across the Maroondah valley into the main aqueduct. Its capacity is 6,000,000 gallons per day.

From the channel a 7-inch pipe conveys water to Healesville, and, owing to the elevation, a good pressure is always obtainable in the township.

Gracebura Aqueduct

Graceburn Weir.

THIS WEIR is built of masonry and concrete, and collects the waters brought down from the valleys lying between Mount Riddell and Mount Juliet.

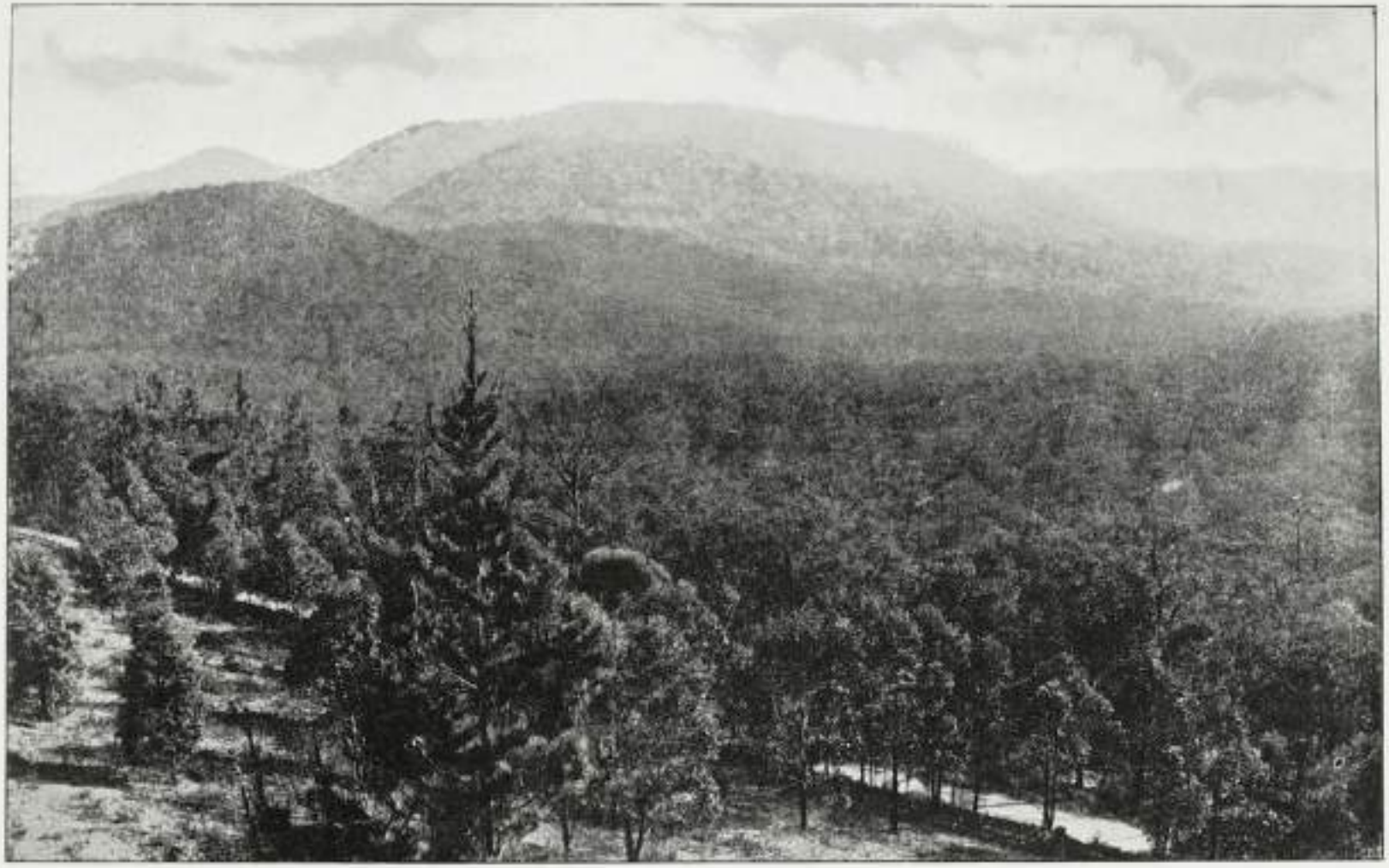
Though comparatively small in volume, the quality of the water impounded at this point and taken into the general system is exceptionally good. Continued chemical analyses place it in the front rank for purity.

Graceburn Weir

View of Mount Mondah and Mount St. Leonard

THIS PICTURE has been selected as displaying in a comprehensive view the general characteristics of the watershed areas around Healesville, comprising a total of about 40,000 acres. Besides the panoramic vista here shown there are Mounts Juliet and Riddell, which likewise form part of the watershed.

The most elevated of these adjacent mountain ranges is Mount Juliet, which attains a height of 3,700 feet.



View of Mount Mondah and Mount St. Leonard

The Badger or Coranderrk River

THIS is a fine stream of water, flowing on the south-eastern side of Mount Riddell.

It is about to be utilised for the purposes of the Melbourne Water Supply, and will contribute from 3,000,000 to 5,000,000 gallons daily to the Maroondah System.

The water is of excellent quality, and the volume available will prove a valuable auxilary.

Some extensive alienation of land had been permitted along the course of this River, but the Board has purchased all existing rights.

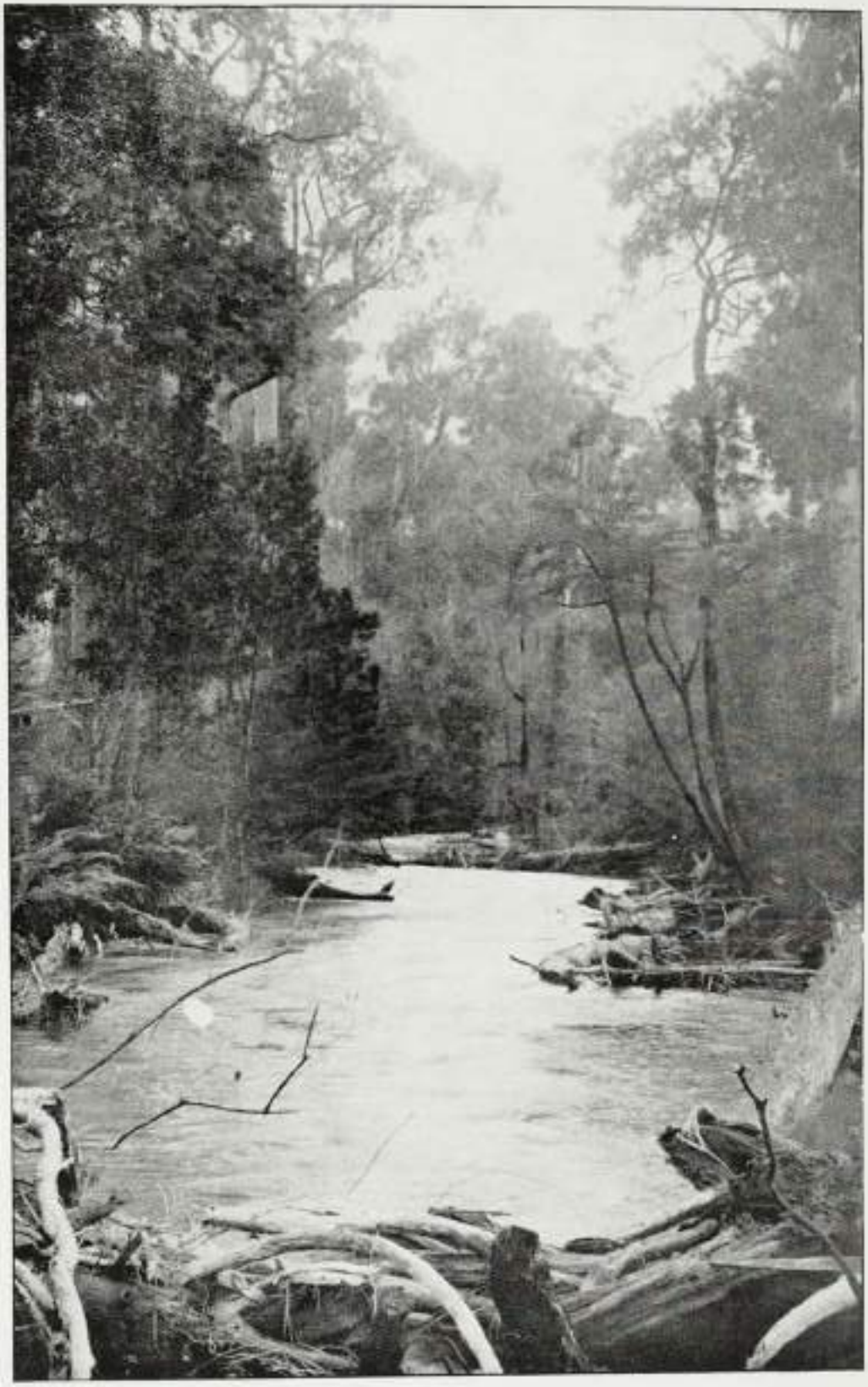
The Badger or Coranderrk River

O'Shannassy River.

THE O'Shannassy River is a tributary of the Yarra, which it joins a few miles beyond Warburton.

The view here shown is about half a chain above the junction of the two streams.

A scheme is now under consideration for taking the waters of the O'Shannassy into the Melbourne Water Supply system, and thereby adding about 20,000,000 gallons per day. An extension of this scheme will provide for the inclusion of the waters of the Upper Yarra.

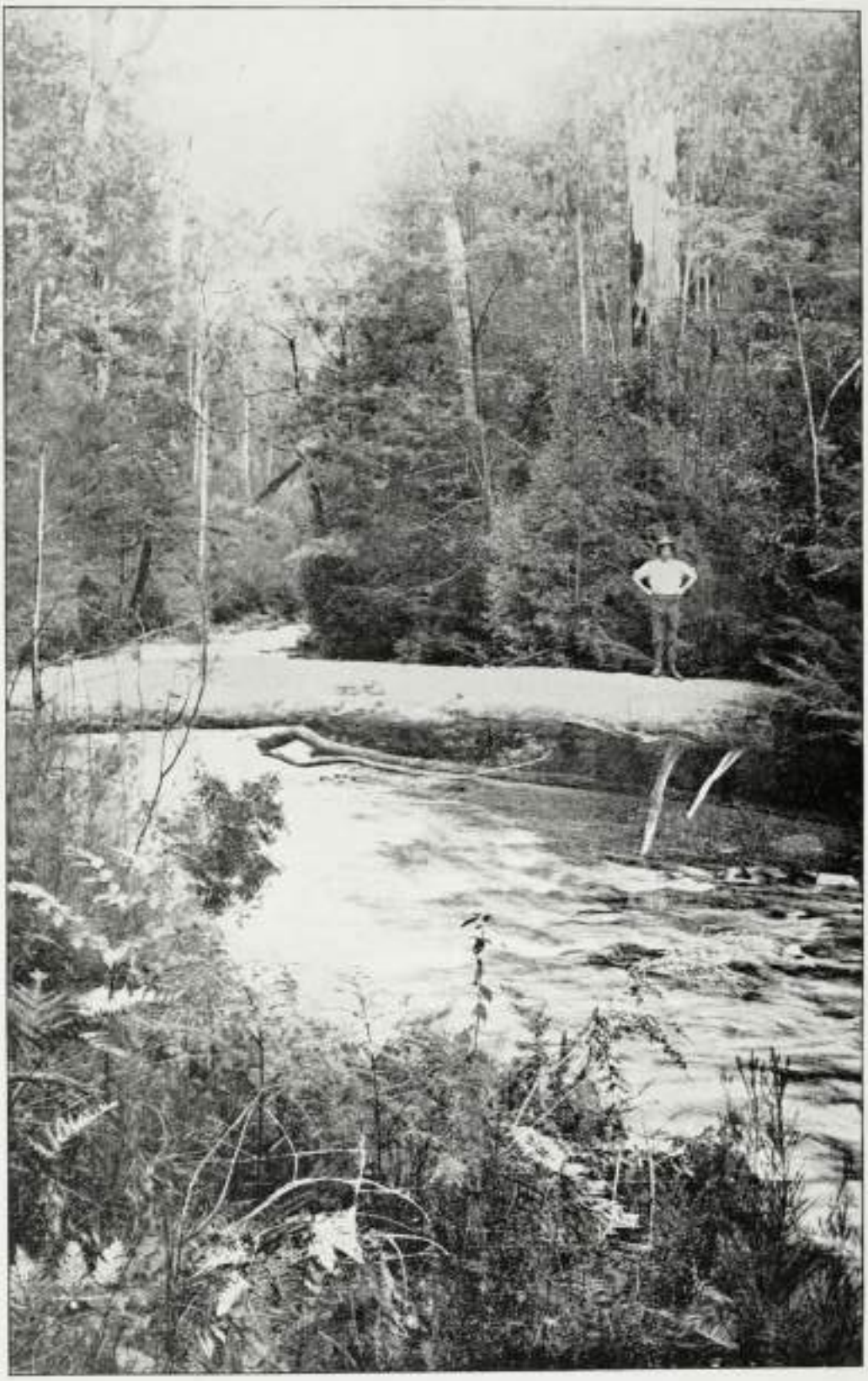


O'Shannassy River

O'Shannassy River.

THIS is another view showing the volume of water flowing in the O'Shannassy River, pure and uncontaminated from its source. The system will form an important auxiliary to the water supply of Melbourne and suburbs.

The locality depicted is about three miles above the junction of the O'Shannassy and Yarra Rivers.

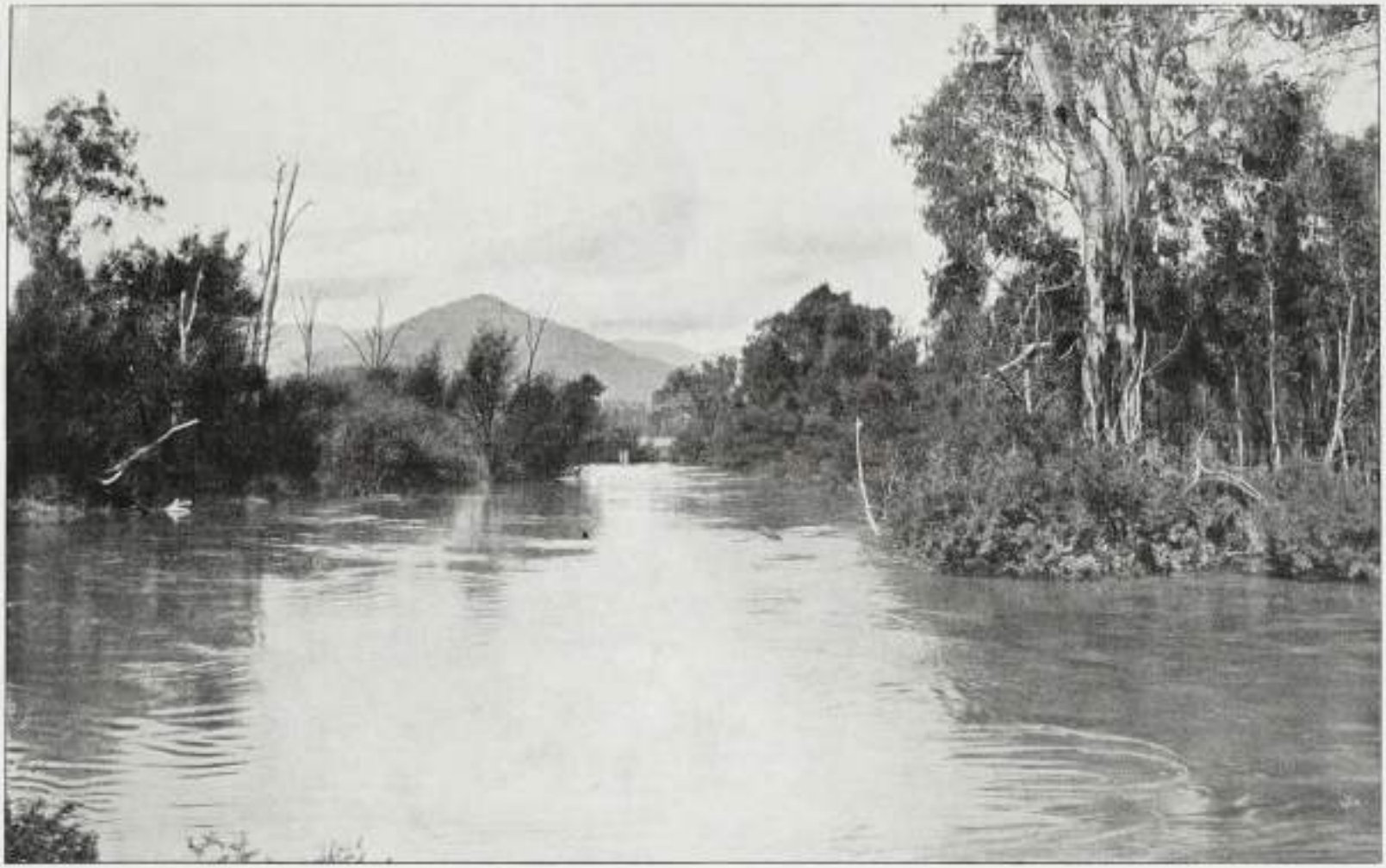


O Shannassy River

Junction Maroondah and Yarra Rivers, Healesville

THIS PICTURE is mainly of interest as showing the augmented stream of the Yarra River when joined by the Maroondah near Healesville.

The volume of water is not always as large as shown, the two rivers being in partial flood at the time the view was taken.



Junction of Maroondah and Yarra Rivers, Healesville

Enlargement of Maroondah Aqueduct.

THE Board decided, in February, 1908, to increase the capacity of the Maroondah Aqueduct by raising the sides. This work is now in progress by means of a concrete berm and slopes, 18 inches high, constructed on top of the old concrete. About 607 chains have been completed, and 150 chains yet remain to be done.

The view shown is a portion of the Aqueduct near Yarra Glen.

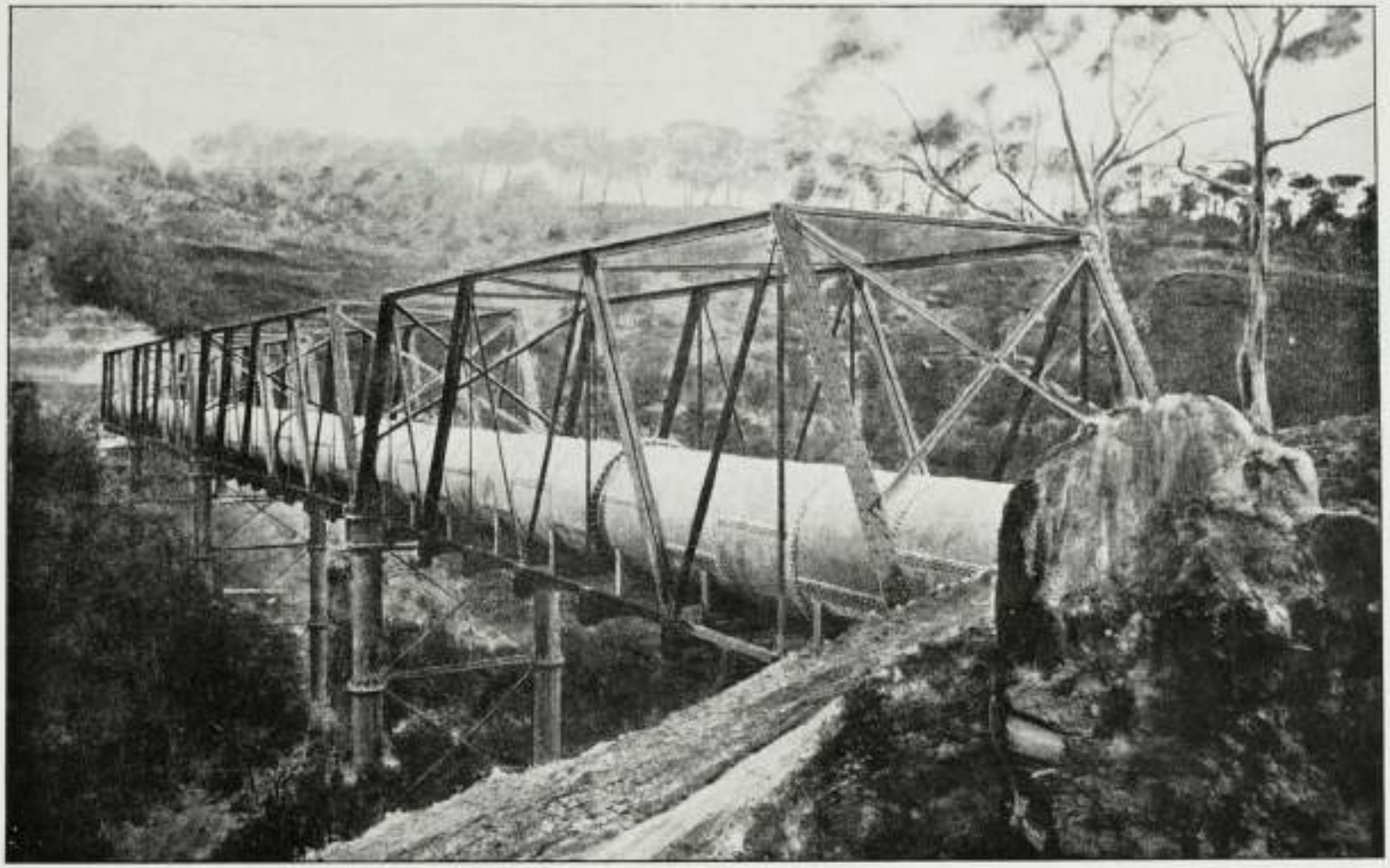
The entire work is estimated to cost £18,000. The capacity of the Aqueduct has been increased from 25,000,000 gallons to 50,000,000 gallons, but, until the syphons have been altered, the enlarged size of the channel can only be taken advantage of to the extent of about 6,000,000 gallons per day.

Enlargement of Maroondah Aqueduct

Maroondah Aqueduct across the Plenty River.

THE MAROONDAH AQUEDUCT crosses the Plenty River in a wrought iron pipe, 53 inches in diameter by 210 feet long.

This pipe is carried by an iron lattice girder of four spans, which is constructed of sufficient width and strength to carry another pipe similar to the existing one, when the aqueduct is completed to its full size, or double its present capacity.

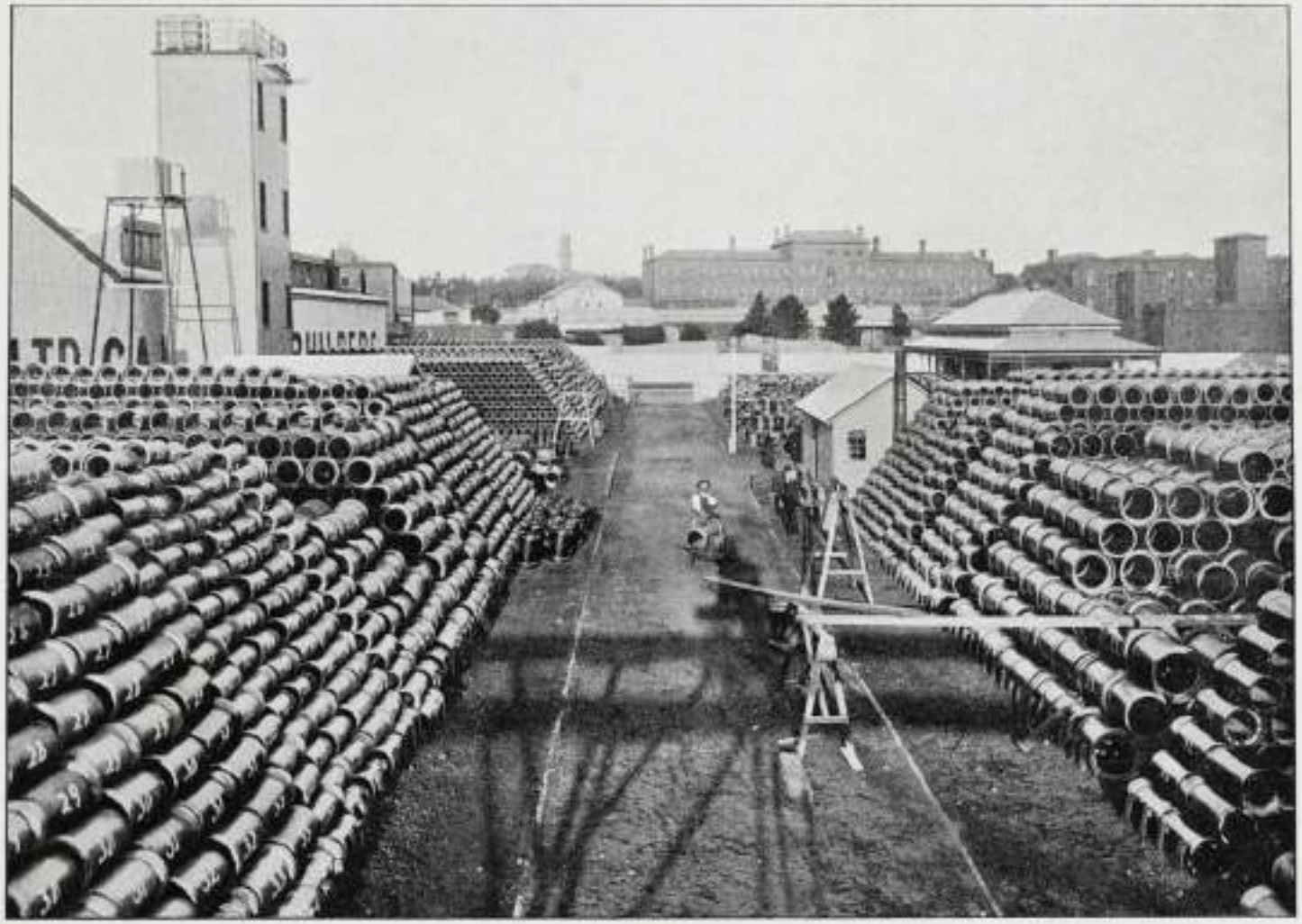


Maroondah Aqueduct Crossing Plenty River near Greensborough

South Melbourne Storeyard

THIS Storeyard consists of about four acres of ground, and is situated in Wells Street, South Melbourne, at the rear of the St. Kilda Road Barracks. It has formed the main central depôt for the storage of pipes and fittings of all descriptions required for general sewerage purposes and house connections, and has latterly been made the head quarters for the Water Supply Maintenance Staff. Testing plants for pipes, meters, &c., are provided in the yard.

The Board has recently acquired 2 acres, 0 roods, 19 perches of this land in fee simple, part payment being made by sale of the old tank yard on the Eastern Hill.



South Melbourne Storeyard

Excavation for Pumping Station, Spotswood.

THIS Picture shows the hard nature of the ground that had to be excavated for the foundations and wells of the Pumping Station.

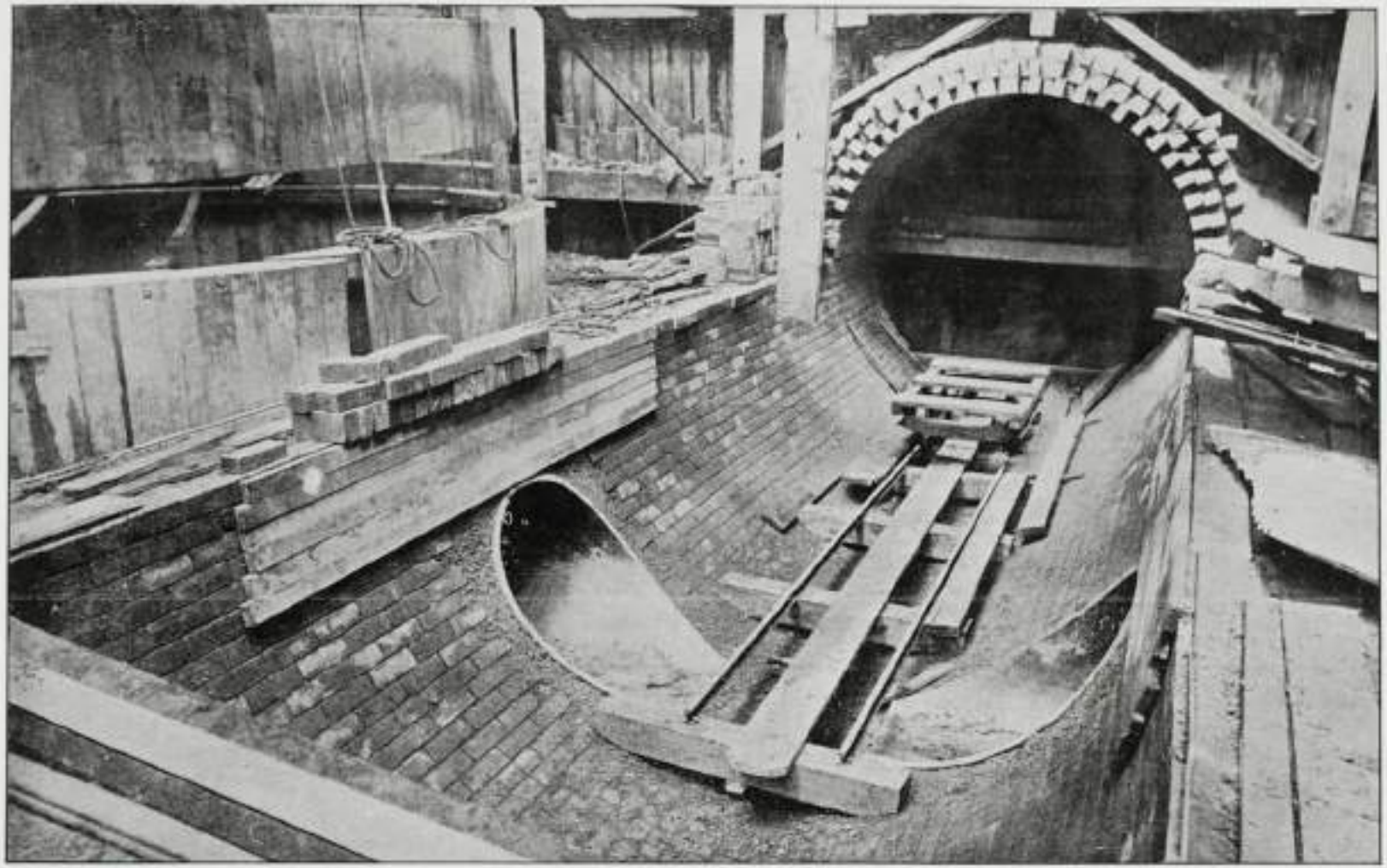
The site is specially suitable, close to the River Yarra, and about half a mile from the Spotswood Railway Station, from which a branch connecting line runs, so that it has double access for coal supply.

The cost of the land—nine acres—was £6,286.

Excavation for Pumping Station, Spotswood

Sewer at the Pumping Station During Construction.

THIS view was taken during the course of constraction at the Pumping Station, and shows the method of arranging the brickwork. Two of the inlets to the pumps wells are seen opening into the sewer. The top of one of the wells can also be seen on the left of the illustration.



Sewer at the Pumping Station During Construction

Pumping Station: Exterior View.

THE whole of the sewage of the Metropolis flows to the Pumping Station by gravitation, and is then forced through the Rising Mains to the head of the Outfall Sewer. The North Yarra and South Yarra sewage is dealt with in separate compartments, but can be worked unitedly. The buildings are designed to carry an ultimate installation of 20 engines. Wells are constructed to take 12 engines, and 6 engines are now in position. The average height to which the sewage is lifted is about 103 feet.

The sewage enters the Pumping Station through Straining Wells, which are 22 feet in internal diameter. Certain materials are removed by cages, rendered innocuous in a Johnson's Drier, and then burned.

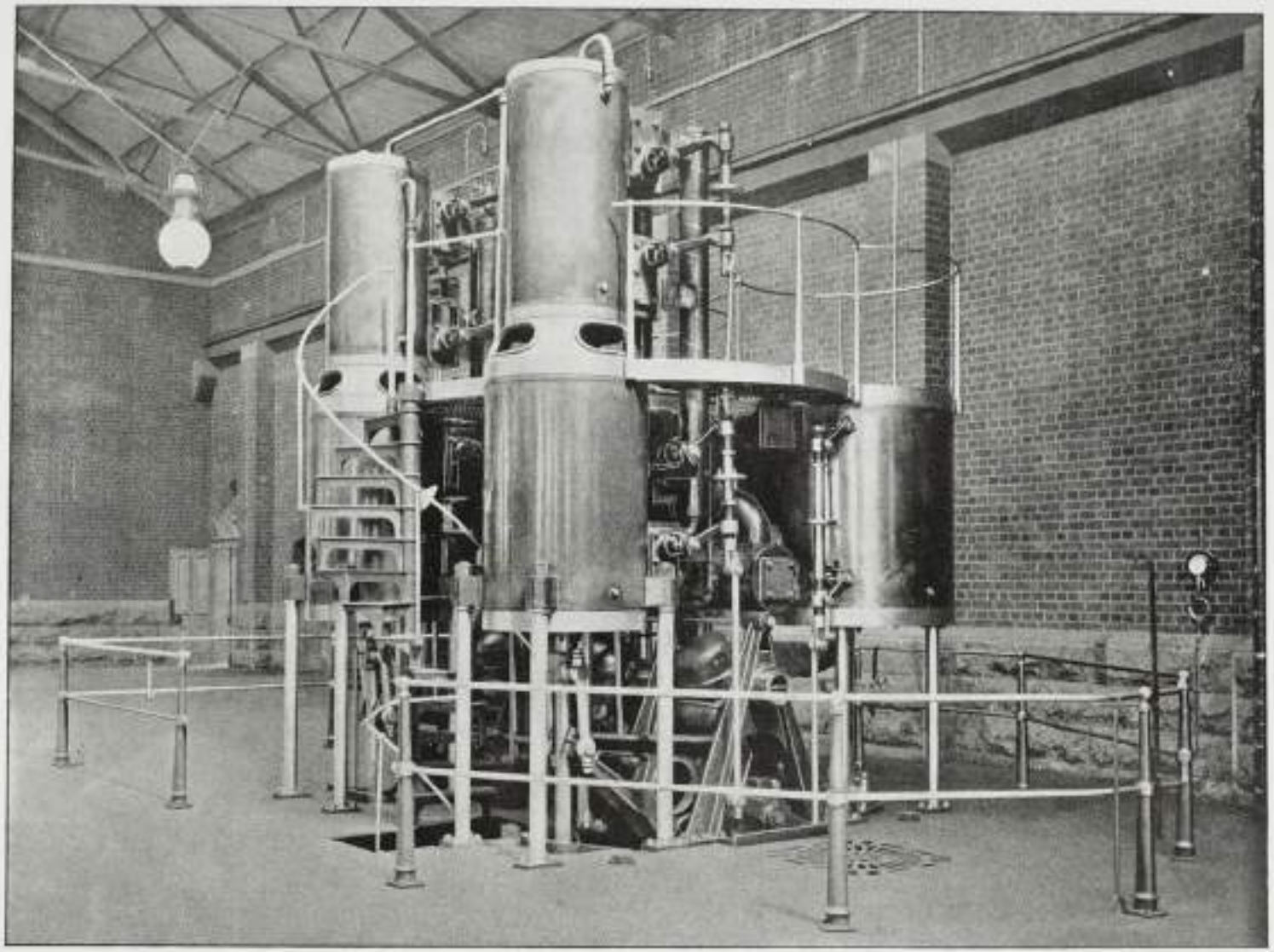
Pumping Station: Exterior View

Pumping Station: Thompson Engine (Victorian).

THIS Picture shows one of four engines, similar in type, constructed in 1893-7 by Messrs. Thompson & Company, of Castlemaine. These engines are described as Vertical Triple Expansion, Duplex Beam Compensated, Direct Acting, Surface Condensing, Sewage Pumping Engines. The Contract of Messrs. Thompson & Company also included six Steel Boilers, Delivery Mains, Economiser, Boiler Flues, &c. The total payment under this contract was £39,476 18s. 1d., and the cost of each engine, with new water ends, works out at about £7,500.

Diameters of cylinders—low pressure, 44½ inches; intermediate, 26¼ inches; high, 16¼ inches. Stroke, 3 feet.

Each engine raises 1,000 cubic feet of sewage per minute into the head of the Outfall Sewer.



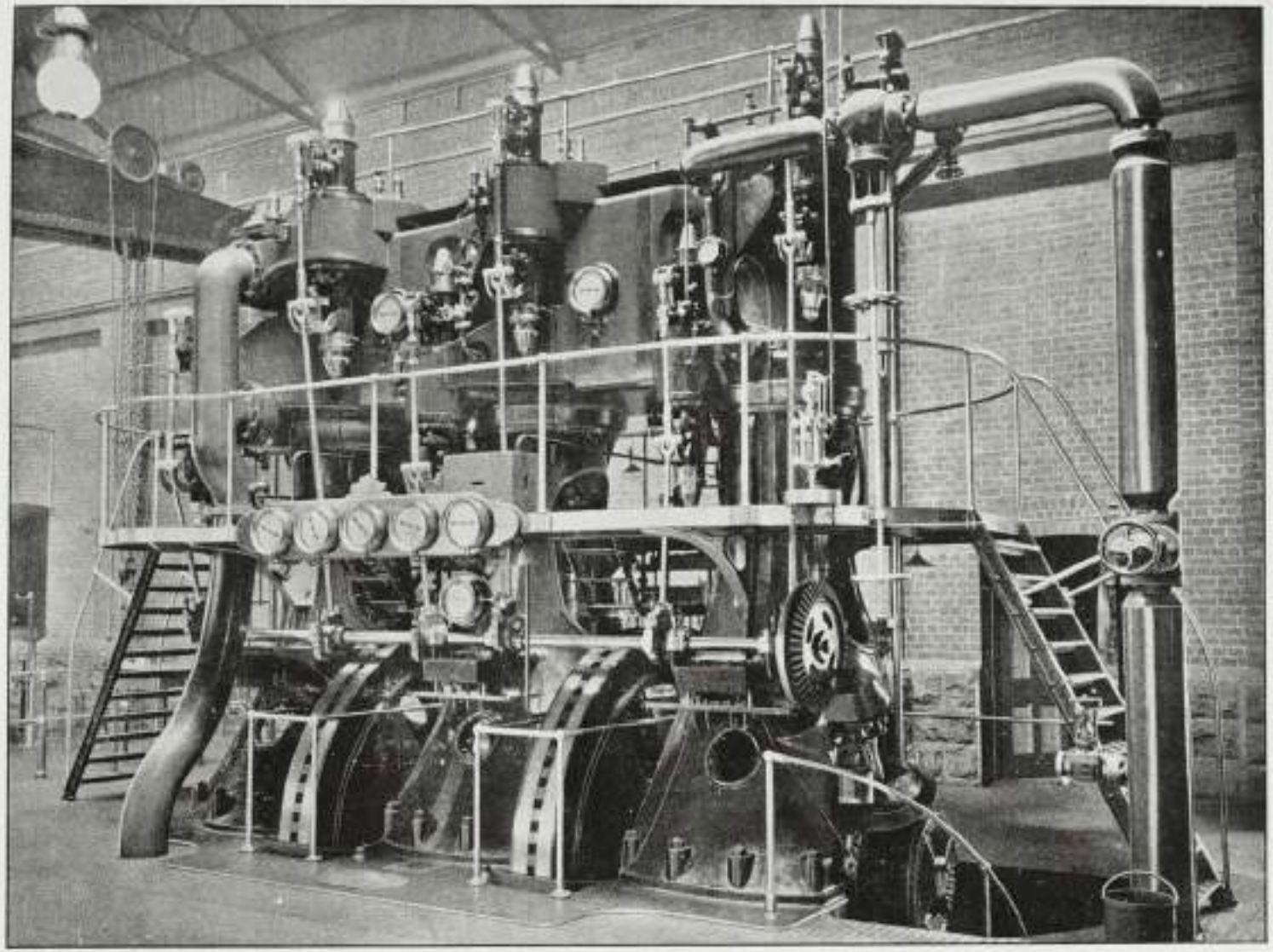
Pumping Station: Thompson Engine (Victorian)

Pumping Station: Otis Engine (Victorian).

THIS ENGINE was made in South Melbourne, in 1900, by the Austral Otis Engineering Company.

Description—Vertical, Triple Expansion, Direct Acting Crank and Flywheel Type. Cost £15,944.

Diameters of Cylinders—low pressure, 55 inches; intermediate, 36 inches; high, 20 inches. Stroke, 3 feet. It raises 1000 cubic feet of sewage per minute into the head of the outfall sewer.

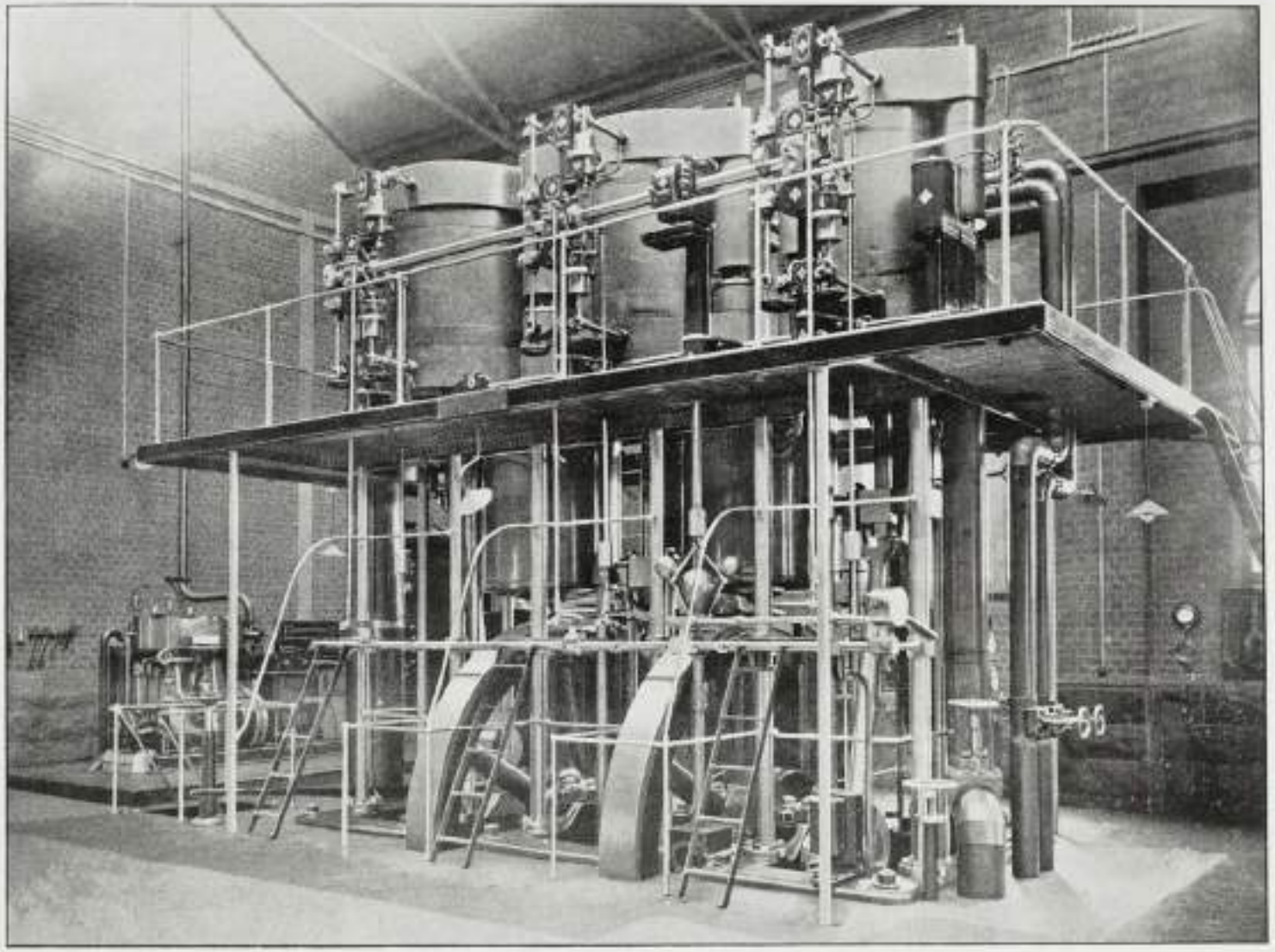


Pumping Station: Otis Engine (Victorian)

Pumping Station: Hathorn-Davey Engine (English).

THIS ENGINE is described as an Inverted, Vertical, Triple Expansion, Corliss, Surface Condensing, Rotative, Three-crank Type, Sewage Pumping Engine. It was manufactured in 1900 by Messrs. Hathorn, Davey & Company, of San Foundry, Leeds, England, and cost £11,475.

Diameters of Cylinders—low pressure, 54 inches; intermediate, 36 inches; high, 20 inches. Stroke, 3 feet 6 inches. It raises 1,000 cubic feet of sewage per minute into the head of the outfall sewer.



Pumping Station: Hathorn-Davey Engine (English)

Manufacture of Pipes for Rising Main.

THE large wrought iron pipes for the Rising Main are here shown in the yard of the contractors, Messrs. G. and C. Hoskins, of South Melbourne. Their size (6 feet diameter) is indicated by the workman standing upright inside one of them. The amount of Messrs. Hoskins's two contracts for these pipes was £32,193.

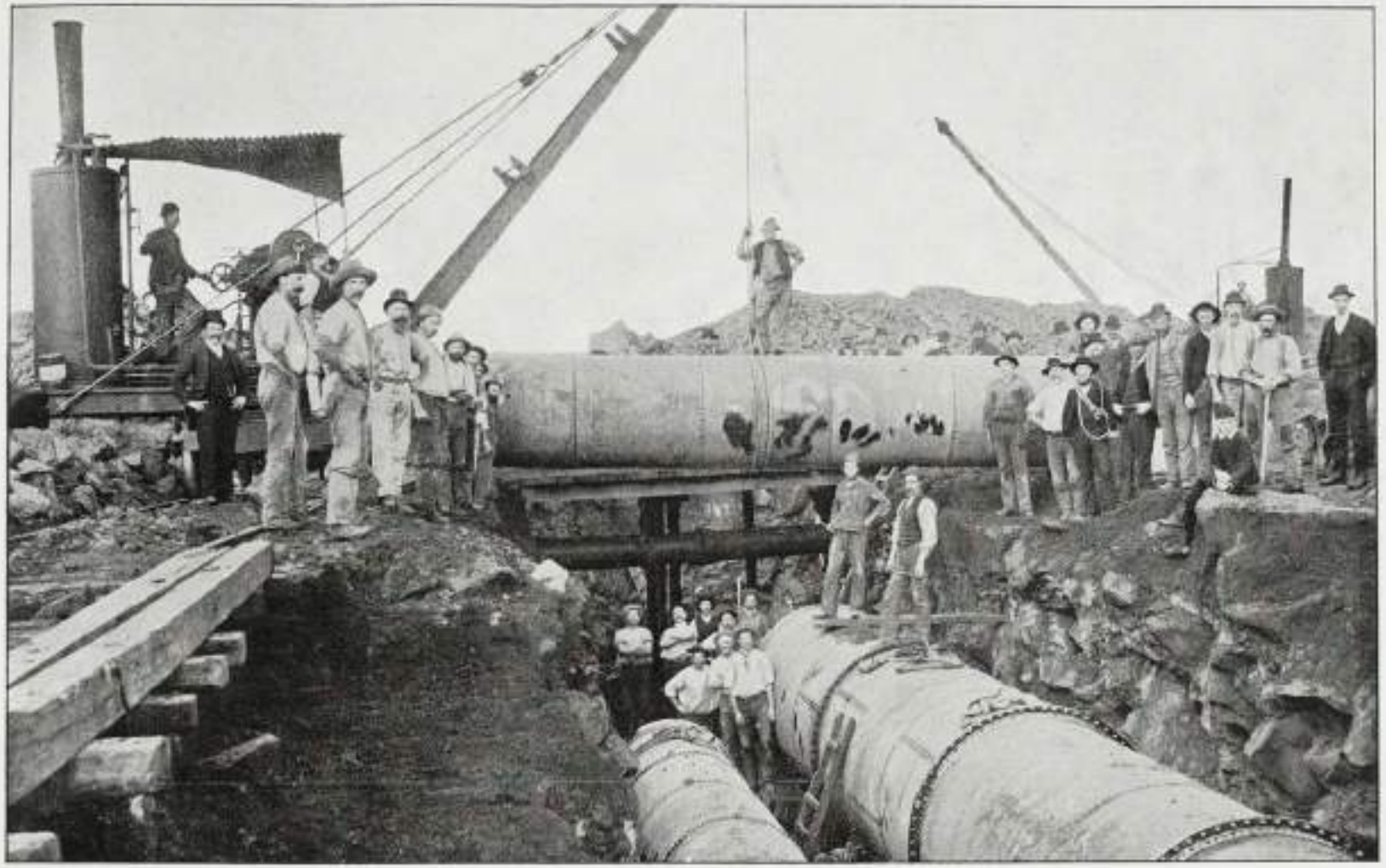
The 4 feet pipes for the Rising Main were made by Mr. Mephan Ferguson, of Footscray, whose contract price was £21,017.

Manufacture of Pipes for Rising Main

Laying Pipes for Rising Main.

THIS Picture shows the 6 feet and 4 feet pipes *in situ*, and the nature of the excavations that had to be made through bluestone rock (basalt) for their reception. Mr. Mansergh recommended that three of these pipes should be laid, each of 6 feet diameter; but up to the present time (August, 1908) one 6 feet and one 4 feet pipe have sufficed. The Engineer-in-Chief of the Board has recommended the laying of another 6 feet Rising Main, and the proposal has been adopted by the Board.

The sewage is forced through these pipes by the pumps a distance of nearly three miles, and to a height of 130 feet. Pumping was commenced in 1897.



Laying Pipes for Rising Main

Turning First Sod of the Outfall Sewer.

THE LATE MARQUIS OF LINLITHGOW, during his occupation of the office of State Governor, under his more familiar titular dignity of Lord Hopetoun, took much interest in the water supply and the promised improvement of the Metropolis by sewering.

This picture shows the occasion on which he honored the Board by turning the first sod of the Outfall Sewer, near the site of the Aqueduct across the Werribee River, on the 19th May, 1892. The ceremony was a memorable one, and was witnessed by a large concourse of representative people—amongst them the late M. Paul Blouet, "Max O'Rell," the author of "John Bull and His Isle," &c. It was marked by a banquet given by the late Chairman of the Board, Mr. Fitz Gibbon, C.M.G., in the Orderly Room, at Werribee.

The sod was raised and turned with a spade, designed, made for and presented by the Chairman to His Excellency. It was of silver, inlaid on the blade with emblems of gold depicting St. Michael as Purity, prevailing over the Fiend of Foulness, and with the motto of the Order of St. Michael and St. George, "*Auspicium melioris ævi*"—"The beginning of a better time." The handle was of native blackwood, elaborately carved.

The completion of the Sewerage Works from Werribee into the City of Melbourne was celebrated on the 5th February, 1898, when the then Governor, the Right Hon. Lord Brassey, opened the penstock at the Australian Wharf, and proceeded in the Government steamer, *Lady Loch*, to the Board's Sewerage, or, as it has since been called, "Metropolitan" Farm at Werribee, and had lunch with a numerous company. A model penstock, arranged as a cigar box and cutter, was manufactured at desire of the late Chairman, and presented by him as a memento to His Excellency, and a commemorative medal of silver was presented to each of the company.

Turning First Sod of the Outfall Sewer

Outfall Sewer: Kororoit Creek Aqueduct During Construction.

THE OUTFALL SEWER crosses three main watercourses, viz.: Kororoit Creek, Skeleton Creek, and Werribee River.

The type of aqueduct in each case is the same, consisting of four or five spans, all of 42 feet. The illustration is of the aqueduct over the Kororoit Creek, Mr. C. Wadey, contractor. The piers are shown in course of construction, and also the concrete sewer, which at this point is above the the natural surface level, and the continuation of which is carried by the bridge.

Outfall Sewer: Kororoit Creek Aqueduct During Construction

Outfall Sewer: Werribee River Aqueduct During Construction. River in Flood.

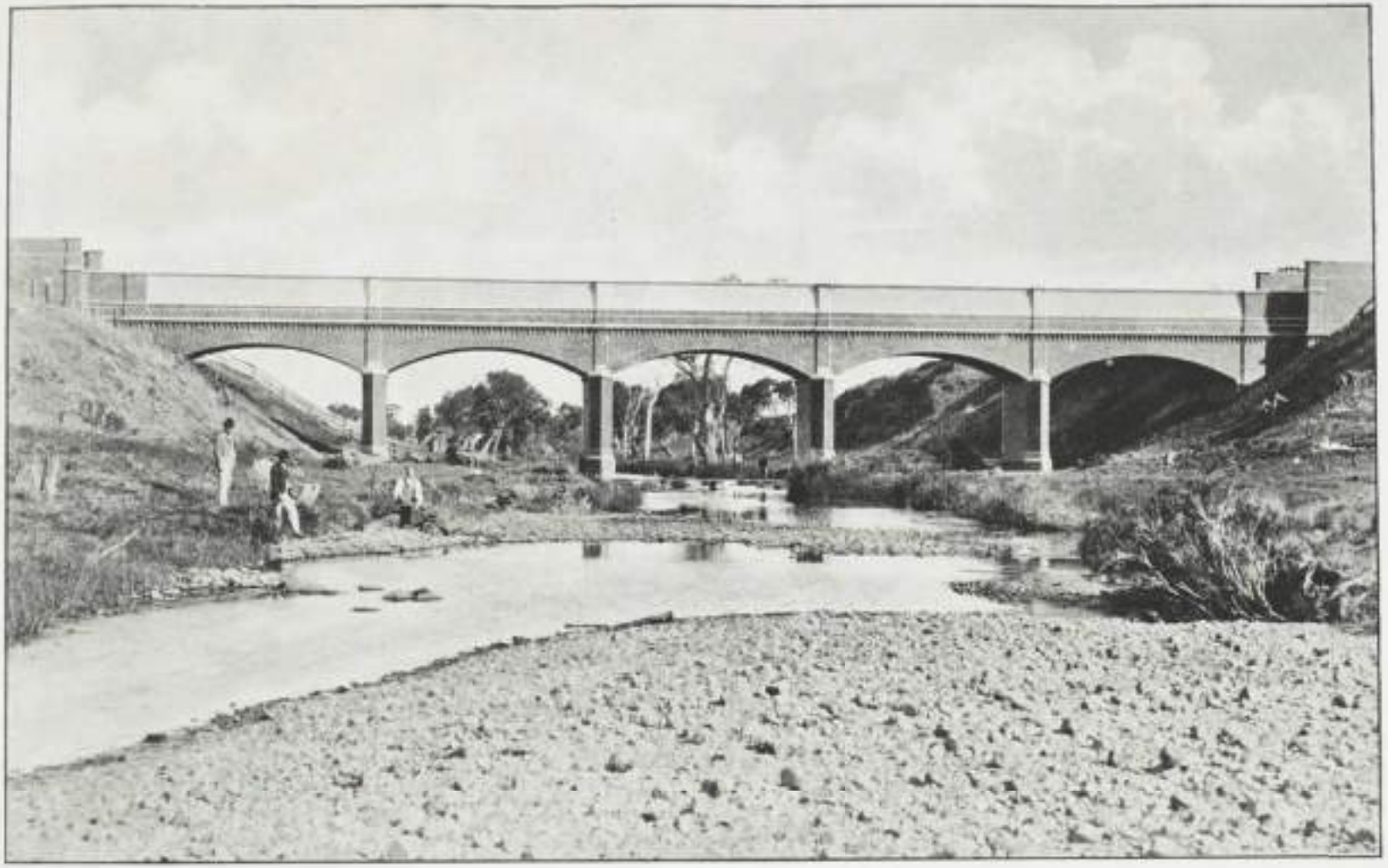
THIS Illustration shows the Werribee Aqueduct during construction, and at a time when the river was in flood. As may be seen, a certain amount of damage was done to the scaffolding The crossing of the river takes place in Section No. 2 of the Outfall Sewer, and the works shown are part of the contract of Mr. J. F. Mixner.

Outfall Sewer: Werribee River Aqueduct During Construction. River in Flood.

Outfall Sewer: Werribee River Aqueduct Complete.

THIS Structure carries the main Outfall Sewer over the Werribee River. It is built of brick in cement, and consists of five spans.

It is here shown as completed.

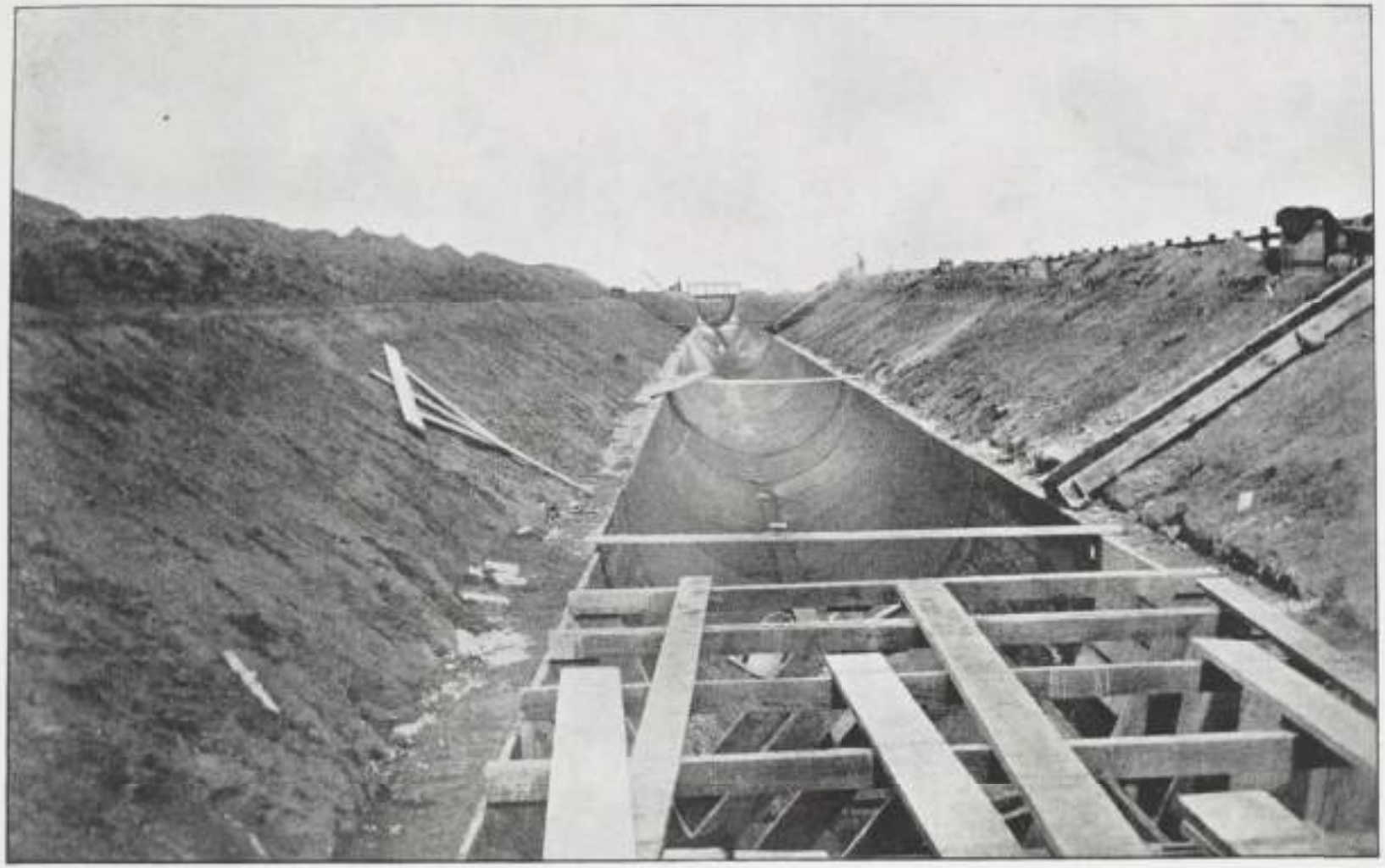


Outfall Sewer: Werribee River Aqueduct Complete

Outfall Sewer: No. 1 Section During Construction.

THE Illustration shows a portion of the Main Outfall Sewer near the Metropolitan Farm, Werribee, in course of construction.

This part is semi-circular in section, but in other portions the upper arch is completed, making a finished circular sewer 11 feet in diameter. It is built in some parts of concrete, in others of brick in cement, and is lined throughout with cement rendering.

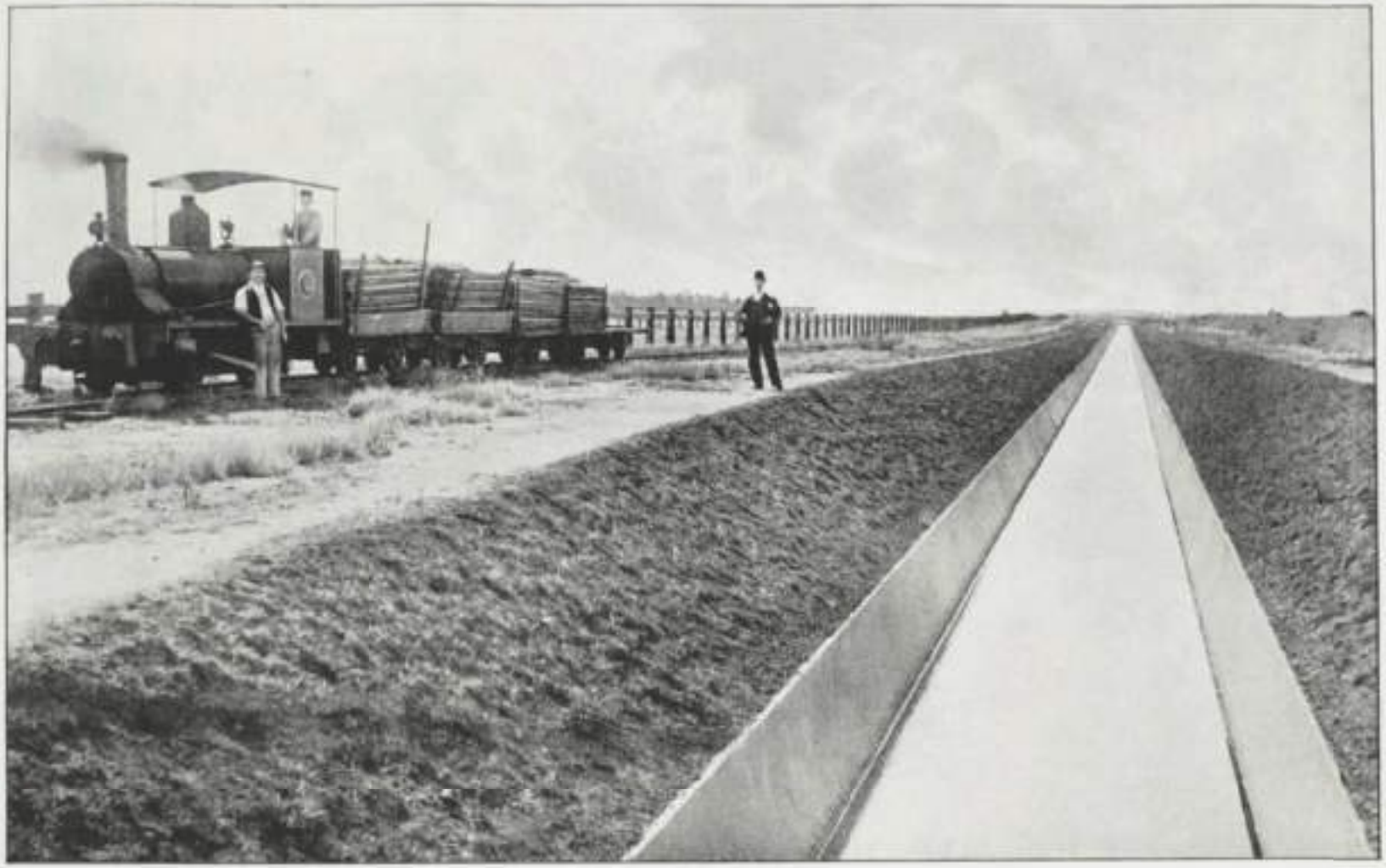


Outfall Sewer: No. 1 Section During Construction

Outfall Sewer: No. 1 Section Complete.

A SECTION of the Main Outfall Sewer is here shown, completed, and in use. A construction train used by the contractor, Mr. Mixner, is shown on the left.

The Outfall Sewer is 15¾ miles in length, and for long sections runs in an absolutely straight line.



Outfall Sewer: No. 1 Section Complete

Outfall Sewer: Distribution Head at Farm.

ON reaching the northern boundary of the Farm, the Outfall Sewer, which conveys the sewage from the end of the Rising Main, divides into three main carriers, from which sub-carriers distribute its contents over the various sections of the Farm lands. Sluice gates are provided, by means of which the sewage can be turned into any of the three branches as required.

Outfall Sewer. Distribution Head at Farm

Metropolitan Farm: Western Branch of Main Carrier.

THIS Branch is carrying sewage in a Westerly direction, along the Northern boundary of the Farm. The Carrier is lined with concrete for only a small portion of its length, and its construction has been consequently cheapened.

Metropolitan Farm: Western Branch of Main Carrier

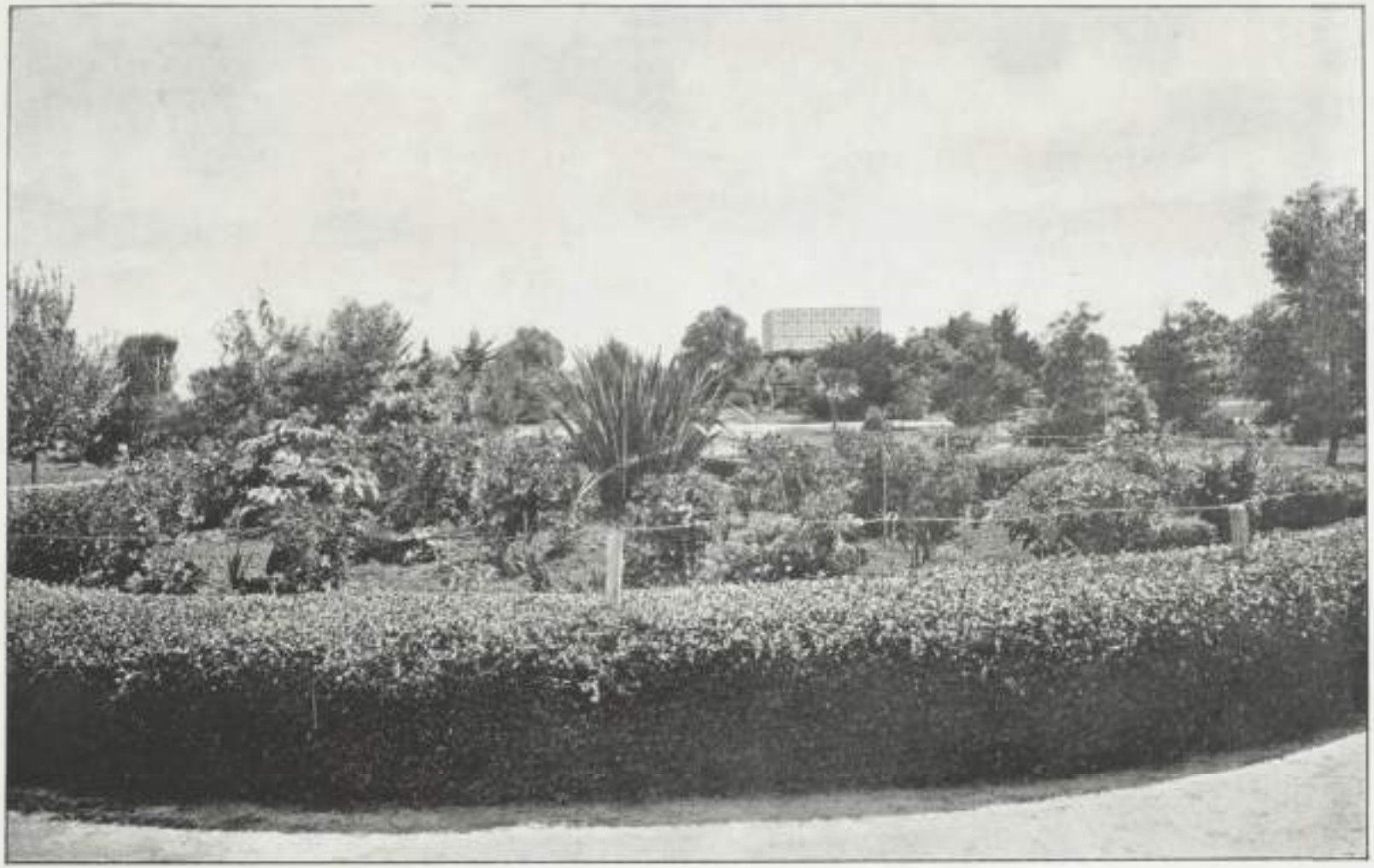
Metropolitan Farm: Nursery and Tank.

THE Nursery and Water Tank at the Metropolitan Farm are here shown.

A large number of young trees and shrubs are produced each year in the nursery, and the plantations and gardens serve to greatly relieve the monotony of the flat landscape surrounding the Farm.

In various parts of the Farm the Board has planted a total of 179,000 trees, mostly eucalyptus and pines.

The tank shown in the picture was formerly situated in the old tank reserve, Eastern Hill, Melbourne.

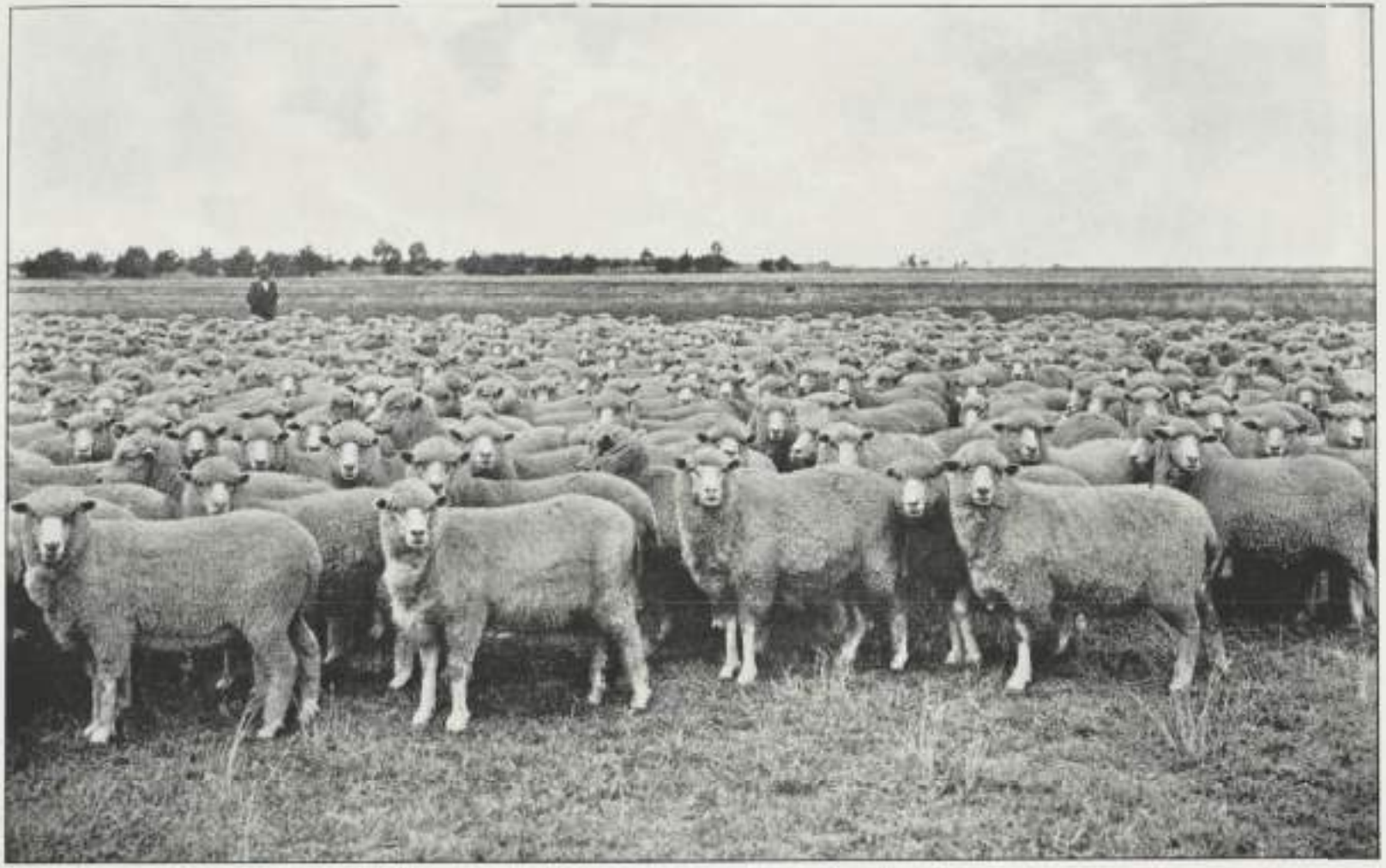


Metropolitan Farm: Nursery and Tank

Metropolitan Farm: Sheep Fattening Paddock.

THE METROPOLITAN FARM consists of 8,847 acres, and is situated at Werribee on the Western side of the Werribee River. Of the area prepared for intense irrigation, about 3,282 acres have been sown with various grass crops, chiefly lucerne, prairie and rape, and about 794 acres have been sown for broad irrigation. Nearly 3,138 acres are leased as agricultural lands. The cost of the Farm up to June, 1908, was £437,443, made up as follows:—Purchase of land, £155,037; Farm preparation, £282,406. From 1899 to 1908 a total profit of £53,924 has been made in connection with the purchase and sale of sheep.

The picture shows one of the paddocks used for sheep fattening. At the present date—August, 1908—there are 15,805 sheep on the Farm belonging to the Board.



Metropolitan Farm: Sheep Fattening Paddock

Metropolitan Farm: Steam Ploughing Plant.

TWO Steam Engines are here shown, and the "Oliver" plough midway between them, being drawn towards the further engine. The engines are of 20-horse power, and the plough is capable of breaking up the ground to a depth of 2 feet 6 inches. The rope and winding drum can be seen below the body of the nearer engine.

In addition to the ploughing engines and the "Oliver" plough shown in the illustration, the cultivation plant also includes a five-furrow plough, capable of breaking up ground to a depth of 15 inches; a heavy and also a light "Cultivator"; a "Mole" plough, an implement provided with a specially shaped share called the mole, attached to a vertical rod, and by it drawn along under the ground to form drainage openings; a Crosskill Roller for breaking up large and hard clods; a "Ditcher" and harrows; also a machine that cultivates, drills, rolls, and harrows at one operation, and operates over a strip of land 15 feet wide at a time.

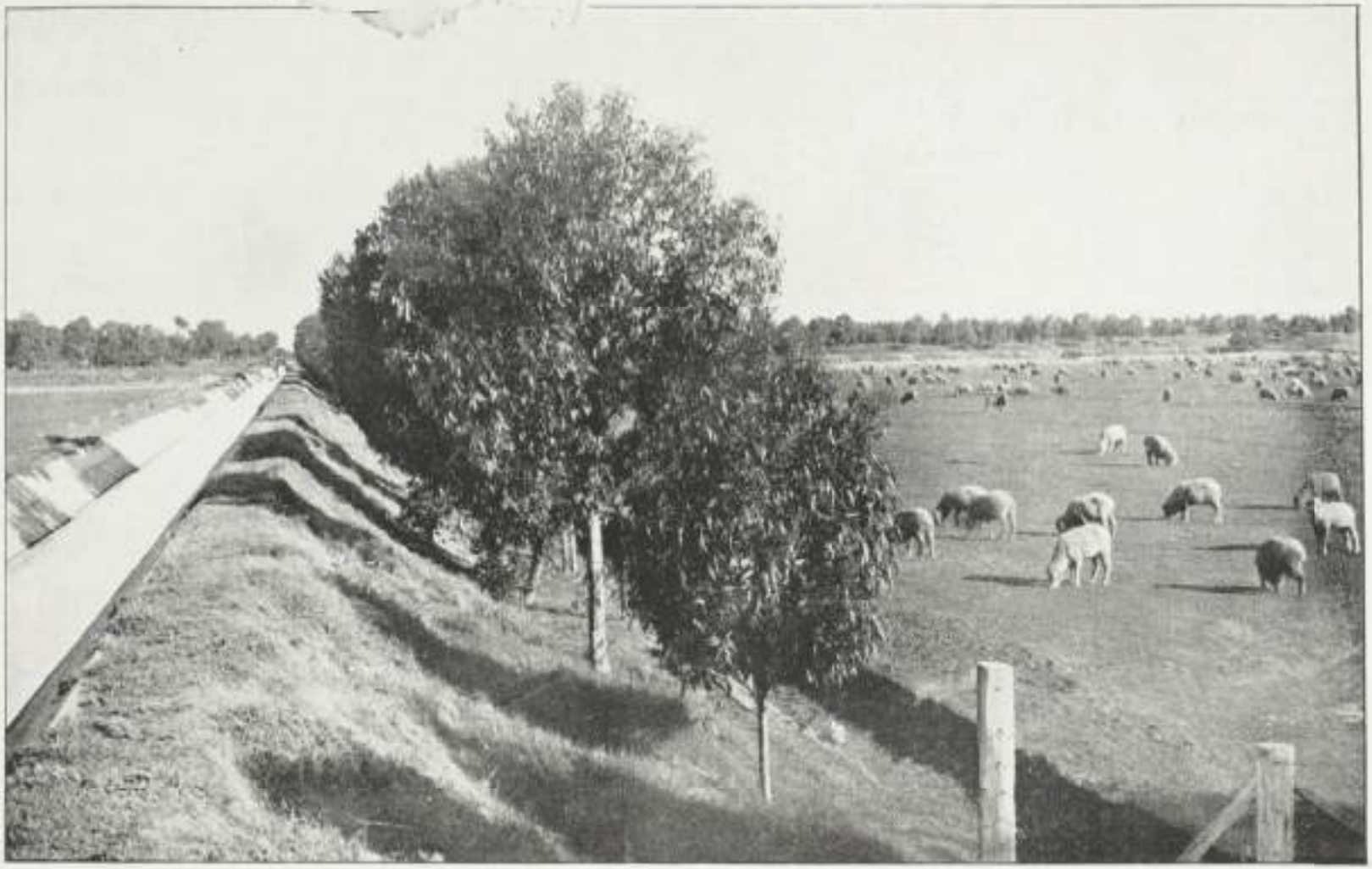
All these implements are worked by and in connection with the steam engines shown in the illustration.

Metropolitan Farm: Steam Ploughing Plant

Metropolitan Farm: View at 45 Chains West, 200 Chains South.

THE MAIN CARRIER, constructed in concrete, is here shown raised above the ground. The sewage is distributed in lateral sub-carriers on both sides at a distance of every 10 chains.

The sheep are depasturing upon crops that have been raised in ground properly tilled and sown with grass, and irrigated from the carriers.



Metropolitan Farm: View at 45 Chains West, 200 Chains South

Metropolitan Farm: Jetty.

THIS Structure is 1,620 feet long, and extends into the Bay at a depth of 13 feet at low water.

Tram lines are laid on the jetty for connecting to the various works on the Farm.

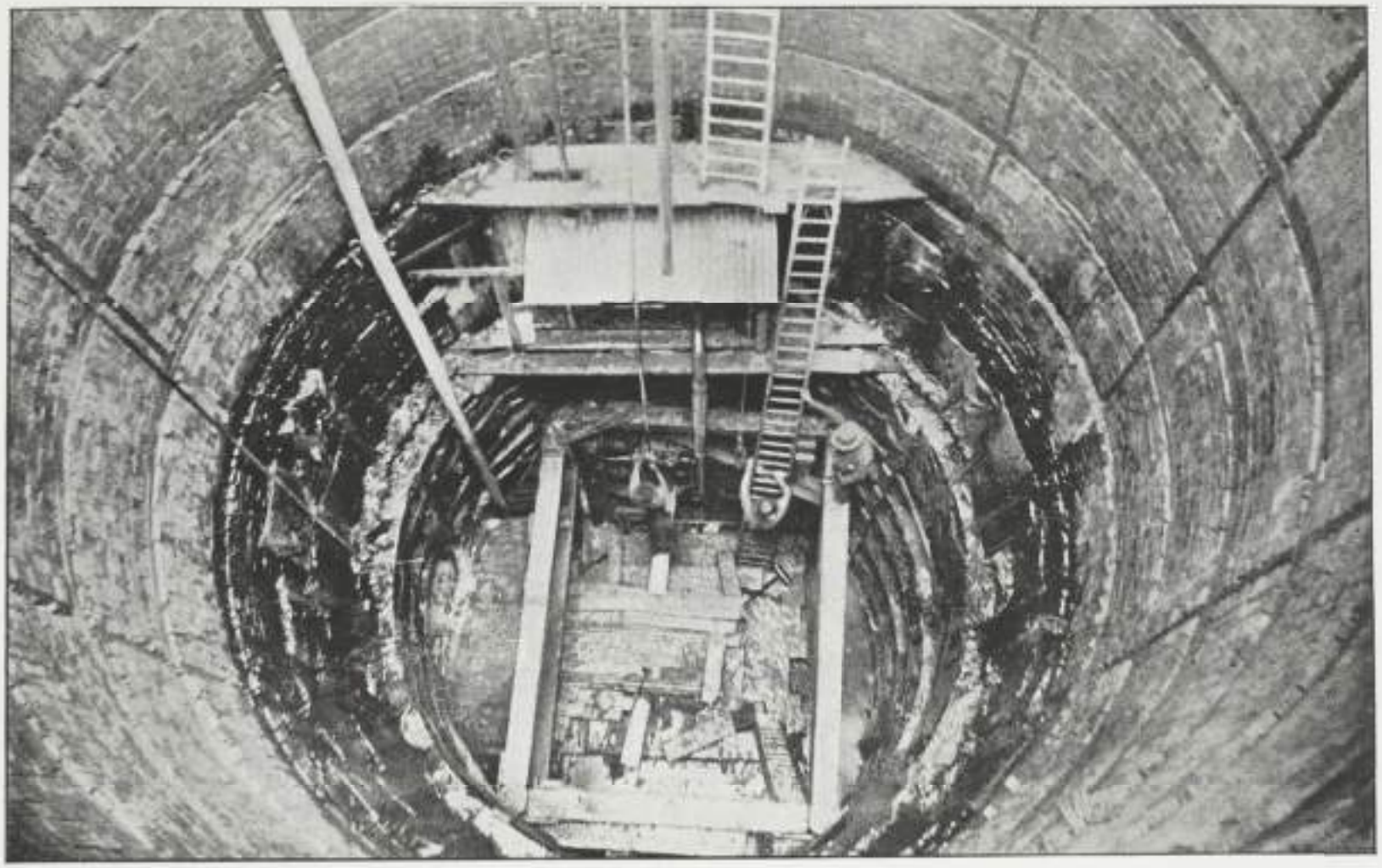
Metropolitan Farm : Jetty

Interior of Shaft, Section 2, Hobson's Bay Main.

THE Contract for this main was let to Mr. James Moore in July, 1893. The sewer, which is called the No. 2 Hobson's Bay Main, extends from Graham Street, Port Melbourne, to the Yarra, a distance of 10,230 feet across "Fisherman's Bend," for the most part nearly parallel to the beach of Hobson's Bay, and distant about 1400 feet from it, at a depth of 46 feet to 53 feet from the surface, which is but little above sea level. Along the line of it, at distances of about 800 feet, shafts 15 feet in diameter were sunk to the lowest depth of the sewer level. A heavy circular framework of timber was placed in position; the earth within the circle so enclosed was excavated; the wooden frame pressed downward by a heavy internal casing of bricks; and, as the excavation proceeded and the annulus sunk deeper, fresh rings were added to it from above.

From these shafts the sewer was driven and constructed, by means of a shield, through soil which was for the most part alluvial ooze, so oleaginous and gaseous that at one place a sheet of flame burst upon the workmen, one of whom, as he fell back in fright, cried to his mate, "Oh, Bill, we've struck h——!"

The rings and brickwork are well shown in the picture, which represents a vertical view from the top of one of the shafts.

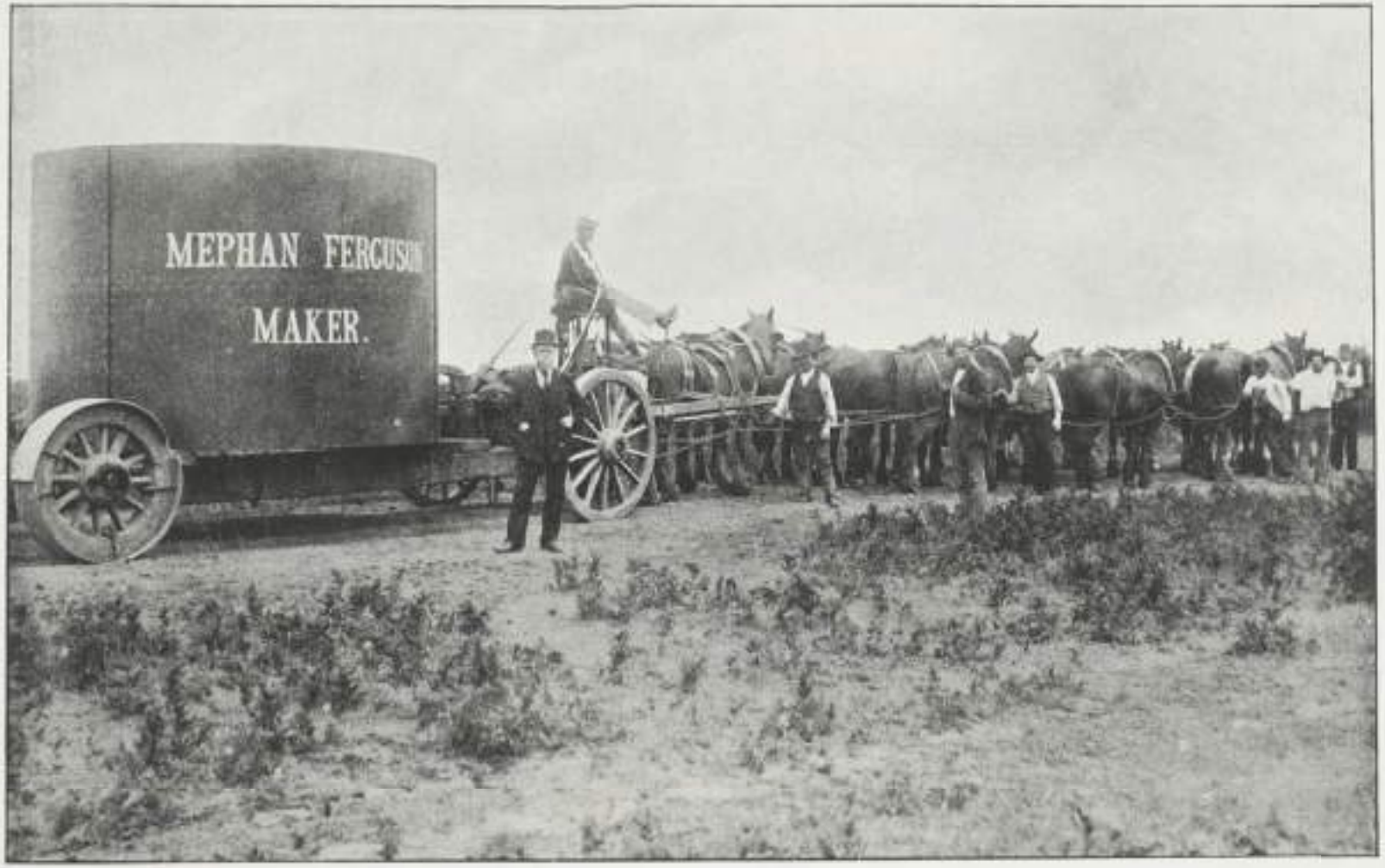


Interior of Shaft, Section 2, Hobson's Bay Main

Clark's Shield for Sewer Construction in Bad Ground.

THIS SHIELD is a modification of that of Greathead, the original inventor, and a number of them have been used on the works of the Board. The first was employed by Mr. James Moore on the Hobson's Bay Main Section No. 2. The shields are iron cylinders of the diameter of the sewer, with a cutting edge in front and a central diaphragm. They are lowered down the construction shafts, and thence propelled by hydraulic rams in the direction to be excavated. After each propulsion of the shield forward, a section of the sewer is built in the rear of it.

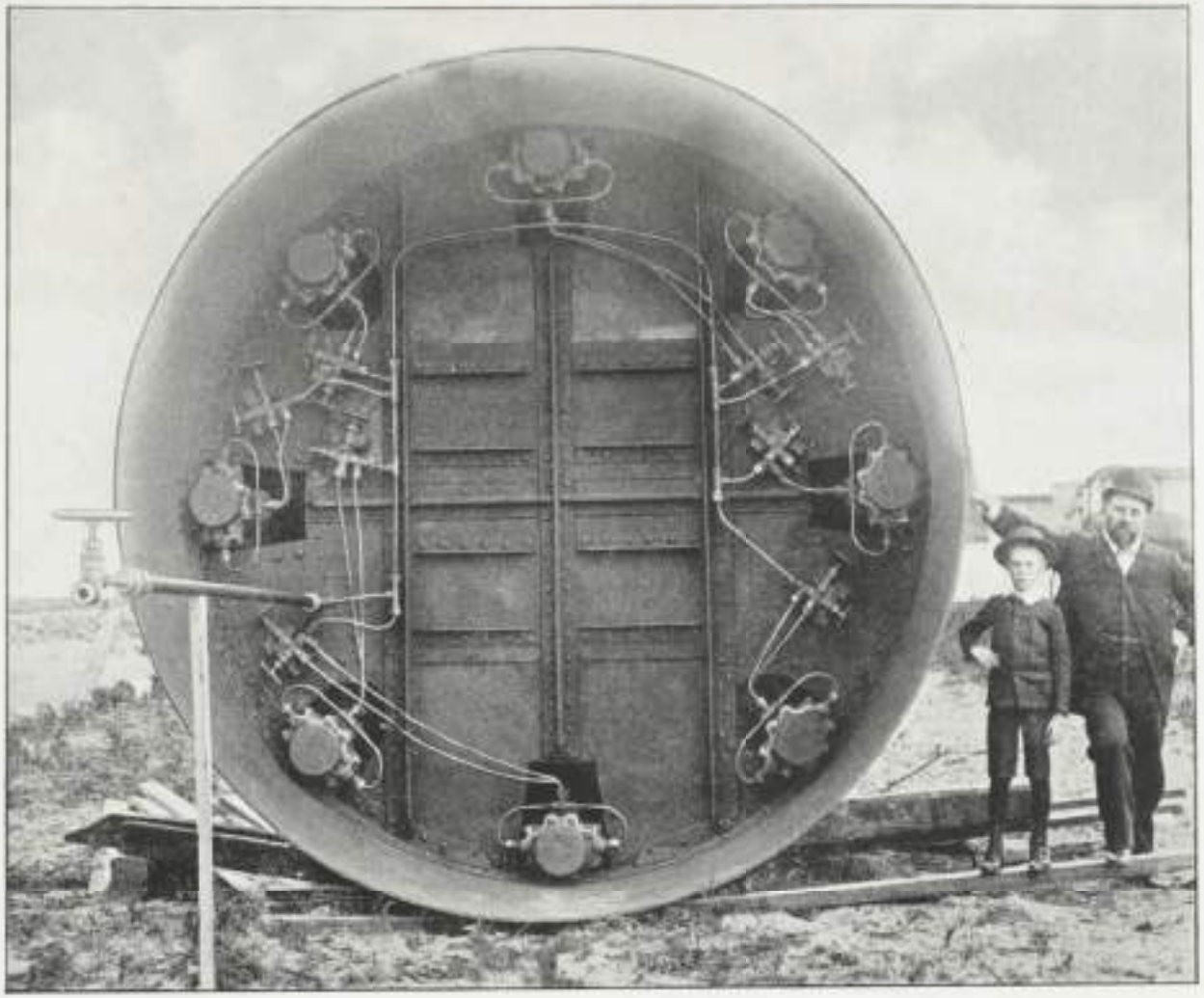
The illustration shows one of the largest shields being conveyed to the site of operations, and the number of horses employed to draw it gives some idea of its weight.



Clark's Shield for Sewer Construction in Bad Ground

Rear View of Clark's Shield.

THE back view here shown exhibits the internal construction of the shield. The shield is propelled in the direction of the sewer by means of hydraulic rams, of which eight are shown in the illustration. The pistons of these rams press back upon the last completed section, and so thrust the whole apparatus foward into fresh ground. As the earth is cut away by the front edges of the shield, it is removed through the central door, and taken back to the shaft for disposal.



Rear View of Clark's Shield

Hobson's Bay Main, Section 3: View in Graham Street, Port Melbourne, During Construction.

THIS Section of the sewer was carried out in 1894-5 by Contractor A. G. Shaw. The illustration shows the surface works in Graham Street, Port Melbourne, and indicates the extent of street occupation that was necessary in some cases to build the sewers. The sewer at this point is 8 feet 6 inches in diameter, and 50 feet below the surface of the ground.

Great difficulty was experienced in sinking all the shafts on this section, on account of running sand and water.

Hobson's Bay Main, Section 3: View in Graham Street, Port Melbourne, During Construction

OSBOLDSTONE & CO.,

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