1860s-1920s

Early water

Surveying the Orongorongo River, February 1915

The mayor and councillors boarded three waggonnettes and, with the bad news fresh in their minds, headed for the works. The roads were still muddy from the rains and their journey by vehicle ended at Sinclair's sawmill. From here, guided by works staff, they picked their way along a valley floor strewn with branches and rocks and caked in silt. They might have ridden the little tramway line, but it had been engulfed by the flood. After what seemed miles of sloshing, but was only 20 minutes on foot, they arrived at a site of utter devastation. The dam into which so much hope and ratepayers' loan money had been poured was a wreck – scoured out behind and breached in its middle. While some minds turned to blame, the engineers immediately thought 'rebuild' – Wainuiomata's water must get through to Wellington.[1]

This event in 1883 probably inspired a later mayor to claim "the engineer made Wellington".[2] With its reclamations, and road and rail works, the city had been hewn from an unwilling shore, but the water story is no less one of vision and skill, of overcoming doubters and harnessing this "natural genius of place".[3] It is an engineering story that had started two decades earlier, when the new Town Board was presented with a growing population.[4] Relocating the General Government from Auckland to Wellington in 1865 added to the demand, but also brought the first major injections of capital.[5]

Since Wellington had been founded water had been "collected from house-tops into barrels and iron tanks, and also some shallow wells". At springs on Grant Road (Thorndon) behind the officers' cottages "a usual sight was a number of women, housewives and maids with large jugs, cans or pails, around the spring getting water which seemed to take a very long time to get, though the flow of the spring was very free, but no more than the gossip".[6] Streams piercing the hills also provided clean water, but the growth on their banks of homesteads, which used them as sewers, "cannot be otherwise than detrimental to the wholesomeness of the water" and was considered "very unsatisfactory".[7] Analysing the water, government scientist Dr James Hector referred to "the misery and suffering entailed especially of the children from the prevalence of intestinal worms" and concluded that "no water collected from within the crowded part of the city, either from wells or house tops, is safe or proper for human consumption".[8] Recent research in England had linked water to diseases, such as cholera, so the health aspect was known early.[9]

The town had "long been crying out for a water supply and various plans have been suggested [by 1867], more or less grand in design, and expensive in nature…. The chief difficulty is the financial one".[10] Wellington, as residents know, is a hilly city – the topography presents a challenge in laying utility services. However, hills had one advantage – gravity. Engineers could rely on a drop of almost two metres-in-the-kilometre bringing water to town.

Parliament received the city's first water supply, in 1868, from a spring on Tinakori Road. This detail from a plan of the 'Tinakori Water Supply' shows the spring (far left) close by the Premier's residence (Premier House), with pipes leading to nearby government buildings. (Wellington City Archives Reference 00456:W1159/7)

The first reticulation in the city was initiated by the Provincial Government, to supply shipping at Queen's Wharf. In 1867 Messrs John Beck and Carter tunnelled through the Hill Street ridge to a spring on Tinakori Road and planned to lay pipes to the wharf.[11] The spring was on a government property purchased in 1865 for the Premier, and the water was collected in an underground cistern by his front door.[12] The city, however, picked up the work laying pipes to the government's reservoir built on Hill Street beside the Meteorological Office.[13] By mid-1868 this supply was in use, and the Colonial Secretary tried to sell 136,000 surplus litres per day to the city. A sales pitch by Jerningham Wakefield could not close the deal.[14] The reason was not money, even though the Town Board was impecunious, but that the government's reservoir leaked badly and the supply was inadequate.[15] After declining this supply, the Town Board laid the government's pipes beyond the Parliamentary 'demesne' to Browns Wharf, off Molesworth Street, where lighters from an increasing number of warships refilled their tanks. The board again used its hard-labour convicts, with overseeing 'gunmen', for this work.[16]

Detail from an 1869 plan of the Government Domain, including water reservoir.
(Archives NZ, Reference AAFV 997, WT9A)

Meanwhile, Wellington's first town surveyor/engineer, Richard Skeet, had developed a waterworks scheme.[17] This was to supply the southern wards of the town from Te Aro (or Waimapihi) Stream in Polhill's Gully (upper Aro Valley), with the Thorndon Ward being supplied from the Kaiwharawhara Stream tapped near Baker's cutting. Together the cost would be £41,575 (a huge amount, beyond the town's budget), though no plans were prepared.[18] At the first mention of the Kaiwharawhara, the board said it would "not undertake or execute any work beyond the outer boundary of the Town Belt" but would leave this to the Provincial and, if necessary, General Government to survey.[19] Other engineers generally agreed with the scheme, George Aicken adding that the water could be drawn via a 1.6-hectare, six-metre deep reservoir for double the current population of 6,000-7,000.[20] A letter to the editor urged the Town Board to adopt the works as they were of "incalculable benefit to the town… [and would] have nothing to do with party politics".[21]

A consulting engineer, Robert Marchant, prepared another scheme for the city in April 1868.[22] Marchant's scheme, which he promoted through a pamphlet with lithographed drawings, would pipe the water down the Kaiwharawhara valley until being tunnelled through the Northland Hill to Tinakori Road.[23] Including plans for a 136 million-litre dam, this was the first proposal submitted to the board "approaching completeness," according to his namesake and new town surveyor/engineer Nicholas Marchant.[24] To pay for the scheme, Robert Marchant proposed Dunedin's solution. The Dunedin Waterworks Act 1864 assigned power to the Dunedin Waterworks Co Ltd to build the waterworks and rate the users: its two dams on Ross Creek were built in 1865-1867.[25] When, in August, Wellington's ratepayers found that the Town Board had "entered into" the expensive scheme with Robert Marchant, their indignation boiled over. Why spend on waterworks when "every occupier of his cottage had a well?" Concern also over 'jobbing'– councillors benefiting financially from public works – delayed the Town Board's advancement into a borough (under the Municipal Corporations Act) by a few months.[26] The availability of the Hill Street supply also discouraged the scheme being adopted. Wellington's Waterworks Company was, however, established and its shares secretly issued, but it played no part in the scheme adopted.[27]

In mid-1869 Beck re-entered the picture with a waterworks scheme. John and William Beck wanted to tap Te Aro Stream to form an 11.4-million-litre reservoir, and asked to open the streets to lay reticulation pipes, which they had ordered.[28] The board "gave the same permission as to the Gas Company" – so long as the interests of other riparian users "were protected".[29] Brewers and bottlers using Te Aro Stream "threatened… several actions" if their water was interfered with.[30] In October 1870 the board declined Beck permission, possibly after he had started the headworks.[31] It did, however, agree to buy his pipes (for £1,265.9.5).[32]

Wellington's new city council (WCC) asked Nicholas Marchant to progress the waterworks. He summarised and borrowed elements from Skeet's scheme, Aicken's scheme, RM Marchant's scheme and finally the Becks' scheme.[33] Having collected data on the Kaiwharawhara since February 1870, he calculated a flow of 1.4 million litres per day, enough for 10,000 people. He reported on 28 March 1871 that the Kaiwharawhara was "the only source worthy" of tapping (having also assessed the Ohiro, Te Aro and Karori streams). The point by Baker's Hill was the place to build the 160-million-litre dam because it "little exceeds two chains in width at the top and [has a] depth of 60 feet".[34] He intended to allow the average summer flow to continue down the stream, but still compensate the "riparian proprietors" affected. Indirectly referring to RM Marchant's proposed route, Nicholas Marchant would "avoid the stream's sinuosities" by sending the supply through a 365-metre-long tunnel under Baker's Hill to a distribution basin at the top of Aro Valley. A drop of 46 metres in elevation from dam to basin would "break the head of water [reduce its pressure]" for its journey down to Willis Street and reticulation thereafter in 200-millimetre and 150-millimetre pipes. His tunnel, basin and 21.7 kilometres of piping would cost £17,358.[35] Notice of the Wellington Waterworks Bill in June 1871 defined the 92 hectares intended to be taken and listed the several owners and two gold mining companies the council had to buy out before proceeding.[36] The Municipal Corporations Waterworks Bill, under discussion by now (and passed in 1872), would vest the water rights in the corporation rather than the Crown.

Polhill Gully reservoir, at the head of Aro Valley, circa 1900. This concrete distribution basin fed by the Kaiwharawhara Stream was the source of Wellington's first public water supply, in 1874. This distinction has often been credited to Karori's lower reservoir, which was not completed until 1878.
(Alexander Turnbull Library, Wellington, NZ. Reference G-8021-1/2)

Karori water

The Karori waterworks on the Kaiwharawhara Stream was started in 1871. On 12 December that year the council created a permanent waterworks committee and instructed Nicholas Marchant to start. He asked John Blackett CE to consult, and the works are as much his as Marchant's. Meeting first on 2 February 1872, the permanent committee opened the tenders for the tunnel through Baker's Hill, selecting Ebenezer Short to undertake the work. Blasting began on 5 February from both ends, the two drives meeting on 24 October.[37] Meanwhile, valuers had been assessing the claims by landowners whose land the council needed, keeping the city solicitor, WLT Travers, busy.[38] Early in 1873 tenders were received for the Aro Valley distribution basin (on what is now the corner of Raroa and Mount Pleasant roads), to receive water from the tunnel. The Becks tendered, but the Saunders and O'Malley tender, the cheapest at £3,749, was accepted. The water mains contract was let in April and a working overseer appointed.[39] By now, shortage of money reined in the project. A full dam across the Kaiwharawhara had been intended, but "Financial reasons … rendered it necessary to abandon the large reservoir for the present, and it was then determined to increase the size of that in Polhill's Gully" from 2.3 million litres to over 4.5 million litres.[40] The concrete basin was itself a big engineering job, being in a valley nestled on a steep hillside (a 'snuggery'). Marchant had the contractors essentially dam the valley, involving works 27 metres high and foundations six metres below the floor of the basin. A wet winter and vast slump of earth slowed the works, adding £1,100 costs.[41] Boat-shaped, the 'dam' was nine metres deep and 36.5 metres long, pointing into the hill and the tunnel. The tunnel was not lined (except for a small section where it tapped a spring, which was lined in brick), and the water was carried in cast iron pipes.[42] To cause a flow into the tunnel a small weir was built across the Kaiwharawhara Stream early in 1874.

Some 22 kilometres of pipes had been laid by Collie & Co, including on reclaimed harbour-front land and The Terrace (neither originally contemplated), and were initially filled with water from the Te Aro Stream, tapped at 38 metres altitude. This water was available from November 1873.[43] With the basin nearing completion, the engineer promised, "the want of an abundance of water will be a thing of the past".[44] On Saturday 2 May 1874, with some fanfare, "the full force from the [Aro Valley] reservoir was flushed through the mains to their extreme range as far as the lower end of Tinakori Road, and the pipes with one exception proved equal to the pressure. The basin itself was emptied…."[45]

Karori reservoir's gothic-style valve tower

The first Karori dam (built 1876-1878), shortly after its completion.
(Alexander Turnbull Library, Wellington, NZ. Reference F-20096-1/2)

Marchant and Blackett both received bonuses, but the sensitive issue of sending out accounts for the connections made to people's homes, and determining the water rate, came in for more discussion.[46]

The dam on the Kaiwharawhara Stream, however, had not been built. With the price of iron and labour higher than expected, the first loan (of £25,000) had run out, and another Act was required for another loan. The new Act was passed in August 1874, authorising borrowings to "extend the pipes and construct a reservoir on the main stream".[47] Marchant started planning this waterworks extension in September. Finalising his drawings, he called tenders in 1875, but was not able to contract J Saunders for this work (at £17,195) until October 1876.[48] Already the summer demand for water had outstripped the flow and, as he got under way in November, Saunders was asked to erect temporary works to boost the supply. The dam, a central puddled-clay core similar to Ross Creek (Dunedin), and to a height of 21.6 metres, had a top water level 141 metres above sea level. It overlaid the original weir, burying the tunnel entrance. The shoulder upstream of the core was formed from layers of stones, each coarser than the previous, with the final one faced in concrete for wave protection.[49] During construction, the engineer "altered the relative positions of the front [upstream] wall and the puddle wall in the centre of the dam, bringing them about 29 feet (nine metres) nearer together… to suit the ground".[50] Other modifications were made to the plans as they went: reducing the height of the dam; shortening the front slope to 3:1, thus reducing the quantity of earthworks inside and length of the pipe culvert underneath; changing the outlet to a culvert type; and launching the valvetower bridge from the side rather than the more-distant crest of the dam. Marchant supervised the "final closing of the dam" in January 1878, and had the "streambed cleared and the storage of water commenced" at daybreak on 25 January.[51] A Waterwork Investigation Committee adjudicated on the contractor's extra costs of £2,305.14.0.[52]

The Karori supply was quickly to prove inadequate. Rainfall records had been available for a few years only, and the dry summers of the late 1870s were unexpected. In addition, the city's population was rising rapidly, having jumped in four years from 10,000 to 18,000.[53] Finally, a more plentiful supply had meant a corresponding increase in consumption; half the supply was being used in industry.

The first Karori dam was completed in January 1878, and is shown here about to be filled. A lone man sits on the Baker's Hill gold mining weir, which had supplied water to a stamper battery.
(Zoe Martin – Carter Collection, Alexander Turnbull Library, Wellington, NZ. Reference PA1-f-171-75)

Wainuiomata water

In 1878, despite having just spent £80,000 on a water supply, there were severe water shortages in the city.[54] The water flow was stopped at night. The public complained. Extraordinary usage was metered at the rate of one shilling per 4,500 litres and fines introduced for wastage.[55]

Fires hastened the search for a more reliable water source. Overnight on 22 October 1877 the Princess Hotel, home to the new Premier Sir George Grey, burned down, killing widow Johnson and her five children.[56] This and the tinder-dry nature of Parliament buildings led to investigations and talk of "water supply failure". The Te Aro Stream supply was again turned on, and the Government even considered the Tinakori Creek supply in the Botanic Garden for fire fighting.[57] In 1878 the railway station caught fire.[58] There was no water in the pipes to prevent the blaze. Fires made the city engineer fraught: "At the sound of the fire bell, I always leave my house and when I get there [to the fire] the turncock goes back [along the route of the distribution main] and closes off all the valves to give maximum pressure. This can take half an hour."[59]

To find another source, the new City Engineer James Baird (former Wellington provincial engineer) worked with William Clark CE.[60] While Wellington rainfall was around 1,200 millimetres per annum, Wainuiomata averaged 1,900 millimetres.[61] They visited the Wainuiomata River in Sinclair Valley, 27 kilometres away, on 17 May 1878, guided by Duncan Sinclair. They rode the little logging loco to Horseshoe Bend above John Dick's Point.[62] In subsequent visits Baird measured the flow and took levels, and after discounting all other rivers recommended a dam there, with a pipeline bringing water to Wellington.[63] The WCC asked the Government to reserve the watershed in July and started buying it (a total of 3,400 hectares). The council resolved to go ahead with the development, despite the cost, after an affirming ratepayer poll on 20 August 1879.[64] After ordering £68,684 of pipes from Glasgow, tenders were let for two pipe tunnels in 1880.[65] Clearing the site began in October.[66] WF Oakes started the water-race job in July 1881 and John Blackett consulted over the pipe bridge required over the Hutt estuary. In 1883 GH Bayliss was contracted to build the main dam wall (for £3,997), and the work was sufficiently advanced in September for the water mains to be charged.[67]

As designed, the small dam had a concrete-face wall, with earth filling and a spillway on the left bank. It was as much a pond for settling silt as a reservoir for storage. The impounded water flowed through a concrete headrace, 1.9 kilometres long, to a pressure-reducing well.

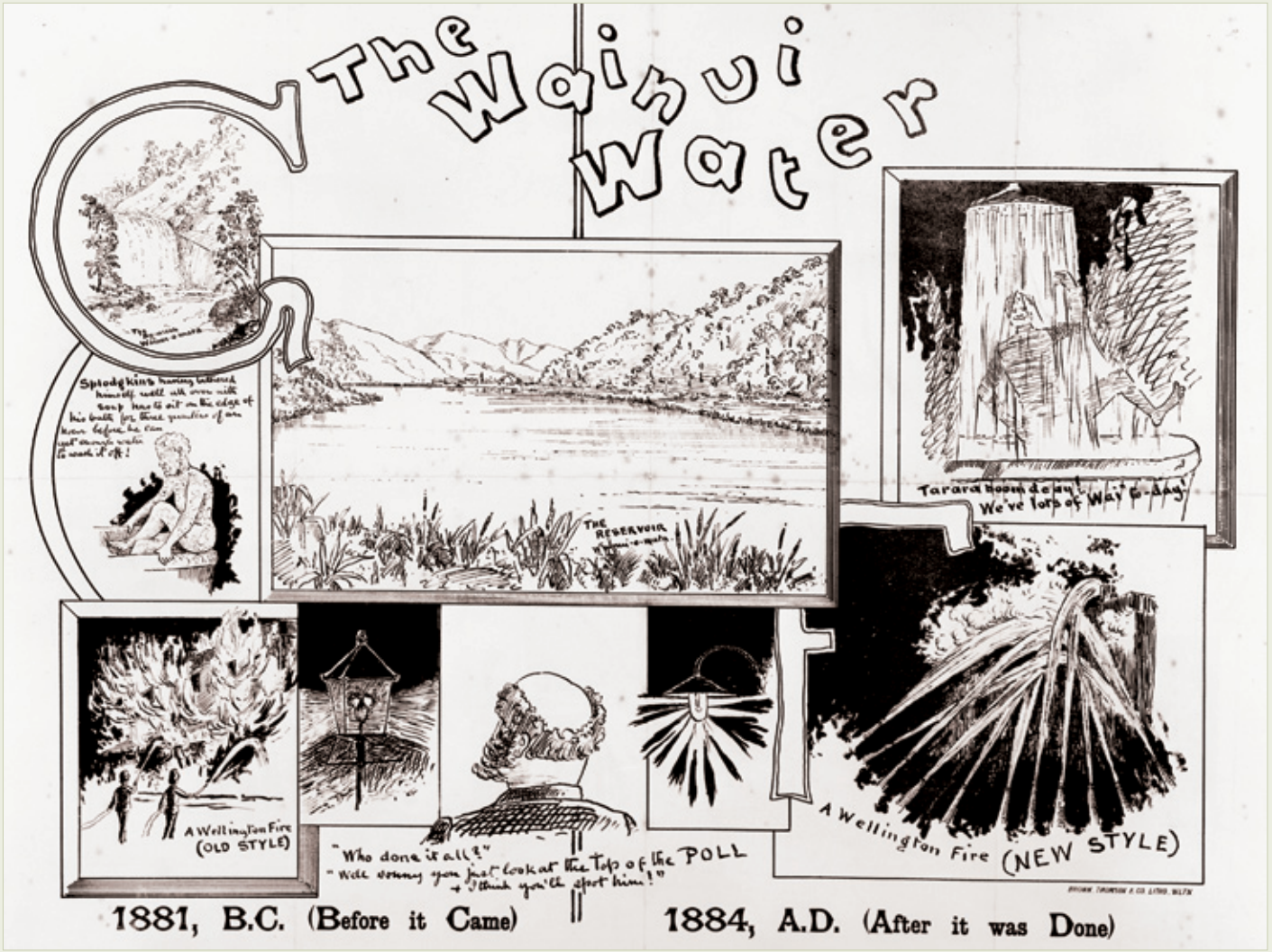
The first Wainuiomata dam in 1884, after it was breached by floodwaters. This failure and the subsequent controversy around its repair and the scheme's leakiness occupied Wellington's engineers and politicians for years to come. (Martin Album, Alexander Turnbull Library, Wellington, NZ. Reference PA1-f-036-13-2. Image cropped slightly)

Here it dropped 18 metres to enter a 750-millimetre cast-iron pipeline. This pipeline passed through two tunnels, under Dick's Hill (200 metres) and the Waiwhetu hills (1.1 kilometres), to reach Gracefield. A further 13 kilometres of 600-millimetre piping was laid along the Petone Esplanade and Hutt Road to Thorndon Quay.[68] The project was difficult and frustrating throughout. The journey for wagons delivering the pipes over the Hill Road was arduous, and in 1881 a tunnel cave-in slowed work.

What the council couldn't plan for were a series of strong summer or 'rata' floods, which seriously damaged the dam. On the night of 19 October 1883, after a fortnight's heavy rain, flood waters scoured out the earth filling behind the concrete-face wall and opened a "large gap" in it and the rock core below. Repairs to this nine-metre gash were hindered by another flood on 4 November 1883.[69] Each time the pipes were charged, they burst as far as Petone (six times in four months). As if this was not enough, a third flood hit the works in January 1884 – on the day the city planned to ceremoniously turn on Wainuiomata's water. A "severe, tremendous storm" set in suddenly on the 21st as the town prepared for its 44th Anniversary Day regatta and Druids fete. That afternoon the *Evening Post* revealed "the new dam is being rather anxiously watched". By this time the dam was complete and had been handed over to the council, full of water. Sure enough, overnight floodwaters rose to 3.3 metres above the dam crest, causing damage that took months to repair. This "washed away the dam" (though Baird would deny it) and all the bridges downstream.[70] Baird delayed his departure from the city engineer's job to oversee repairs, which cost £3,426.[71] While he repaired the dam, Joseph Saunders flumed the water from the river to the race, allowing the pipes to again be charged: water flowed to Wellington from 10 May.[72] The Wainuiomata waterworks were completed later in the year, and the dam soon planted in trees (a practice now frowned upon) to help stabilise its earth filling.[73]

When these mains were turned off temporarily in 1887 for repairs to the badly leaking water-race, another disastrous fire occurred, in Panama Street, for which the flow from Karori was inadequate. The public backlash led to the Waterworks Investigation Committee being revised,

and a bitter public spat ensued between Baird and the new City Engineer, Bernard Loughrey, over the scheme as a whole and the water-race in particular. Loughrey put aside "professional etiquette" to criticise Baird. Other consultants weighed in. The media lampooned the leakiness and frequent inspection visits, which often included a wet lunch.[74] The committee found that Baird could have supervised more (despite Oakes saying "he had been watched as if he were a pickpocket"), but there was "no grave defect in any part" of the Wainuiomata scheme.[75] It was, after all, supplying 176 litres per head per day for domestic use, but to some people the crystal clarity of Wainui water made Karori water by contrast "inferior in quality".[76] Replace the race with piping, the committee said, and for future supplies Wellington should look to the next valley over, the Orongorongo River. Bringing Wainuiomata's water to Wellington cost £130,000.



"Tarara boom deay! We've lots of 'Wai' to-day!" This 1884 lithograph reflects the great optimism surrounding the imminent arrival of Wainui water to Wellington. (Alexander Turnbull Library, Wellington, NZ. Reference B-034-020)

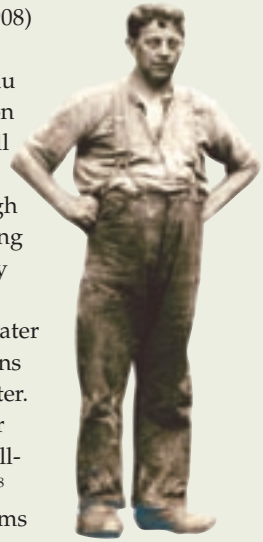
Around the region

As Wellington grew, so did the local authorities in the region. In 1876 provincial government was abolished, and under the Counties Act, Hutt County was established in 1877. It covered the whole future Wellington region – with the exception of Wellington city. County revenue came largely from licensing, rates, and the much-hated tolls on roads and bridges. This revenue was barely sufficient to maintain and improve these services, let alone extend to the provision of public waterworks. Most councils nonetheless searched for public water supplies. The Hutt and Petone town boards commissioned reports on possible water schemes in the mid-1880s.[77]

Petone residents relied on private artesian wells, tapped from 1883. This underground water, or river-fed aquifer, leapt out of the ground at Petone (whereas up the valley it had to be pumped by windmill or hand). This supply was also fed into underground tanks on some street corners for fire-fighting purposes. Wellington offered Petone a supply in 1884 (at one shilling per 4,500 litres), but rather than buy this costly Wainuiomata water Petone applied to be a co-user.[78] The application was declined, and the necessity to establish its own water supply led to the formation of the Petone Borough Council in 1888. Petone's first plan was to draw a supply from the spring on Mr Fitzherbert's Hutt Road property. Nicholas Marchant said this would be inadequate and recommended Belmont Stream or Takapu Creek.[79] Cost precluded this, so in 1899 Petone and Lower Hutt boroughs jointly investigated a Belmont supply. Lower Hutt Borough nominally dropped out but quietly purchased the Belmont Stream water rights from the owner, Speedy, while Petone was in negotiation. This kept relations cool between the two boroughs for a number of years.[80] In June 1901, following a fire that destroyed the Victoria Hotel, Petone again applied to connect into the Wainuiomata main for fire-fighting purposes, but was again rejected owing to water shortages in Wellington.[81] The borough settled on the only other stream available, Korokoro, but this brought it into conflict with the woollen mill there, which had riparian rights over the supply. A solution, which split the council and saw the resignation of five councillors, was for the borough to build two dams, one for public supply and a second smaller dam for the mill. Both were built in 1903 by borough engineer Samuel Jickell.[82] The borough's dam had a capacity of 36 million litres, but stream flow was inadequate in summer and had to be supplemented by bores and pumps in Tennyson Street. This episode was very costly, as the mill successfully defended its rights to the water in court.[83]

The Lower Hutt Borough started works in January 1906 for fresh and wastewater reticulation. For a population of just 3,000, they were expensive. The borough's first engineer, Henry Rix-Trott, diverted the Belmont Stream in the western hills, piped the water 600 metres to a new reservoir at Normandale and built a pumphouse to add artesian water drawn from Williams Grove. By the time the work was finished in 1908, costs had blown out to nearly £20 per resident. The ratepayers revolted by throwing out the mayor, most councillors and Rix-Trott.[84] The system, however, successfully supplied 136,000 litres a day and the reservoir had to be considerably enlarged only four years later.[85]

Other local authorities (formed 1906-1908) established rudimentary supplies.[86] Johnsonville drew a supply from Ohariu Valley in 1912. A small dam was built on Ohariu Stream with a pumphouse to fill a high reservoir near the ridge-top (the pipeline down to the town went through a tunnel). This dam survived a damaging flood in 1918 and was supplemented by two others at the top of Elliott Street in 1920.[87] Eastbourne in 1911 engaged a water diviner and investigated tapping Gollans Stream, but neither produced town water. Some residents privately dammed their backyard creeks, Bartolo Russo even selling water to his Rona Bay neighbours.[88] Residents in other suburbs cut by streams used hydraulic rams to pump water to their own tanks. The Porirua Mental Hospital in 1893 dammed Mitchell Stream coming off Colonial Knob for a water supply (adding another tributary in 1912).[89] Upper Hutt's supply was started in April 1914 with a weir on Clarke's Stream and pipes crossing the Hutt River at Birchville. The Defence Department established a separate reticulated supply for Trentham camp (town-sized in itself) in 1915, with reservoirs on Cuckoo Valley Creek.[90] Paekakariki's town supply, designed by G Laing-Meason, was initiated in 1922 from McKay's Creek, on land owned by former Hutt County Council chairman Arthur McKay.[91]



Labourer

This plan of the Kaiwharawhara Stream watershed, dated 1901, shows the catchment land to be purchased (blue) in relation to the planned upper dam and reservoir.

Extending water

Wellington city grew phenomenally: by the 1890s it was the country's biggest settlement. Shiploads of immigrants boosted the city's population to 43,000.[92] New boroughs ringed the city – Melrose in 1888 (including what are now Kelburn, Brooklyn, Vogeltown, Island Bay, Lyall Bay, Kilbirnie, Hataitai and Roseneath), Onslow in 1890 (Ngaio, Khandallah, Kaiwharawhara and Wadestown), Karori in 1891 and, in 1904, Miramar (the remaining eastern suburbs).[93] Melrose applied to tap into the Wainuiomata supply (as Petone had), before parts of both it and Karori were deemed to be within the city's water supply area in 1895. Following the report of a Special Boundaries Committee in 1898, parts of Onslow, Seatoun and Karori that lay within the Wellington watershed were also brought under city control.[94]

The remains of the incline tramway used in the construction of Karori's upper dam can still be seen in the Karori Wildlife Sanctuary.

Initial confidence in the abundance of the new Wainuiomata supply led to over-use, including by water engines, fountains and even hydraulic lifts.[95] By now electricity was being generated from the piped supply.[96] Where use by church organs, swimming pools and garden hosing had been occasionally restricted, the 1890s saw them prohibited and the supply conserved for domestic use. A plumber was appointed as water inspector to curb excessive waste.[97] Already the first pipes laid now carried a lesser flow, encrustation reducing their usable diameter.[98]

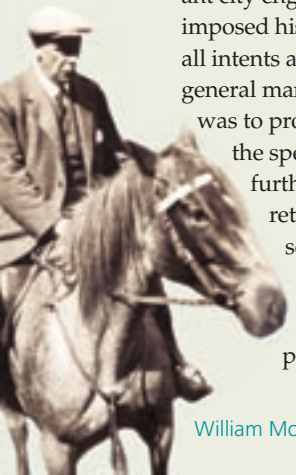
By 1900 the city instructed its new City Engineer, Richard Rounthwaite, to advise on "the best means of increasing the supply… in view of the inconvenience householders are being put to through the shortness of water".[99] Rounthwaite recommended new dams in the upper Wainuiomata (with new mains) and above the Karori dam, as well as investigating the South Karori Stream. Test bores were sunk at the Wainuiomata site. A second Karori storage dam had first been mooted in 1880, by Nicholas Marchant.[100] Rounthwaite also recommended replacing Wainuiomata's old water-race with piping.[101] This work was completed in

1902-1903 and included the installation of the new Venturi meters to more accurately measure the water delivered.[102]

City hygiene was being addressed, with a main-trunk sewerage system completed in 1899 (a main from Dixon Street to the outfall at Moa Point, tunnelled under intervening hills) and other measures.[103] Fears that water shortages would exacerbate poor sanitation prompted the council to set up a Special Waterworks Committee in 1902. The committee endorsed Rounthwaite's proposals for additional storage, as well as acquiring the Karori catchment (which was still used by a "thoroughly dirty… dairy farm and sheep run"[104]). Costed at £162,000, however, these proposals were rejected by ratepayers.[105]

William Morton became city engineer in 1904. He had been in public works in Australia for two decades, 16 years alone with Melbourne city (where he was assistant city engineer).[106] The 38-year-old soon imposed his dominant personality: "to all intents and purposes he was the city's general manager".[107] His two-decade tenure was to prove very influential. He adopted the special committee's findings, and further recommended that water be reticulated to the recently absorbed borough of Melrose and elsewhere throughout the city.[108]

Probably through Morton's persuasiveness, and with Melrose voters in favour, ratepayers now approved the waterworks loan for the upper Wainuiomata and Karori dams, piping and catchment purchase in 1905.[109] In mid-1906 tenders were called for both dams and the city purchased the Karori catchment, mostly from AB Fitchett.[110]



William Morton

The upper Karori dam was started first. A gravity dam, 21 metres high with a curved concrete wall, was completed by Mitchell & King in March 1908.[111] It impounded 284 million litres[112], with the water level 35 metres higher than that of the old reservoir.

At the same time, reticulation by gravity was started in the new low-level suburbs. For hilltop suburbs, high-level zones were created using new pumping stations: for Brooklyn in 1907; Northland/Kelburn in 1908; and Roseneath, Melrose and Wadestown in 1911.[113] These were made possible with the recent advent of the 500-volt DC power network for the trams (previously steam engines had pumped water).[114] The pump stations had to be built close to tram routes, but they provided water to previously impractical heights (Brooklyn's service reservoir was 223 metres above sea level, Wadestown's 241 metres and Karori's 257 metres).[115]

With the upper Karori dam finished, the council turned its attention to Wainuiomata. A site not far upstream of the first Wainui dam was chosen, beside a hillock called Solomons Knob. The river had to be

Contractors for the Karori upper dam, Mitchell & King, gather for the opening ceremony in 1908.
(W F Tibbutt Collection, Alexander Turnbull Library, Wellington, NZ. Reference PAColl-0419)

Wellington's high peaks were used for several service reservoirs, to which water had to be pumped, but which then gave a good gravitational flow to residents. This is Wadestown's reservoir, 241 metres above sea level, built in 1911 and smartly fenced.

The second Wainui dam (Morton Dam) under construction beside Solomons Knob in Sinclair Valley (circa 1911). (S C Smith Collection, Alexander Turnbull Library, Wellington, NZ. Reference G-20074-1/1)

diverted and new roads and bridges built before dam building could start. Martin, Hurrell & Snaddon were contracted (for £46,424) in November 1908. They started the following January and finished in November 1911.[116] The buttress dam in reinforced concrete (of cellular section) was 164 metres in length and 12.5 metres high, and impounded 485 million litres. A fortnight after completion, the council named it Morton Dam in appreciation of the stalwart city engineer (who three years later consulted on sites for Auckland's dams).[117] Melrose residents got their water supply as a 1911 Christmas present.[118]

Morton also recommended duplicating the 600-millimetre main from Gracefield to Wellington. Since laid, this pipeline had leaked and burst, often alongside earth tremors, particularly on the Wellington fault along the Hutt Road.[119] In March 1907 a major flood of the Hutt River destroyed part of the pipe bridge, breaking the Wainuiomata main. The Waterworks Department took 21 days to repair it, working around the clock.[120] A new pipe bridge over the Hutt River estuary was built in 1909 to improve security of the supply. Morton's duplicate 525-millimetre main, connecting to the city's reticulation at Thorndon Quay, was started in 1910. This new main reached Thorndon in 1912 and increased the supply of water from Wainuiomata by 1,075 million litres in its first year.[121] A further connection was also planned to a nine-million-litre distribution reservoir to be built at Bell Road, above the Nairn Street Reserve, to regulate the pressure throughout the city. The new 525-millimetre main arrived there, via Lambton Quay, The Terrace and Nairn Street in 1913. In a rare case of poor planning, the Bell Road reservoir was built a bit too high so that, in summer and with the head loss in the pipe, the water could not rise to it. Instead it was filled, sometimes with difficulty, from Karori.[122]

The 1909 pipe bridge on the Hutt River carried water from Wainuiomata to Wellington for 45 years. (A P Godber Collection, Alexander Turnbull Library, Wellington, NZ. Reference G-453-1/2-APG)

Morton Dam was named after William Morton, the city engineer who oversaw its construction. It was a concrete buttress dam and its cellular mode of construction was 'state of the art' at the time. The spillway was removed when the dam was decommissioned in 1988.

Orongorongo water

Looking at the Orongorongo River as a future source, the Special Waterworks Committee had in 1887 pronounced its waters "as clear as crystal" – but suggested they leave it "to future generations".[123] With Morton Dam nearly finished, Morton proposed that the Government be asked to set aside the Orongorongo catchment as a waterworks reserve. Morton felt its time had come in 1915 and took the mayor there in February, after which the WCC authorised him to pipe Orongorongo water to the dam.[124] Preoccupation with the war hampered this, but the years 1915-1917 were the three driest consecutive years on record – the Wainui dams completely dried out for three days over Easter 1917. *The Dominion* sensationalised this under the headline 'Our Shrinking Water Supply' – and kept the Orongorongo proposal alive.[125] In 1919 Morton refreshed his proposals. At first he proposed that Orongorongo water be supplied into a new large storage reservoir in the lower Wainuiomata valley. This scheme was modified in 1920 because of the unexpected depth required for the dam foundations. He settled on conveying the new supply directly to the lower Karori reservoir, 34 kilometres away, by adding a third pipe.[126] This time the council favoured the Orongorongo as their next source of supply.

Council waterworks staff investigated the inaccessible but pristine Orongorongo River in February 1915. Morton and Morice are sitting (left to right) with Messrs Drummond, Hindmarsh and Luke behind them (left to right).

As a run-of-the-river scheme no dam was involved (merely a weir and intake), and gravity would get the water to its destination. With the absorption of new boroughs Onslow and Karori placing further strain on existing supplies, Wellington ratepayers approved the loan to borrow £561,943 on 15 September 1920.[127]

The Orongorongo project, overseen by Waterworks and Drainage Engineer JM Morice, was major: in all 13 contracts were let, over half for preparing the approaches to the tunnelling sites and pipeline route. Water was to be drawn from a weir, piped through two tunnels to Wainuiomata, then to Karori through new pipes laid alongside the existing two. The 3.7-metre-high weir on the Orongorongo was at the Huia Creek confluence, at 260 metres above sea level.

The headworks and tunnels were built by cooperative labour under a contract between the labour gang, led by the once-militant miner-unionist Robert Semple, and the WCC. The major problem for the headworks was access. For transporting light materials, Semple's team cut a 6.5-kilometre packhorse track over the 580-metre-high bushy ridge between the two valleys. Heavier loads were trucked 45 kilometres to the mouth of the Orongorongo Stream from where horse teams dragged them on sledges 22 kilometres up the bed of the snaking river to the tunnel site. This involved crossing many fords and rough shingle beds, and cutting side roads where the riverbed was too narrow. About 600 tonnes of steel water mains, cement, timber and compressing plant were carried in this way.[128]

At each end of the long tunnel, the council erected a camp with "two power houses with water turbines for driving air compressors for working the rock drilling machines". The WCC also supplied the drilling machines, tools and explosives.[129] The camps were connected by telephone, the insulators and wires slung from trees. The long narrow tunnel, started in October 1921, was the biggest engineering part of the project. At 3.2 kilometres, it was the "second longest in New Zealand", WCC boasted in its 1926-27 Yearbook, "and the largest work of any kind any municipality in Australasia has undertaken in connection with its water supply". Parties started digging from each end, the 525-millimetre pipe (and the 610-millimetre tramway) being laid as it proceeded: the headings met on 23 February 1924.[130] At the headworks in the Orongorongo valley, the shorter second tunnel, 800-metre pipe track and 18-metre truss bridge were completed in 1922: the weir and intake chamber in May 1924.[131] Concreting the long tunnel lining (for about 40 percent of its length) was completed in March 1926. Because of the weir's elevation, the water had enough pressure for the pipeline to be laid over the Waiwhetu hill and not through it.

The western portal of the tunnel to link the Wainuiomata and Orongorongo water catchments, seen here during construction. The 3.2-kilometre tunnel took 28 months to complete, with tunnelling parties working from both ends.

On 23 December 1926, the 'practical men of Wellington' gathered at Karori's lower dam to officially turn on the Orongorongo water supply scheme. Karori was the terminus for all incoming water to Wellington.

When the last pipe was laid for the 'O-K main', as the Orongorongo-to-Karori main became known, the supply was turned on at a ceremony at the Karori reservoir on 23 December 1926.[132] Unlike earlier jobs, New Zealand-made bituminous-lined, steel lock-bar pipes were used (the lock-bar holding the pipes together like a zipper).[133] Three branch lines were connected to reservoirs at Karori, Onslow and Kelburn (which filled when the terminal valve at Karori was shut). The new supply, together with existing sources, was capable of providing 335 litres per head per day for a population of well over 130,000 people. This was anticipated to meet all requirements for at least 15 years.[134]

A caretaker's cottage was built in the Orongorongo valley, but the isolation was not easy. The wife of the first caretaker, Frank Ryan (after whom Ryan's Creek is named), wrote to the council in 1930. "This is a very bad place for a woman to live in," she said, asking for a jigger for her husband or one she could work herself "for getting our necessities through the tunnel. The telephone is very unreliable." The council attended to footbridges over the two creeks on the Wainui side, and fixed the phone, but mentioned no jigger.[135] In what has been a remarkably safe industry, with its dam building, trenching and tunnelling, a death in Orongorongo tunnel provides stark contrast. A staff member going through the tunnel in 1967 failed to stop his jigger at the Orongorongo end and crashed over the turntable into the river, which was swollen at the time. His drowning led to more visible signs warning jigger drivers of the approaching terminus.[136] Some of the topography now owes its identity to this project, with names like Semple's Track, Semple's Tunnel, and Telephone Creek.[137] Before being finished, the high cost led to criticism of the project. At a Newtown political meeting of Labour supporters before the 1925 municipal election (in which Semple was standing), "Severe criticism was directed at the Orongorongo tunnel scheme, which, it was stated, was costing a considerable sum of money each year in interest, but was giving no service in return".[138]

Orongorongo project living quarters