THEME 5: INFRASTRUCTURE

5.1 GAS

Figure 50: Dunedin's Gas Light and Coke Co. works.
[George O'Brien watercolour] **1865** *Otago Settlers Museum collection*

The Dunedin Gasworks [**B021-022**] was the first to be built in New Zealand in 1862 and, when the works closed in 1987, was the last to do so. Part of the complex was saved and is now operated as the Dunedin Gasworks Museum. The original steam pumping plant, much of it dating to the 1920s, remains in place and fully operational, and it forms one of New Zealand's more important industrial archaeological sites. In its heyday gas was piped all around the city, and was used for street and domestic lighting, heating, cooking and industrial processes. For many years the gas and electricity departments of the Dunedin City Council vied for custom; electricity eventually won out.

The first structures (Fig. 50) were built on the tidal edge of the upper harbour by the Dunedin Gas and Coke Company whose engineer, Stephen Stamp Hutchison, had come from Melbourne. It was proposed that the private company supply the gas and lay mains while the City would provide street lamps. Hutchison's management of the Gas Company was highly questionable and he was noted in Dunedin as a sharp operator who walked through the town with a liveried manservant or 'tiger'. The Dunedin City Council bought the gasworks from the company in 1876 and supply eventually reached most suburbs. The street lamps were designed by the City Engineer, John Millar, whose name was cast prominently into the base. An example is situated in the

lawn area to the north of the Otago Settlers Museum. These, along with the large gasholders that were situated in parts of the city, have been removed. The last, at Kensington, was cut up as late as 2000 while an 1879 gasholder has been resited at the Gasworks Museum.

Post-war development and expansion included a large retort house constructed in 1962 that loomed over the site. This was demolished in 1989. A brick governor house on the outer corner of the site was also controversially destroyed in 1991. One of the earliest brick structures on the site is also the most endangered. Known as the Fitting Shop [**B021**] through its use by Gas Department engineers, the building originally housed the laboratory. It was constructed with semi-open arches to allow air to circulate and reduce the risk of explosion and, over time, has been seriously weakened by neglect. The Dunedin Gasworks Museum was opened on the site in 2001 and the fitting shop, boiler house, main chimney and engine house remain as an in-situ industrial museum and exhibition space for steam engines and equipment used to pump gas around the city.

Figure 51: View of the gas works and Caversham Railway Station, Dunedin. 1925

Caversham Gasworks: Stephen Hutchison built another gasworks (Fig. 51) in Caversham in 1881 in competition with the City Gasworks. His new company gained the contract to supply the boroughs of

Caversham, Mornington, and Roslyn. Parts of the structure remain on South Road beside the Main Trunk Railway.

Port Chalmers Gasworks: The Port Chalmers Gas Company was established in 1888 and the works were located on reclaimed land beside the railway line at Mussel Bay. A gasholder with a capacity of 12,000 cubic feet was built and the works supplied 4,000,000 cubic feet of gas annually.

5.2 ELECTRICITY

The gas industry was well established in New Zealand and cities were relatively slow to take up electricity. As with many similar infrastructure projects, Sir Julius Vogel was a major instigator. Vogel was a representative of the British Electric Light & Power Company and pushed the use of electricity. The carding and spinning rooms at the Mosgiel Woollen Mills were lit by electricity in 1885 in what was the largest installation in New Zealand. The Phoenix mining company adopted electric power in 1885 and the remains of the 1885 hydro-electric plant at Bullendale near Queenstown is amongst the earliest such plant still on site in the world. Dunedin established its own hydroelectric supply in 1907 (Thornton 1982: 146), and the foundations of the old powerhouse can still be seen at Waipori Falls (ironically, outside Dunedin City, but rather in Clutha District). In rural areas a national grid of electric power supply did not arrive until the second half of the twentieth century, and many small private power generation schemes were installed. The quality of these varied immensely (some were distinctly Heath-Robinsonesque). The remains of a small farm generator are located at *Inverlochy*, near Hindon. This was powered by a water wheel, and operated between about 1916 and 1956, when reticulated power arrived (Petchey 1993: 34). Many similar small plants would have been installed in the region, and it is possible that some remain abandoned but intact on more remote farm properties.

Waipori project: While Dunedin was not the first centre in New Zealand to install an electrical supply, the city was the first to develop a publicly

owned hydro-electrical generation system. Planning was fraught with a number of different sites considered. The Dunedin City Corporation chose Lee Stream while the private Waipori Falls Company proposed to establish facilities on the Waipori River. This proved to be the better choice. The Waipori Valley descends sharply through a steep gorge, falling 165 metres over 4 km. The river flows on to join the Taieri near Henley, a distance of 30km from the central city.

The City finally had to buy out the private company and ceased its construction project at Lee Stream, although it was already significantly advanced. The scheme was completed in 1907 with two 1,000-watt generators in operation. Access to the site was difficult with heavy equipment and materials hauled by horse teams across land from Lawrence or up the valley from Berwick. The initial scheme utilised the flow of the river which was undammed. Water was conveyed to the Pelton Wheel generators along a wooden flume 1.9m wide and 1.2m deep. Concern was expressed about the ability of the plant to cope with fluctuating river levels and construction began, in 1909, on a series of dams and tunnels, forming reservoirs on the river. The Loudon dam was of earth construction and the later one, holding back the new Lake Luella, of concrete. Further generators were installed in 1913 and the plant was capable of turning out 6,000 watts. By this time Waipori had become a small village housing the twenty-two families of engineers and staff.

Electricity was extended from Dunedin to Port Chalmers in 1914 and the post-war revival of the local economy created further demand for supply. The City Corporation proposed the construction of a large dam to create Lake Mahinerangi. This work was completed in 1930. Electricity was sent to a substation at Halfway Bush along two 33kV lines. From there, two further lines were constructed to distribute power to the city. On Bauchop Street, in the industrial area by the wharves in Dunedin, a 1920s transformer house is still in use, and is only now having some of its original equipment replaced.

The Waipori Hydro Scheme now comprises four stations; Waipori 1A delivering 10 MW, and Waipori 2A, 3 and 4 delivering 58 MW, 7.6 MW and 8 MW. The system is now part of the TrustPower network.

5.3 WATER

Figure 52: Leith Valley. *circa* **1890**

The Leith was used for the town water supply but was polluted, even by the early 1850s.

A clean water supply is essential for the public health of any town or city. In the early years of settlement water was taken from the natural streams in the town belt (Fig. 52), but in the 1860s it became obvious a better supply was required. The town's water was collected from rainwater and springs. Those in the lower city became polluted with human waste as a result of the lack of a piped sewerage system in the upper parts. Another supply was tapped from a spring in High Street and a public pump installed in Manse Street in 1860.

Figure 53: Ross Creek Reservoir. *circa* **1925**

Ross Creek Reservoir: The engineer Richard Woolley, later responsible for the Dunedin Port Chalmers Telegraph, proposed a private waterworks project at Ross Creek, capturing part of the flow of the Leith. A similar publicly-owned scheme was initiated by the Otago Provincial Council and the Ross Creek Reservoir, capable of holding 46,000,000 gallons of water, was opened in December 1867 by the Dunedin Water Works Company. The scheme was taken over by the City Corporation in 1875.

The Ross Creek Reservoir (Fig. 53) was New Zealand's first major urban water supply. The treatment plant introduced chlorination in the1950s, microstraining in 1971 and, controversially to this day, fluoridation in 1967. A clarification plant using magnetite was installed in 1990, the first use of this technology for a public water supply in New Zealand and only the fourth in the world. The site now has the unique contrast of the oldest hydraulic structures and the newest treatment process in New Zealand. The Ross Creek dam [**B517**] and valve tower [**B516**] are today registered historic structures, and are still in use.

Ross Creek was considerably lower than the more elevated suburbs of Dunedin on the Roslyn/Maori Hill ridge and the Silverpeaks were eventually chosen for an extension to the city water scheme in 1878.

Current Dunedin reservoirs are Mount Grand Reservoir (completed 2006, volume: 375,000m^3), Southern Reservoir (completed 1923, volume: 245,000m^3), Cedar Farm Reservoir (completed 1956, volume: 108,000m^3). Rossville Reservoir (completed: 1875, volume: 48,000m^3), Sullivans Dam (completed 1916, volume: 133,000m^3) and Ross Creek Reservoir (completed 1867, volume: 162,000m^3).

Mosgiel was reliant on water collected from roofs until 1905 at which time a supply was obtained from Leishmans Creek. This was augmented by bores with the first drilled near Factory Road. This system was extended and the Whare Flat supply phased out due to pollution.

Port Chalmers relies on the early Rossville Dam which was built above Sawyers Bay in 1875. The system was expanded with the Cedar Farm Dam in 1953.

5.4 WASTE

The disposal of waste from a growing population was a difficult issue for Dunedin's various authorities. Concerns about pollution in the Leith were expressed as early as 1853, with a letter to the editor of the *Otago Witness* suggesting that those who were not convinced should drink 'a little of the limpid fluid'. [UNTITLED: *Otago Witness*, Issue 106, 28 May 1853, Page 2] The *Dunedin Roads and Streets Ordinance* (1855) made the Town Board responsible for drains and sewers but more attention was paid to keeping drains above ground clear than to the construction of an underground sewer.

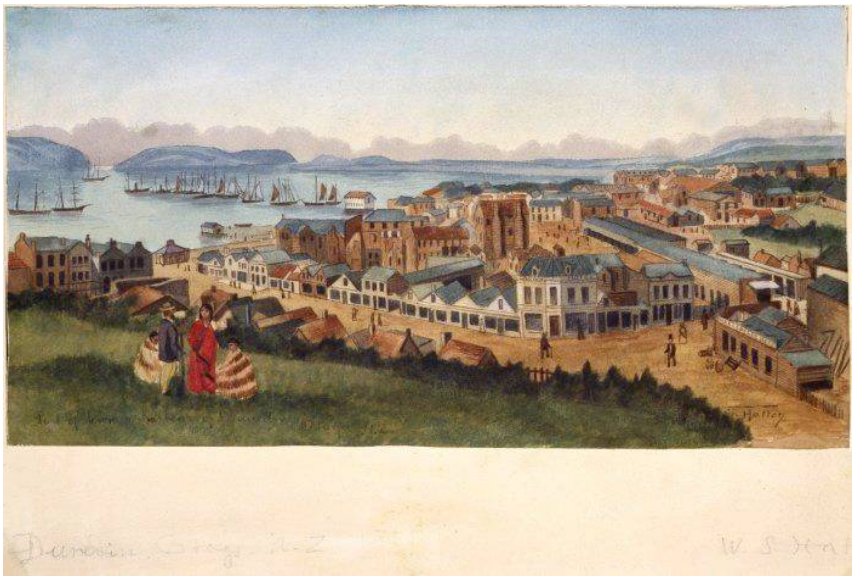

Figure 54: Painting showing the concentration of buildings in the area of Rattray Street and Serpentine Avenue, 1861. [W.S. Hatton]

All these buildings discharged waste into the harbour from a pipe carrying the buried Toitu stream.

A large sewer was placed under Rattray Street in 1861 (Fig. 54), but in 1862 it was reported that still no proper sanitary provisions had been made for the city and an outbreak of typhoid could be expected as a result. A large 6 foot by 5 foot underground drain to replace a foul open

sewer in Maclaggan Street was proposed in 1864 and the City Engineer was asked to provide a report on sewerage and water supply. John Millar recommended linking the new sewer to the old culvert that conveyed the Toitu stream into the harbour underneath the reclamation. A flood in 1865 caused £3,000 damage to buildings in the Rattray, High and Maclaggan Street triangle and the disposal of groundwater was also an important consideration.

Sanitation Commission report: The report of the Sanitation Commission in 1865 condemned the lack of action, attributing deaths to the unhygienic situation facing the city. It stated the average life expectancy in Dunedin was lower than in England and that half the deaths in Dunedin were caused by 'zymotic diseases' and were preventable. [THE REPORT OF THE SANITARY COMMISSION: *Otago Witness*, Volume 03, Issue 705, 3 June 1865, Page 1]. Millar's proposal to direct sewerage directly into the harbour with storm water was problematic for reasons soon made clear. Engineer Charles Swyers' studies of tidal flow in the harbour revealed that waste would not be carried out on the tide and that Ocean Beach was the preferred place to discharge into the ocean, but this advice was not taken on the basis of cost and disruption.

Miram's scheme for the draining of Dunedin: Samuel Miram's 1872 drainage scheme proposed dividing Dunedin into five districts with a system of brick pipes of 4 foot 6 inch diameter, but a further report in 1875 under the Public Heath Act showed that matters had not improved and that Dunedin was frequently awash. 'Night soil' collections removed faeces from private houses whence it was carried, by horse and cart, for dumping at an area close to the Gasworks. In later years it was taken by punt to the head of the harbour to be cast into the sea and, from 1900, buried in the Ocean Beach sand hills.

The lengthy and persistent disagreements between the City Council and the Harbour Board over drainage issues led to the establishment of a drainage board for the city in 1900. Something like Swyer's scheme of 1865 was finally put in place in 1907 when Lawyer's Head was chosen as the ocean outfall. Work began in 1907, connecting forty miles of

sewers from across the city. Night soil collection (Fig. 55) in the City ceased in 1912 and a cart remains in the Otago Settlers Museum collection as a reminder of this period. The actual underground infrastructure of pipes, sewers and stormwater drains is of archaeological interest. As a recent article in the Otago Daily Times (4 April 2009, Page 39) illustrated, some of the brick stormwater drains in the central city are over 150 years old, but are still in use.

Figure 55: Metal night soil container

Waste disposal: As with sewerage, Dunedin's arrangements for waste disposal were poorly organised for much of the early phase of the City's growth. It was left to building owners or users to dispose of waste in a way that did not cause offence or nuisance to others. Hard materials such as bottles, ceramics, leather objects and tinware were frequently placed under floorboards or used as hard fill in site levelling. Such materials are commonly found in excavations around old building sites. The early reclamation sites around the central city area were also repositories for household waste. Rubbish was also frequently cast into the harbour from ships. This was an offence and court records show a number of prosecutions. Combustible material was usually burnt in household fires and food scraps were fed to animals, considerably reducing the bulk of material to be disposed of. A manure depot was established in Caversham in the 1860s but was closed due to the stench.

Tip sites in the city recorded by the Dunedin City Council after 1915 include: Albany Street (1915-21), Andersons Bay (1916-1948), Carisbrook Embankment (1920-21 for Caversham collections), Chisholm Park (1915-1916), Dean Street (1933-34 and 1951-2) Frasers

Road, Kaikorai Valley (1951-1959), Glen Road (1919-1922), Green Island (1958-present), Henry Street (1934-1935), Hillside Road 'Ten Acre Block' (closed 1912), McBride Street reclamation (1929-30 opened), Jubilee Park (1946-1954), Logan Park (1930-?), Midland Street (1942-1948), Montecillo (1953-1962), Musselburgh Rise/Bayfield (opened 1921-22 for tipping of trade waste), North East Valley (1929-30 'Railway tip'), Norwood Street (1963-1977), Ocean Beach Domain (used for night-soil deposits, offensive trade waste and Caversham rubbish 1921- 1958), Ocean Grove (1950-1951 closed because of smoke nuisance), Opoho (1950-1963), Oval (c1900-1912), Prospect Park (1934-1943), Roslyn (1914-15 purchase of 2 acres in 'Roslyn Baths Road' for tip), Somerville Street (1933-34 section purchased for tip), Springhill Road (1930-31), Sydney Street (1948-1958), Town Belt, Unity Park, Mornington (1921-1946), Upper Junction (1928-29 farm used for disposal of fish waste), Wharf Street (1915-1933) which seems to have been a major tip for many years and was used for household wastes and as a 'burning tip' after Harbour Board grudgingly gave permission for its use, Woodhaugh (1931).

Tips in rural areas of Dunedin include Aramoana, Berwick, Fairfield, Karitane, Middlemarch, North Taieri, Peninsula County, Port Chalmers, Mosgiel, Sunnyvale, Waikouaiti, Warrington and Wingatui.

5.5 CIVIL ENGINEERING

Refer to previous sections on road construction (**4.1**, page 75), dams (**5.3**, page 97 and railways (**4.3**, page 82).