Victorian Water Supply Heritage Study
Volume 1:
Thematic Environmental History

Final Report
31 October, 2007

Prepared for
Heritage Victoria
Authorship

Report prepared by Context Pty Ltd for Heritage Victoria.

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Report Register

This report register documents the development and issue of the report entitled Victorian Water Supply Heritage Study Volume 1: Thematic Environmental History undertaken by Context Pty Ltd in accordance with our internal quality management system.

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Barwon River Industries
[SLV IAN01/05/91/12]

Figure i

Anderson’s Mill, Smeaton (showing detail of water wheel)

John T. Collins
[SLV H98.251/702 & H98.251/705]

Figure ii
PREFACE

The Victorian Water Supply Heritage Study Volume 1: Thematic Environmental History is the first output of the Victorian Water Supply Heritage Study project. Further stages of the project are described below.

As described in the following section, this environmental history provides an explanation of the themes and activities that have been important in shaping the State’s water supply heritage. It provides a context for the assessment of places and objects of State and local heritage significance. It also provides linkages to the Australian Historical Themes (AHT), which are listed in Appendix 3.

Terminology

The terms used throughout this report are consistent with the Burra Charter: The Australia ICOMOS Charter for Places of Cultural Heritage Significance. A glossary of some key Burra Charter terms and their meanings as well as technical terms associated with water supply activities, is provided at Appendix 1.

ACKNOWLEDGEMENTS

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Steering Committee

Members of the Steering Committee for the project:

- Julia Cusack, Frances O’Neill and Amanda Bacon, (Heritage Victoria)
- Paul Balassonne (Melbourne Water)
- Siraj Perera and Roslynn McRoberts (Office of Water)
- Steve Bird (VicWater)

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Water authorities

- Melbourne Water
- Barwon Water
- Central Highlands Water (Peter Blackburn and Rosalie Polowski)
• Coliban Water (Rob Krober)
• East Gippsland Water (Dean Boyd)
• Goulburn Valley Water (Melinda Malcolm)
• Grampians Wimmera Murray Water
• North East Water (Terry Wisener)
• South Gippsland Water (Ros Griggs, Public Relations)
• Wannon Water (Andrew Jeffers and Nora Walsh)
• Westernport Water

Local historical societies
• Birchip Historical Society (Dorothy Green)
• Buninyong Historical Society (Anne Beggs-Sunter)
• Daylesford Historical Society (David Endacott)
• Footscray Historical Society (Frances)
• Horsham Historical Society (Lindsay Smith)
• Jamieson Historical Society (Marion McRostie)
• Katandra and District History Group (Garry Wallden)
• Keilor Historical Society (Susan Jennison)
• Knox Historical Society (Steve Flemming)
• Little River History Group Inc. (Les Sanderson, President)
• Nepean Historical Society (Janet South)
• Newstead Historical Society (Dawn Angliss)
• Somerville Tyabb & District Historical Society (Brenda Thornell)
• Swan Hill Historical Society
• Warrnambool & District Historical Society (Elizabeth O’Callaghan)
• Whitehorse Historical Society (Valda Arrowsmith)
• Winchelsea & District Historical Society (Geoff Mathison)
• Woodend & District Historical Society (Janet Hawkins)
• Yarra Glen & District Historical Society (Mr Leigh D. Ahern)
INTRODUCTION

Purpose

The Victorian Water Supply Heritage Study (the study) was commissioned by Heritage Victoria. The purpose of the study is to prepare:

- A thematic environmental history of water supply in Victoria; and
- A desktop survey of Victoria’s water supply systems and sites as the first part of an in-depth examination of the heritage of Victoria’s water supply infrastructure.

The study is to provide land managers and water authorities with a better understanding and appreciation of the value of its water-related heritage assets, in order to guide their future conservation and management.

These actions flow from the Victorian Government’s heritage strategy, *Victoria’s Heritage: Strengthening our Communities*, which recognises and emphasises the importance of thematic and typological studies as important tools for heritage conservation in the context of land development pressures.

Heritage Victoria, in conjunction with Melbourne Water, seeks to use this study as the basis for identifying sites and points of focus for future regional water heritage studies.

The output to this project will be a practical tool, providing its future anticipated users with:

- A concise and detailed thematic environmental history of water catchments, storage, supply and distribution in Victoria.
- A comprehensive list of places of potential and identified cultural significance relating to water supply systems and sites in Victoria.
- A complete database of these items, accessible via the HERMES database, with each entry identified by site number, name, GPS location, historic theme, and GIS map.

Background

There has been no State-wide comprehensive heritage survey and/or studies into water and its associated supply systems in Victoria to date. Given the size, extent and nature of water supply infrastructure in Victoria, consideration of any element or site must be approached from the broader perspective of water supply and delivery systems developed throughout Victoria. It must equally take note of the forces, events, stories and technical advances that have influenced the development of Victoria’s water infrastructure.

While various Municipal studies have identified elements relating to water supply in their respective districts, the overall benefit of such localised studies is difficult to realise without a comprehensive study to provide a comprehensive understanding of their historical context.

In light of the drive to secure a stable water supply for the State in the face of continuing environmental and economic pressures, and the range of major projects (under consideration, or currently underway) relating to water distribution, catchments, and storage, there is a need for a thorough survey of the heritage of Victoria’s water infrastructure to assist in identifying, preserving and managing related heritage assets.

Outcomes

A comprehensive historical and typological study of water heritage across the State is the first step to producing a tool that will:

- Assist Heritage Victoria, land managers and water authorities to understand and appreciate the value of water-related heritage throughout the State; and
• Provide a knowledge base and reference point to assist future studies of water infrastructure in regional and metropolitan areas.

The project’s second stage will comprise detailed studies into the heritage of water supply across regional Victoria, the first of which will be an in-depth survey of the heritage assets of Melbourne Water. It is understood that this study, independently commissioned by Melbourne Water, will serve as a model report for future regional water supply studies.

Study Area

The study area is the State of Victoria. Key features of the study area are illustrated on the Map of Victorian Water Supply, shown opposite.

The scope of the study does not extend to all sites and activities involving water; hydro-electricity generation, recreation on fresh water, transport on fresh water, and sewerage works are not included. The study will cover water supply infrastructure that served domestic purposes, including private schemes on farms, and will extend to towns and larger regional schemes.

Identifying the historic themes for Victoria’s water supply history

The themes used in this environmental history have been adapted from the Australian Historic Themes (AHT) set down as guidelines by the Australian Heritage Council (AHC). A list of the AHT is provided in Appendix 3. The AHC notes that:

The consistent organising principle for the Thematic Framework is activity. By emphasising the human activities that produced the places we value, and the human response to Australia’s natural environment, places are related to the processes and stories associated with them, rather than to the type or function of place.

The themes for the study follow the model set down by the AHC in that they are ‘active’ concepts that mark specific and distinct activities, and are loosely but not exclusively chronological. Like the AHT, the themes for Victoria’s water supply history, taken together, attempt to provide as far as possible a comprehensive overview of a much bigger and more complicated story. A table showing the relationship between the AHT and the Victorian water supply themes is provided in Appendix 3a of this report.

Developing the thematic framework involved the following key steps:

• A draft set of historic themes was identified after the initial research phase of the project, which was broad-based in its scope in terms of time-frame and locality. The themes drawn out from this research took into account the parallel concerns of social and economic change, and technological and industrial developments, but needed to remain relevant to a broad time scale rather than present a strictly linear, chronological story.

• As more detailed research of Victoria’s water supply history was carried out in the course of the project, it was evident that this history could be reasonably accommodated into seven major themes, with some minor amendments.

The seven major themes that form the basis of the chapters in this report seemed the best way of characterising and explaining the particular history of the diverse and complicated system of water supply in Victoria, which itself embodied so many overriding yet inter-related aspects of Victoria’s history, including exploration, exploitation of natural resources, agriculture, transport, industrial development and innovation, government and institutional administration, urban development, hydrology, social and economic change, tourism and recreation, adapting to the environment, and heritage and conservation concerns.
Map of Victorian Water Supply (map built online at Victoria Water, 2007)
OVERVIEW

Proclaimed a British colony in 1851, just as the excitement of gold fever erupted, Victoria held grand visions of its future progress. The popular view was that this was a promised land, an 'Australia Felix' - of bountiful gold and agricultural richness. Subsequent observers through the nineteenth century and into the twentieth continued to lavish praise on the country - for its natural beauty and rich natural resources; with its large-scale agricultural development, Victoria was described as a garden and a yeoman's paradise. In reality, however, the natural fertility of the colony of Victoria extended only to a limited area, including the thin rim along the seaboard and in the high river valleys of the north-east. Moreover, seasons were often unpredictable and drought, or 'water famine', as it was sometimes called, could be catastrophic. As one journalist explained in the 1880s, 'the terror of the Australian settler is a drought. Even in his moments of utmost prosperity he has his anxieties about the next season.' The harnessing of a reliable water supply, and its effective distribution and use, was therefore vital for the success of European settlement in Victoria.

The raison d’être of colonial settlement was for progress and development through the exploitation of natural resources. Water was the critical resource - for domestic needs, agriculture, and industrial development. Since Classical times, the development of an artificial means of storing and distributing water was critical to the notion of material progress, and the image of an advanced and civilised city.

Throughout the colony, water supply was initially procured on an ad hoc basis by private individuals, or collectively in small settlements, with varying levels of success. Inevitably, extensive public projects were required to serve the larger centres of population. The means with which this could be achieved depended upon the engineering talent of the resident population; a ready labour force; sufficient public revenue; and an effective system of organisation and management. As populations grew, local authorities augmented their water supplies accordingly by extending catchment areas; building additional holding reservoirs and enlarging existing storages; increasing the outflow; and extending urban reticulation. Where settlements fell into decline, or where water shortage itself was a chief cause of a failed settlement, elements of early water supply schemes were often left disused and abandoned. Where water was readily available, it became the source of embellishing the 'garden state' with parks, gardens, plantations, while at the same time, at reservoir reserves like Maroondah in the Yarra Valley, it was in fact the inspiration for doing so. In the 1950s, the sheer, awe-inspiring vastness of the reservoirs at Upper Yarra and Eildon represented the triumph of modern engineering over nature. Just as Yan Yean had been celebrated in the 1850s, these reservoirs were spectacles in themselves, and so became places for tourism and recreation.

The development of water supplies both shaped, and was shaped by, the development of Victoria as a whole. Where water could be easily tapped and stored, settlements flourished. Some settlements comprised workers and their families, as at Yan Yean in the 1850s, at Murchison in the 1860s-70s, and at Lake Eildon and Upper Yarra in the 1950s. In irrigation districts, water brought permanent communities, and several state schools names reflect their localities and their very reason of being: for example those at Glenmaggie Weir and Eppalock Weir. Hotels also opened up where new waterworks were being developed; this satisfied the demand of workers on the new schemes, but also, later, helped to boost local tourism.

1 In 1834, the explorer Major Thomas Mitchell had christened the western plains as an 'Australia Felix' on account of the fertile appearance of the country.


As Andrea Gaynor has recently pointed out, the history of water supply has close links with broader historical themes in Australia’s development. A successful water supply system represented one of the key objectives of colonial settlement: the triumph of man over the natural environment. Efforts (and failures) to improve the water supply in the city and country areas were caged in language about national identity, the ‘British race’, progress, and the resourcefulness and stoicism of the Australian settler.¹

In more recent years, faced with issues such as climate change and environmental degradation, the building of new dams and even the maintenance of existing irrigation systems has been questioned. Water supply systems in Victoria are now managed with a greater emphasis on sustainable development. All water authorities pay closer attention to environmental and conservation issues, and heavily promote water conservation at a local level.

¹ *West Australian*, 25 March 2006.
Aborigines fishing at Badger’s Creek, Coranderrk Mission, near Healesville c.1888

[SLV AN H83.321]

Figure 1

Tooram Stones, Warrnambool, postcard dated c.1907.

The Tooram Stones on the Hopkins River at Warrnambool is an Aboriginal fishing site that became a popular recreational place for settlers in the late nineteenth century

[SLV H90.160/358]

Figure 2

The Yarra near the Junction of the Saltwater River

(Walter Hart, 18 March 1865)

[SLV IAN18/03/65/4]

Figure 3
1. SOURCING WATER IN EARLY SETTLEMENT

This theme examines both the ways in which the search for water shaped patterns of early settlement in Victoria, and the kinds of water sources used. It also looks at water use in gold-mining. This theme also addresses the conflict between settlers and Aborigines over access to land and water, and recognises that Aboriginal people continued to draw on ancient knowledge about water sourcing long after settlers arrived, and that settlers often benefited from this knowledge. Finally, this theme recognises transport and transport routes as being shaped by and reliant on the availability of water in the early settlement period. This theme is important because it recognises the integral role of water supply in the spatial patterns and cultural experiences of the early settlement period.

This chapter incorporates the following Australian Historic Themes:

| AHT | 2.1 Living as Australia’s earliest inhabitants; 2.2 Adapting to diverse environments; 2.5 Promoting settlement; 2.6 Fighting for land; 3 Developing local, regional and national economies; 4 Building settlements, town and cities, especially 4.1, 4.2. |

1.1 Appropriating Aboriginal water supplies

Rivers, lakes and other natural water sources shaped the layout of the new and relatively uncharted country, and were the defining marks on settlers’ early maps and charts. Settlers’ efforts to harness water, with the sinking of wells and building of dams, weirs and tanks, were superimposed over an ancient knowledge of water supply that belonged to the Aboriginal people of the country.

When Europeans invaded the country that became Victoria, the Aboriginal people who had lived in harmony with the land for countless generations were displaced with tragic consequences. Their way of life was intrinsically tied to the land and water of their ‘country’; the natural environment provided both physical and spiritual nourishment. Lakes and waterways were integral to daily activities, such as drinking, fishing, hunting, swimming, camping and ceremonies. Aborigines built stone weirs and fish traps on many rivers and lakes. On the floodplains of Lake Condah in western Victoria, they constructed an intricate network of stone channels to harvest fish. Many of these structures have been lost, but some were appropriated by European settlers in the post-contact period, such as the stone weir across the Saltwater (Maribyrnong) River that Charles Grimes encountered in 1803. For Aborigines, water sites were inextricably connected to life’s meaning and as such had powerful cultural associations. Many Aboriginal groups told Dreaming stories about special places, and believed that mythic creatures like the Bunyip haunted particular lakes and waterholes. There is also evidence that waterways and lakes defined the boundaries of tribal groups, and so had a bearing on social organisation and trade routes.

The arrival of Europeans with their herds of hoofed animals caused irreversible damage to the delicate environment. Pastoralism destroyed the native pastures, eroded the creek and river banks, and silted up and polluted the chains of waterholes. Rising silt made the waterholes and rivers shallower, which contributed to evaporation. As settlement spread, these water sources became increasingly contaminated and less reliable.

For a time, Aborigines continued to camp at their traditional campsites along rivers and lakes, where they kept up their traditional ceremonies and corroborees. It was on the banks of the

5 Susan Jennison, Keilor’s Heritage (Keilor & District Historical Society, 1997), p. 82.
Merri Creek, for example, that the signing of John Batman’s ‘Treaty’ with the Wurundjeri is thought to have taken place in 1835. Squatters generally established their new homes close to watercourses and lake banks, often on Aboriginal camping sites, where food and water were available, as well as shelter and elevation. In some cases, the newcomers shared access to water with the Aborigines who remained in their traditional country.\(^8\)

During the period of conflict between settlers and Aborigines, in the 1830s and 1840s, there were various incidents that involved competition over access to water. At the typical squatting station, there was one waterhole reserved for settlers’ domestic use and another for stock. As Ian Clark explains, ‘these were considered out of bounds to local clans people’ and any transgressions by Aborigines had serious repercussions.\(^9\)

Massacres of Aborigines sometimes occurred at or near sources of water supply. The white perpetrators of massacres often threw the bodies of murdered Aborigines into waterholes or lakes, presumably for ease of disposal. In western Victoria, a number of place names are a reminder of these tragic events - for example, ‘Fighting Waterholes’; Lubra Creek (where a number of Aboriginal women were killed); Waterloo Creek; Piccaninny Waterhole; and ‘The Blood-Hole’.\(^10\)

By the 1860s, many Aboriginal people had been forcibly removed from their traditional lands and waterways. The missions and government reserves they were moved to, such as Yelta, Merri Creek, Mount Franklin, Ramahyuck, Lake Condah, Framlingham, Coranderrk and Lake Tyers, were generally provided with access to water. All over Victoria, the waterways were appropriated for use by settlers, townships and farming. New reservoirs and dams often supplanted an ancient waterhole or swamp. Some settlers relied on local Aborigines’ knowledge of the country to select the best spot to sink a well.\(^11\) Some of these sites had probably once been important ceremonial sites. The Yan Yean reservoir, for example, was built over Ryders Swamp, which was an initiation site for young men.\(^12\)

In the aftermath of dispossession, shadowy reminders of the intrinsic importance of water to the Aboriginal people of Victoria remained, particularly in place names. While European settlers often named the rivers after explorers and statesmen (for example, Murray, Hopkins, Thomson), or after other places, such as Goulburn and Glenelg, the lakes on the other hand, especially those in western Victoria, were often given Aboriginal names, such as Corangamite, Keliambete, Purrumbeet, Burrumbeet, Colac and Bolac. Similarly, a large number of settlement sites were given appropriated Aboriginal names whose meanings were associated with water, for example Colac, Echuca, Lal Lal and Mooroopna.\(^13\)

When the British claimed Australia as their own territory in 1770, they believed they were taking possession of all the land - and, by implication, all the waterways - of the eastern seaboard. While the legality of this land grab remains contentious in itself, the question of

\(^8\) There are many examples of shared country, and shared access to water in Victoria in the 1840s, for example at John Eddington’s Ballangeich station, near Mortlake. Ian Clark also makes this point in Ian D. Clark, ‘That’s My Country Belonging to Me’ (Heritage Matters, Melbourne, 1998), p. 157.


\(^10\) Ian Clark, Scars in the Landscape (1995), pp. 24, 26, 97, 141.

\(^11\) Note, for example, the intriguing story of Creswick’s Well, sunk near Marnoo in 1866; see A.W. Glencross, The History of Creswick’s Well (Marnoo, 1915).

\(^12\) Tony Dingle and Helen Doyle, Yan Yean: The history of Melbourne’s early water supply (2003), p. 12.

\(^13\) Les Blake, Place Names of Victoria (Rigby 1977), pp. 68, 90, 155, 179. ‘Mooroopna is named after a “big [deep] waterhole” in the Goulburn River.’ [Cannon, Vagabond Country, p.30]
ownership of the associated waterways is also unresolved.\textsuperscript{14} Since the 1970s, the Victorian Government has reserved land through legislation for Aboriginal people in Victoria, including land reserved for the Framlingham and Lake Tyers Aboriginal trusts, and more recently through the recognition of native title for the Gunditjmara people of south-west Victoria, an the Wotjobaluk, Jaddwa, Jadawadjali, Wergaia and Jupagulk peoples of the Wimmera region. On many waterways, Aboriginal groups have also been granted fishing rights. More recently, Aboriginal communities have been successful in negotiating 'Indigenous Land Use Agreements' in relation to the use of the land and waterways. One such agreement of 2004 between the Yorta Yorta Nation Aboriginal Corporation and the State of Victoria relates to the management of Crown land and waters over a total area of approximately 50,000 hectares in northern Victoria, and includes the waters and waterfront lands of the Murray and Goulburn Rivers.\textsuperscript{15}

**Heritage – Theme 1.1: Appropriating Aboriginal water supplies**

- Dights Falls, Yarra River
- Fishing sites, Hopkins River, Framlingham
- Lake Condah fishing site, Lake Condah (1830s-40s), now part of Budj Bim National Heritage Landscape (National Heritage List)
- Tooram Stones, Hopkins River, Warrnambool
- Saltwater River weir site, near Footscray
- Whroo Rock Well, Whroo
- Buckley’s Well, near Noble Rocks at Breamlea

**1.2 Sourcing water for early settlement**

The first official attempt at settlement was in 1803-04, when David Collins and some convicts from Van Diemen’s Land established a camp at Sullivan’s Bay, near present-day Sorrento. This site was soon abandoned due to a lack of fresh water. Wooden casks had been sunk in the sand, but these brought up brackish water that was only marginally drinkable.\textsuperscript{16}

Pastoralists in Van Diemen’s Land, hungry for new grazing lands in the 1830s, eyed the rich country across Bass Strait and made plans to settle illegally. The Hentys made their home at Portland Bay in 1834, and the rival parties of John Batman and John Pascoe Fawkner settled on the Yarra River - the present site of Melbourne - in 1835. The success of the Yarra settlement lay partly in its reliable supply of fresh water. The river was critical both for domestic needs and as a means of transport, as John Batman noted in 1835: “the large river … comes from the east, and I am glad to state about six miles up found the river all good water and very deep. This will be the place for a village.”\textsuperscript{17} The settlement’s main water collection point was above ‘The Falls’ (near present-day Queenbridge), where a ledge of rocks marked the point of change from salt water to fresh water. The Wurundjeri had long used this same spot to


\textsuperscript{15} *Age*, 1 May 2004 (this is known as Yorta Yorta Co-operative Management Agreement). Another recent land use agreement is in Glenelg (David Rhodes, archaeologist, Heritage Insight, pers. com., 15 August 2007).

\textsuperscript{16} Janet South, Archivist, Nepean Historical Society, pers. com., 20 August 2007.

trap fish and also as a crossing point. It took only a few years for the once pristine Yarra River to be polluted with the filth of human settlement. Regardless, water continued to be collected from the river by water carriers, and later by a pump system, well into the early 1850s.

![Image: Xmas 1841. How we got our water in the Pre Yan-Yeanite Era picture', sketched by Robert Russell, 1841]

The first water supply at Geelong came from a dam on the Barwon River. An improved ‘Breakwater’ was completed in 1840, but this faced various problems. At Portland, wells had been sunk close to the township by 1840 and a reliable spring (later known as ‘The Pumps’) was discovered in 1843.

The steady stream of settlers, who arrived from Tasmania and, later, trekked overland from New South Wales, took up grazing land under a pastoral license system. They keenly sought runs that were close to fresh water - on a river or creek, a freshwater lake, or near a spring or waterhole. In selecting a site, water courses were often used to mark the boundary of a run. A c.1850 map of the State of Victoria prepared by Robert Hoddle (see Figure 5) shows pastoral runs in the south-west of Victoria clustered around water features such as Lake Colac.

Knowledge of water supplies was conveyed by word of mouth or in the few rough maps of the new settlement. They also relied on the knowledge of Aboriginal guides to direct them to water. In their overland treks, they carried waterbags, which were shaped like a small Gladstone bag ‘with a screw-topped china pourer in one end’, and which cooled by evaporation. The search for a reliable source of fresh water was a fundamental motive in the choice of settlement site, and typically became a key theme in the stories that squatting families

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19 Two wells are indicated on the 1840 survey of the Township of Portland, located near the beach; see Thomas Townsend, ‘Plan of Portland’, February 1840 (held SLV). See also Noel F. Learmonth, *The Portland Bay Settlement* (Baulch Publications, Hawkesdale, 1983; first published 1934), pp. 258-59.

20 There are numerous accounts of exploration where Aboriginal guides are mentioned. See, for example, P.L. Brown (ed.). *Memoirs Recorded at Geelong, Victoria Australia by Captain Foster Fyans (1790–1870)* (Geelong Advertiser, Geelong, 1986).

told and retold about the foundations of settlement. In many cases, too, the Aboriginal guides who featured in these settlement narratives were cast as responsible for directing the white settlers to water.

Initially, new settlers employed rudimentary and primitive means of collecting, storing and distributing water. They carted water manually from nearby creeks and rivers, using buckets and a wooden yoke, but struck trouble when the supply was seasonal, when the creeks and streams dried up in summer. If groundwater was sufficient it could be drawn up from a well sunk close to the house. For domestic purposes, settlers also collected rainwater in a container of some kind, either in an above-ground tank made of timber, stone, brick or iron, or in a below-ground tank, typically built of stone or brick, and sometimes lined in cement (see Figure 5).

22 See, for example, the story of the arrival of the Thomsons at Keliambete, in Western District Centenary Souvenir (Terang, 1934); the Manifolds at Purrumbete.

23 The pastoral run files held in the Public Record Office Victoria often show the located of early wells located near the homestead or outbuilding. See Pastoral Run Files, 1840–79, VPRS 5920.
But collecting water in this way was inadequate for the needs of stock, which needed a regular supply, with extra for sheep-washing. In the 1840s, as yet without any legal claim to the land they occupied, squatters were reluctant to outlay much on improvements. After an Order-in-Council of 1849, however, they won the right to a pre-emptive claim on the homestead block. As a result, they were more likely to sink wells, and build dams and water tanks in order to augment their water supply (the collection and use of water for agricultural purposes is discussed further in the following section).

The supply of water in Victoria varied considerably. Along the coastline, in much of the central area, in the mountainous north-east and in Gippsland, there were reliable streams and rivers, and some freshwater lakes. As squatters pushed further north, however, the country was drier and more prone to drought, and watercourses were few and far between. Here, settlers relied on wells, bores and tanks, as these place names on an early map of the Wimmera testify: ‘Broken Bucket Tank’, ‘Wagon Flat Tank’, ‘Lost Swamp’, and ‘Well and Whim’.

Wells were less than ideal as a water source. They were unreliable and their water was often undrinkable. When placed too close to living quarters, wells were often contaminated by domestic refuse which seeped through the soil, and this led to disease. Their great depth also made them a cause of death, especially for small children who were likely to fall in and drown. Nonetheless they were used in some instances – one example at Colbinabbin is thought to have been sunk in the 1850s or 1860s. The Shire of Waranga acquired the well in 1893 and local people purchased water from it thereafter. It remained in use for almost 100 years before being abandoned after finally collapsing in the 1950s.

**Heritage - Theme 1.2: Sourcing water for early settlement**

- Site of ‘The Falls’ (near Queensbridge), Melbourne
- Well site, Portland and Colbinabbin Community Well, Toedtberg Road and Two Chain Road, Colbinabbin (VHR H1937)
- Site of Breakwater, on Barwon River at Geelong

**1.3 Water use and early agricultural development**

By the 1850s, agricultural areas had been established in the more fertile districts. A variety of cereal crops, fruits and vegetables were grown, as well as hops and tobacco. Orchards and vineyards were also established - for example, in Geelong, the Yarra Valley, the north-east, and along the Murray River. Here, settlers occupied much smaller holdings, often with little or no access to surface water. As a result, they needed to sink more wells and bores, and to build rainwater tanks. The government made provision for hundreds of Crown land reserves for the collection of water in the 1850s and 1860s. As agricultural settlement developed, settlers also devised early methods of drawing on water for irrigation and to power mills.

The availability of water shaped the patterns of small-scale farming settlements just as it had the boundaries of the larger squatting runs. Around Lake Wangoom, near Warrnambool, for example, every land holder was given access to this circular water source by a subdivision plan that resembled slices of pie. In acquiring this waterfront land, they had simultaneously acquired an enviable riparian right.

24 Blake, *Wimmera* (Cypress Books, Melbourne 1973), these place names appear on map titled ‘Wimmera Region’ on the inside front cover.

25 A full list of all Crown land reserves gazetted up until 1881 for water supply purposes was published in the *Victorian Parliamentary Papers* in 1881.
In the 1860s, the land selection acts promised a more democratic occupation of land. Settlers took up land with enthusiasm, inspired by the yeoman ideal. However, squatters used a system known as ‘dummying’ to maximize their holdings and employed ‘peacock’ tactics to ensure that they retained the blocks with the best water access. This created a monopoly on water supply in many places. While selection was thwarted in this regard in the richer pastoral country, selection was successful in opening up large tracts of land in northern Victoria. While selectors clung to the misguided adage that ‘rain follows the plough’, in reality, water was scarce, especially in the north-west, and many struggled to survive.Selectors also faced the loss of commons, which had been set aside in the early 1860s to provide collective sites for water supply and grazing. The government began revoking these by the 1870s, which was bad news for selectors with no waterhole on their block. Facing serious problems with water scarcity, and recurrent drought years in the 1870s, settlers lobbied the government to improve the water supply.

As an aid to selection in drier areas, water reserves were sometimes established. One example at Mt Cottrell near Melton in the Parish of Pywheitjorjor, of 21 acres 1 rood and 20 perches was gazetted in 1872, at the same time that the land was opened for Selection. It was situated in an area where most of the land with river frontage had been taken up by large pastoral interests.

After several seasons on the land, the squatters also learnt that the winter rainfall may not bring sufficient water to see them through the drier periods. Even where a station was sited on a river or creek, this water source was perhaps unreliable, and water storage was needed. Some squatters devised innovative water supply schemes. Samuel Wilson, for example, of Longerenong station in the Wimmera, installed an elaborate system of pumps and pipes that drew water from the Yarriambiac Creek. Many settlers constructed dams or ‘tanks’ (the latter term refers to dam sunk in paddocks or across ‘dry’ gullies rather than on watercourses). At Jellalabad sheep station, near Darlington in the Western District, a large, elaborate bluestone dam was built, probably completed in the 1860s (Figure 7 shows a similar example at Dundonnell). The owner of Green Hills station, which lacked an abundant natural water source, built a large bluestone water tank that collected run-off from the roof of the stables. Building a water tank was no mean feat, as these instructions in 1859 for a circular tank ‘ten feet deep and ten feet in diameter’ made clear: ‘If bricked up, one brick thick, in cement, it would require about 3600 bricks. There would be about one thousand and thirty feet of digging. You should get it taken out at so much per yard’.

At Eynesbury Station in Melton South there survives today an earth moving scoop, which has a maker’s plate marked ‘Gaston Bros Pty Ltd, Maker, Kensington Vic. No. 146’. This was probably used to construct dams and water storages on the property.

At Rockbank, one of the large stations owned by W.J.T. Clark west of Melbourne, the very shallow basalt bedrock made it difficult to excavate dams so the solution was to construct earthen dams across depressions and gullies, probably built with the shallow topsoil (likely

26 See, for example, Argus, 7 September 1863, p. 5.
27 Moloney, David, Rowe, David & Jellie, Pamela, shire of Melton Heritage Study Stage 2, May 2007, Place ID no. 292
29 Kevin Moroney, Koorin, pers. com., 8 July 2007.
30 The substantial bluestone water tank at Greenhills was probably designed by Smith; see Helen Doyle and Context Pty Ltd, citation in ‘Moyne Shire Heritage Study, Stage 2’ (2006), vol. 2.
scooped-up with the aid of horses or bullocks), which were then faced with a dry stone wall. At least four of these dams survive today.\(^{32}\)

By the end of the nineteenth century, after several dry seasons, farmers in Victoria had begun to sink bores. The first successful bore had been sunk in Australia in 1872.\(^{33}\) Victoria was largely outside of Australia's Great Artesian Basin, but there was nevertheless adequate available groundwater across much of the state. Theories abounded, including the claim of a vast underground sea beneath the Wimmera.\(^{34}\) In the late 1880s, one innovative settler, James Alston, developed a new improved windmill design with curved sails.\(^{35}\) As a result, the number of windmills attached to bores increased dramatically in the 1890s and 1900s, especially in the Western District. On the rich agricultural lands near Warrnambool in south-west Victoria, one observer likened the scene to the cultivated Dutch countryside where 'the windmills are as numerous'.\(^{36}\)

Water was also vital from an early date in the development of Victoria's wool industry. The practice of washing wool on the sheep's back prior to shearing was brought to Australia from England by early pastoralists and this practice is reflected in the watercourses in Victoria that bear the name Sheepwash Creek or similar. Natural features such as these were on occasion modified to create sheepwashes using local stone. One example at Bessiebelle was constructed c.1850 by pastoralist Samuel Gorrie on his Ardonachie Run, then carrying 6,000 sheep. The two sheep washes both utilise the natural terrain and are complemented by the construction of massive drystone wall races, and a network of pre and post washing yards. The large and sophisticated network of races and yards are skillfully constructed of field stone.\(^{37}\)

**Heritage - Theme 1.3: Water use and early agricultural development**

- Longerenong Homestead, Burnt Clay Road, Murtoa (VHR H2990)
- Bluestone water tank (c.1870s) at ‘Green Hills’, Greenhills Road, Minhamite and Stone lined dam (c.1870s) at ‘Dundonnell’, Dundonnell Road, Dundonnell\(^{38}\)
- Water Reserve, 2182-2356 Boundary Rd, Mt Cottrell (east bank of Werribee River)
- Dams associated with W.J.T. Clarke’s Rockbank property at Melton\(^{39}\)
- Earth tipping scoop at Eynesbury – associated object included as part of VHR H0362.
- Bessiebelle Sheepwashes and Yard, Pyes Road, Bessiebelle (VHR H2033)

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\(^{32}\) Moloney, David, Rowe, David & Jellie, Pamela, *shire of Melton Heritage Study Stage 2, May 2007*, Place ID no. 151

\(^{33}\) Eric Rolls, *A Million Wild Acres* (1984), p. 189. A bore had been dug in New South Wales in the early 1800s, but this was abandoned at around 23 feet.

\(^{34}\) *Victorian Municipal Directory for 1885* (1885).

\(^{35}\) ‘Technology in Australia’ website.

\(^{36}\) James Smith (ed.), *Cyclopedia of Victoria*, vol. 2 (1903), p. 428.

\(^{37}\) Heritage Victoria, VHR H2033, File No. HER/2000/000197

\(^{38}\) Both identified by Doyle, H & Context Pty Ltd, *Moyne Heritage Study* (2005)

\(^{39}\) For details, see the Melton Heritage Study Stage 2 (Place IDs 151, 110, 077, 082)
Circular bluestone water tank at Tolindert Station, Camperdown (J.T. Collins Collection)

Figure 6

[SLV H93.400/243]

Square stone-lined dam, Dundonnell (c. 1870)

Figure 7

[SLV H95.200/426]

Water Carrier, 1909

Figure 8

[SLV H93.456/40]
1.4 Water and transport

Early exploration, stock and trade routes

The availability of water was a significant factor in shaping the early stock routes and coach routes across Victoria. Whereas Aboriginal people had an intimate knowledge of the various water reserves within their own country, the new European arrivals relied mainly on surface water supplies that were, ideally, named and marked on a map. Explorers and overlanders carried water bags with them, but these were little use to horses. They often took Aboriginal guides with them, who led them to water and food supplies.

Finding and following the main water courses was an imperative of early exploration. On an exploratory trip in 1803, Grimes and Collins had followed the Yarra from its mouth up to the spot later known as Dights Falls. They proclaimed this ‘Freshwater River’ to be ‘the most eligible place for a settlement’. It was Major Mitchell’s brief of 1834 to follow the course of the Murray River that led him into western Victoria. John Batman and his party made various sorties across country in 1835 to ascertain the courses of various rivers and streams (which he duly named after himself and his family).

As stock arrived in the 1840s, both overland from New South Wales and on ships arriving in Melbourne and Geelong, well used tracks emerged. These invariably passed by reliable water sources, such as river crossings, springs and waterholes. By the 1850s, as these rough tracks developed into coach roads, wayside hotels were set up at intervals, where a well could provide water for the horses. A network of wells was established for the use of Cobb & Co. and examples survive at Kooyoora and Mooree. Later stock routes were served with public tanks.

The rivers themselves were also a means of transport and important trade routes, in particular the Murray. Before the arrival of the railway in the late 1870s, the Goulburn River was also used as a means of trade and travel.

Railways

A chief reason for constructing the first railway in Australia in 1854, which linked Melbourne and Sandridge (Port Melbourne), was to efficiently transport fresh water to the port for the use of ships. Water was needed to power the steam boilers and also to replenish the ships’ general supplies. Local lore claims that ships commonly delayed being replenished with water until their arrival at Port Melbourne, where they could get ‘the best water in the world’. Miles Lewis has also noted the importance of ships’ tanks, which were large square iron tanks used to store fresh water while at sea. These later adapted as water tanks on the land.

The location of water sources was an influence upon the route of railways. For example, when new railway lines were planned later in the nineteenth century across the dry north-west of the state, the position of the line was determined in part by the best positions for bores, which were sunk along the length of the line. In the days of steam power, locomotives needed to replenish their water supply at regular intervals and as a result many railways stations were installed with tanks, bores and pumps and reservoirs (for example at Traralgon). Where possible the railway reservoirs, and hence the stations themselves, were at a high altitude, for example at Macedon and Bullarto. Elevated tanks were necessary when the country was too flat for a gravity-fed system, for example at Murtoa, St Arnaud, and Echuca. These tanks often became part of the

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41 James Bonwick, John Batman (1867), pp. 23, 24.

42 Peter Mills, pers. comm.

township water supply. For example, the water tower at Murtoa was purchased from the Railways Department by the Murtoa Water Trust in 1910 and was sued until the 1960s (Land Conservation Council, 1997:54). At Echuca the Victorian Railways built a pumping station that served both the railway and town water supply and also worked the hydraulic presses on the wharf. In the early years of the railways, the station’s water supply was often a town’s only supply. The railway was itself a means of water supply during periods of drought, when ‘water trains’ were dispatched to relieve troubled areas of the state.  

The provision of water at railway stations also probably encouraged the railway gardens movement of the late nineteenth century. Drinking fountains were another early regular feature at railway stations made possible with a water tank. In 1875, the Minister of Railways ordered 23 drinking pillars for all the ‘watering stations’ on Victorian railways.  

Once steam rail was phased out in the 1960s, there was no longer a critical need for water tanks at stations.

Heritage - Theme 1.4: Water and transport

- Early settlements established around key crossing points at water ways
- Water tanks are found at a number of railway stations throughout Victoria. Examples include Mordialloc (HO92, Kingston Planning Scheme), Murtoa (HO41, Yarriambiack Planning Scheme), Quarry Hills (HO617, Greater Bendigo Planning Scheme), St Arnaud (VHR H1594), Sunbury (VHR H1673), and Warrnambool (HO127, Warrnambool Planning Scheme).
- Pumping Station, 2 Murray Esplanade, Echuca (VHR H1053)
- Railway water tank, reservoir and channel system, Korong Vale (HO156 and HO157, Loddon Planning Scheme).

44 See, for example, water trains were sent to Donald in 1882; from Geoffrey Serle, The Rush to Be Rich (1971), p. 54. A photo of a water train appears in Rhona Van Veldhuisen, Pipe Dreams (Wimmera Mallee Water, Horsham, 2001), p. 116.
45 Argus, 13 October 1875, p. 5; 27 November 1875, p. 7.
Map of the Yan Yean water supply system, c.1908

[Melbourne Water]
2. DEVELOPING WATER SUPPLIES FOR SETTLEMENTS AND STOCK

This theme examines the delivery of fresh water for settlement and stock supply in Victoria from the 1850s onwards. It traces the early beginnings of rudimentary water supplies in Melbourne and other early settlements, and examines the important role played by the gold rush in the development of water supplies in rural towns, which assisted in the transition in the 1860s to the operation of large and complex waterworks. This theme looks at the different types of water sources used by towns and cities, and the ways in which these supplies were managed and adapted over time. This theme is important because it recognises the changing physical structure of water supply systems, and the changing needs of local populations in regard to fresh water.

This chapter also examines the Wimmera-Mallee water supply, which is thought to be the only water supply system in Australia constructed primarily for stock and domestic supply, rather than solely for irrigation of crops or town water supply.

The need to establish and develop water supplies inevitably led to the need for companies and authorities to construct and administer water supply systems. The story of administering the water supply is told in Chapter 5.

This chapter incorporates the following Australian Historic Themes:

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2.1 Establishing and developing Melbourne’s water supply

Melbourne’s early water supply

The original Melbourne water supply was rudimentary and unreliable and of a poor quality. As we have seen in the previous chapter, Melbourne’s early water supply constituted a system of tanks and water carts filled with water from the Yarra River above the place known as ‘The Falls’ (near present-day Queensbridge). Here there was a long row of wooden platforms, each carrying pumps. In 1850, a small steam engine was installed, which pumped water into a tank in Flinders Street. For this purpose, there was a water race in Flinders Street and water tanks in Queen Street. Early residents also sunk wells, and employed tanks and barrels to collect rainwater. Most settlers built their homes close to the Yarra, or to the other major streams, the Merri Creek, the Saltwater (or Maribyrnong) River, and Gardiners Creek.

When Melbourne was declared a Corporation in 1842, it was vested with responsibility to provide essential services for its citizens, including the provision of fresh water and a means of sewerage. In 1854, with the Yarra increasingly polluted, the disposal of industrial wastes into the river was banned. In the same year, a large holding and distribution tank with a capacity

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49 Argus, 9 December 1854; 8 January 1851. There were also water tanks in Queen Street.
52 Argus, 5 September 1854.
of 150,000 gallons was built at Eastern Hill, which was filled with unpolluted water from the Yarra above Dights Falls.

The evident inadequacies with the system were exacerbated with the events of Black Thursday bushfires in 1851 and the great influx of population in the early 1850s. Against this backdrop, the Melbourne Town Council called for a scheme to provide an adequate water supply. Early schemes had been proposed in the 1840s - such as that of Patrick Reid, a settler on the Plenty, with a plan to dam the Plenty River - but nothing eventuated. James Blackburn, a convict-turned-engineer, devised a new scheme for the Melbourne City Council, which proposed diverting water from the Plenty River and its tributaries into a reservoir at Yan Yean. Relying on a gravitational flow, the water would be directed through the Plenty Valley to Melbourne, via an open aqueduct, and stored in a reservoir on the outskirts of the city. Blackburn’s scheme was later revised by Charles Oldham, with one of the most significant changes being the replacement of the aqueduct with pipes.

**Establishing Melbourne’s water supply – the Yan Yean scheme**

Construction of the Yan Yean reservoir commenced in 1853 under the Victorian government’s newly formed Commission for Sewerage and Water Supply. The British engineer Matthew Bullock Jackson was appointed Chief Engineer, with Blackburn acting as a consultant. Completed in 1857, the Yan Yean water supply system was hailed as the greatest public work constructed in the Colony, and the reservoir as one of the largest in the world. It was sited at 600 feet above sea level with an earthen bank 30 feet high and a clay puddle core. A single pipe fed the water to Melbourne.

Problems soon emerged, however, due to faulty pipes, polluted water, and lack of pressure. A number of reports were commissioned through the 1860s and 1870s to try to solve the problems with the system. One remedy was a holding or service reservoir at Preston that became known as Preston No. 1, which was completed in 1864 and helped to relieve pressure on the mains and the problems caused by water stagnation. With a capacity of 16 million gallons, it was sufficient to supply Melbourne for three days at that time. Water from Yan Yean

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54 See Dingle and Doyle, *Yan Yean: Melbourne’s early water supply* (2003), see chapters 1-3.
was also stored in the tank at Eastern Hill, which remained in use until 1892 when it was dismantled and relocated to the Werribee Sewerage Farm.\(^5^5\)

Before the Yan Yean reservoir was completed, some municipalities in Melbourne secured water supplies locally. In East St Kilda and Malvern, residents relied on a spring;\(^5^6\) while in neighbouring Prahran, the council had initiated the construction of a water works, which involved piping water from 'Forrest-hill' after it had been collected from the Dandenongs.\(^5^7\) The water from Yan Yean was only available to a limited area of residences, principally those in the low-lying inner suburbs. This problem was rectified in the 1890s when a high-level pipe was built over the Yarra at Fairfield/Kew, which took water to the elevated eastern suburbs.

After several years of low rainfall in the late 1870s, the growing population of Melbourne was placing enormous pressure on the city's water supply. In 1875 to improve the supply of water to Melbourne, the cast iron main between Yan Yean and Morang was removed and replaced with an aqueduct. The removed pipes were then re-laid adjacent to the existing main between Morang and Preston Reservoir, but this soon proved insufficient. The water supply was augmented and improved in the 1880s with the expansion of the catchment area into the Plenty Ranges. This new improved system, constructed under the supervision of William Thwaites, redirected two pristine north-flowing mountain streams, the Wallaby and the Silver Creeks, along granite-lined channels that wound gracefully around the contours of the mountains, through a weir at Wallaby Creek, and to a holding reservoir at Toorourrong. The highlight was the remarkable structure known as 'The Cascades', a stairway cut from the local granite, and sited amidst a dense grove of giant tree ferns. From Toorourrong, where the water had settled sufficiently to stabilise the clayey water and lose any suspended particles, it flowed

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\(^{5^7}\) John Butler Cooper, *The History of Prahran* (1912), p. 95; see also H. Miller (chairman), *Report from The Select Committee of the Legislative Council on the South Yarra Water Works Company's Incorporation Bill; Together with the Proceedings of the Committee and Minutes of Evidence* (The Herald Job Printing Office, Melbourne, 1855).
down the aptly named ‘Clear Water Channel’ to Yan Yean. These extensions in effect completed the Yan Yean system.

As the Yan Yean water supply system was expanded to meet Melbourne’s growing demand for water, so too was its distribution network. Preston was Melbourne’s only service reservoir until 1881, when a small circular reservoir was built at Essendon. Before the end of the nineteenth century a second service reservoir was built at Essendon, plus three others in Caulfield, Surrey Hills, and Kew. Two further reservoirs were added at Preston in 1909 (Preston No.2) and 1913 (Preston No.3). These service reservoirs were originally connected by a series of cast or wrought iron pipes, some of which remained in use for over 100 years.

Extending and developing Melbourne’s water supply

With the Yan Yean catchment fully exploited, other sources were investigated. In 1872, the Water Supply Board recommended that future supplies be brought from the Watts River in the Yarra Watershed. Work finally commenced in the 1880s on the construction of a weir across the Watts River and 41 miles of aqueduct, tunnels and syphons to connect with the Preston Reservoir – this later became part of the Maroondah scheme. Work began on the O’Shannassy Scheme in 1910, which supplied water to a storage reservoir at Surrey Hills, which served the fast growing eastern suburbs of Melbourne – as noted in Chapter 5, this was the first water supply project to be undertaken by the Melbourne and Metropolitan Board of Works. In the 1920s, a large dam was constructed at Maroondah, followed by another at Silvan.

In the postwar period, Melbourne’s water supply struggled to keep up with rapid population growth. The number of private swimming pools and industrial plants also increased during this period, which contributed to higher levels of water consumption. A new reservoir had been planned at Upper Yarra in the 1940s, but works were delayed by the war. The new dam was finally completed in 1957, the centenary year of the completion of the Yan Yean water supply system.

In some outlying parts of Melbourne, significantly in the towns near Yan Yean, such as Whittlesea, piped water was not available until relatively late. Elsewhere, pumps continued to be used for domestic purposes. There was a public pump connected to river water that was still in use at Warrandyte until the early 1970s.\(^{58}\)

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Heritage - Theme 2.1: Establishing and developing Melbourne’s water supply

- The early Yan Yean Water Supply System, comprising Yan Yean Reservoir, Valve houses and other elements of the original scheme constructed 1853-57 and the Preston Reservoir No. 1 constructed in 1864. Additions to the system to increase or improve supply include the Wallaby and Silver Creek systems, Toorourrong Reservoir, Clearwater Channel, Reservoir Nos. 2 and 3 at Preston, the Junction Basin in Cheddar Road where the Maroondah system meets the Yan Yean system, and surviving sections of additional cast and wrought iron mains in the pipe reserve between Preston Reservoir and Melbourne.

- Service reservoirs at Surrey Hills (HO34, Whitehorse Planning Scheme), Mitcham (HO119, Whitehorse Planning Scheme), Kew and Caulfield

- Eastern Hill Water Tank, now situated at the Western Treatment Plant, Cocoroc Road, Werribee (VHR H1416)

- ‘The Springs’, Spring Street, Malvern

- Systems added after Yan Yean to increase Melbourne’s supply including Maroondah system (1880s-1927, including the dam and aqueduct), O’Shannassy system (1910-4), Silvan system (1932) and Upper Yarra system (1957).

2.2 Establishing water supplies on the goldfields

Outside of Melbourne, most of the earliest township water supply schemes were established in goldfields towns, where the water needs of the mining industry provided the impetus for the development of engineered schemes. Until financial assistance was provided by the State Government these towns were also the only ones with the financial means to consider such undertakings.

Early gold-mining water supply schemes

The gold rush of the 1850s attracted large numbers of immigrants to inland Victoria, where there were no organised services, such as a fresh water supply, drainage or sewerage. Miners initially made do with primitive water-gathering methods, but later constructed more sophisticated systems (See Section 4.2 for more details of how water was used in a range of gold-mining activities). Historian Susan Priestley writes:

> The provision of water to inland towns was closely linked to the demands of gold-mining. For the first seven years after 1851, miners dug water-races leading from natural streams according to individual whim. They even tunnelled into mountains to tap the source of springs. The system was wasteful and inefficient since there was no attempt to collect stormwater or winter rains. In dry seasons only those races closest to the source got a flow of water. At Beechworth, the tangle of intersecting races spread the supply so widely that the flow impetus was reduced to a mere trickle. 59

As will be discussed in Chapter 4, miners needed copious amounts of water to work the field. Large tracts of Crown land that were turned over to ‘diggings’ were sunk with wells, dug with tunnels, and criss-crossed with water races, but access to fresh water on the goldfields was fiercely guarded and protected. At the same time, there was inadequate monitoring and policing of water use and much misappropriation went on. The alleged ‘mis-use’ of water by the Chinese rankled the non-Chinese miners and sparked racist attacks. 60

Accordingly, one of the first tasks of the Goldfields Commissioners was to protect crucial water supply holes, both for the miners and for public use. At Bendigo early Government Camps

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were located near water holes at Sheepwash and Bullock Creeks outside the Bendigo Creek catchment during the dry first summer of the Bendigo rush. Later, mining by-laws were established to protect waterholes for domestic use.

As the gold fields were worked out the infrastructure left behind, particularly dams or reservoirs were sometimes acquired by local authorities for use as municipal water supplies. At the Amherst and Talbot goldfields, the largest water race system was constructed by Messrs Stewart and Farnsworth. These men had by 1871 invested over £9,000 in the construction of several reservoirs, and hundreds of miles of water races. By the end of the 1870s most of the available shallow alluvial ground within the reach of Messrs Stewart and Farnsworth water supply system had been sluiced. The reservoir was purchased by the Borough of Amherst in July 1875 and tenders were called in 1876-8 to raise the reservoir walls and for pipes to reticulate Talbot.61

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61 Department of Natural Resources and Environment, *Victorian Goldfields Project: Historic Gold Mining Sites in Amherst Mining Division*, Maryborough Mining District, (1998), pp. 5-6
Many miners turned to farming once the alluvial gold had petered out. They benefited by the government’s introduction of the ‘miner’s right’ in 1855; this gave miners the right to store water in a dam for their own needs and, as a result, a multitude of small private dams were constructed.  

**Development of engineered schemes – The Waterworks Act 1865**

The establishment of permanent centres of population on the goldfields necessitated a more adequate means of water supply. By the 1860s, growing populations could no longer be sustained on meagre stream flows and household wells. The greater spread of population and the impacts of mining activities had also made water cartage and polluted surface water more of a problem. The drought of 1864-65 exacerbated the difficulties of inadequate water supplies, but the passage of the *Waterworks Act 1865* provided the sum of £50,000 to be distributed as government loans for the construction of local waterworks. As a result, many new schemes were constructed, including Creswick (1865), Daylesford (1867), and Clunes (1870).  

The most extensive and ambitious water supply constructed in the gold-mining district was the Coliban system, constructed by the Bendigo Waterworks Company to a design by Irish engineer Joseph Brady who had worked on the Yan Yean project and had also designed the earlier domestic water supply for Bendigo. Commenced in 1864, this was at the time the largest water supply system outside Melbourne. It comprised a large reservoir at Malmsbury, completed in 1870, as well as various storage reservoirs and miles of channels. Using a gravity-fed system of pipes, it supplied water to the towns of Bendigo, Castlemaine, Harcourt and Chewton.  

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62 These numerous private dams, or ‘reservoirs’ are listed in the *Victorian Parliamentary Papers*; see for example, ‘Victorian Water Supply: Third Annual General Report by the Secretary for Water Supply’, 1889.


In the 1870s, reticulation was extended to other mining towns, including Castlemaine, Maryborough, Stawell, Talbot, and Beechworth.\footnote{Victorian Municipal Directory 1885.} Stawell and Talbot, in the prevailing mood of civic pride in the 1880s, boasted of the superiority and 'excellent supply' of their water systems.\footnote{Victorian Municipal Directory 1885, pp. 101, 103.} The Stawell system included several notable feats of engineering including a one kilometre long tunnel and long section of iron fluming on drystone supports that carried the water to the town.

**Heritage - Theme 2.2: Establishing water supplies on the goldfields**

- Coliban water supply system (VHR H1021), includes Malsmbury Reservoir
- Various sites in the Amherst Mining Division of the Maryborough Mining District such as Stewart and Farnsworths Reservoir and Race (Talbot Reservoir), Amherst Reservoir, and water standpipes – e.g. at Talbot
- Gong Gong water supply system, Ballarat
- Langi Ghiran Reservoir and other components of the Ararat water supply system
- Stawell water supply system

**2.3 Developing water supplies in rural areas**

**Early township water supply systems**

Growing populations placed increased pressure on existing town water supplies. A rudimentary water supply was standard for many towns, including a reliance on private wells and carting or pumping water from a local stream or lake. Many people installed their own tank for rainwater collection. Often the water supply constituted a 'shire dam', for example at Ararat, or a 'shire well' as at Numurkah.\footnote{Argus, 2 June 1860, p. 6; Myrtle L. Ford, *Flour Mills and Millers of the Goulburn Valley* (1983), p. 35 (the Numurkah shire well was in use from 1883).} Outside the goldfields, few towns had the financial capability to construct complex waterworks schemes prior to the 1860s and 1870s; Bendigo (1859), Geelong (1862) and Hamilton (1872; not reticulated until 1880) were exceptions.

A reticulated water supply was established at Bendigo in 1859 by a private company, the Bendigo Water Works Company, which supplied water for domestic purposes to the population of Bendigo. This scheme pre-dated the more extensive Coliban Scheme described...
in the previous section.\textsuperscript{69} At Geelong a reticulated system had been proposed as early as 1849, but disputes about the location and form of the scheme held up action until after 1860.\textsuperscript{70} A Select Committee of the Legislative Assembly recommended the use of the Barwon, and further inquiries led to a report by Capt. Pasley and M.B. Jackson that recommended that the area to the north of Geelong be considered. A site for a dam was selected on the Stony Creek 42 kilometres north of Geelong in the Brisbane Ranges. Planning for the project commenced then the Water Commission was abolished and the work was turned over to the Water Supply Department. Due to inadequacies in its design this dam failed, and it was not until 1874 that water was supplied to Geelong from the Lower Stony Creek dam.

As settlement progressed, and local populations grew, serious concerns also developed about the unsanitary conditions in many townships. The lack of a reliable source of fresh water, the problem of inadequate drainage, and the presence of excess groundwater were known causes of fatal infectious diseases.\textsuperscript{71} At Tower Hill, near Koroit in south-western Victoria, a serious outbreak of typhoid fever in 1888 struck fear into the local community and urged action on the provision of fresh water. The Koroit Water Works Trust was established in 1889 in response to this public health scare.\textsuperscript{72}

As noted in the previous Chapter, the passage of the Waterworks A\textsuperscript{ct in 1865 enabled the provision of government loans for the construction of local waterworks, but it was not until the 1880s that a large number of towns, including Horsham, Murtoa, Benalla, Wangaratta, Kyneton, and Sale, set up water trusts to finance the construction of a water supply and a reticulation system.\textsuperscript{73} In many cases, the needs of the steam railways hastened this development. In south-west Victoria, a reticulated water supply was built at Warrnambool in 1893 and at Mortlake in 1915.\textsuperscript{74}

Upstream rivers provided the best water supplies. At Horsham, for example, water was pumped from the Wimmera River, while the town of Warragul developed a scheme between 1910-9 that pumped water from the Tarago River to a holding reservoir that was then reticulated to the town and neighbouring centres. In other parts of Victoria, other sources, such as artesian supplies, were drawn on. In Gippsland, the town of Sale was supplied with two artesian wells in the 1880s - one private, the other public, ‘the two large in Macalister Street always filled’, while at Palmerston in the 1880s authorities were boring at 194 feet for a government-funded artesian well.\textsuperscript{75} Where the land was flat, for example in Swan Hill, town water was stored in an 85 feet tower.\textsuperscript{76} In some places, lakes and springs served as water supplies.\textsuperscript{77} At Penshurst, the

\begin{footnotes}
\item[69] The development of local water supply systems is well covered in the\textit{Argus}; For Ararat, see R.A. Blachford, \textit{The Centenary of Water Supply in Ararat} (1976), p. 12.
\end{footnotes}
water supply came from a ‘never failing spring’, which in 1885 ‘was enclosed with a wall in the regular Eastern style’, while at Winchelsea, from 1914, the local council pumped water from the Barwon River into a storage reservoir.

As towns grew larger and needs grew accordingly, water storages were enlarged and the schemes grew in the sophistication of the design and technology employed. At Bairnsdale, a pumping station was constructed in 1888, which supplied water to an in-ground brick reservoir with a capacity of 100,000 gallons. An upgrade to the station in 1906 included installation of a new larger cylindrical concrete tank with a capacity of 350,000 gallons, designed by (Sir) John Monash’s Reinforced Concrete and Monier Pipe Construction Company.

The provision of a water supply for townsfolk was life-changing. It meant easier access to water, and in most cases, cheaper water. At Murtoa in the 1880s, there was excitement at the prospect of household ‘baths’ as local tradesmen clambered to provide suitable plumbing for these as yet unknown facilities. The new water supplies prompted the availability of new household fittings, and some of the more substantial new homes were fitted with proper ‘indoor’ bathrooms. As in Melbourne, the arrival of a reliable water supply meant comfortable bathrooms for wealthy country residents.

While the growth of towns was celebrated as a result of technology, in some cases towns were sacrificed for the sake of a larger catchment. In the 1920s, for example, the small settlement of Darlingford was inundated by the Eildon Dam, and the town of Glenmaggie in Gippsland was flooded by the Glenmaggie Weir. Other towns were partially demolished and then inundated in the process of dam-building, including Fellmongers, near Ballarat (c.1870); Fernshaw, near Healesville (1880s); and Tallangatta, near Jindabyne (c.1950). Various buildings from these towns were relocated prior to the floodings, but in years of drought the remains of these structures have eerily resurfaced.

State Rivers and Water Supply Commission schemes

The process of connecting all households in rural townships to a reliable water supply was slow and onerous. Assistance to rural towns with more limited means came with the formation in 1906 of the State Rivers and Water Supply Commission (SRWSC) as noted in Chapter 5. By the mid 1930s, the SRWSC provided water to 98 country towns and supervised the local trusts responsible for 138 cities and towns outside the Melbourne metropolitan area. Despite this, some towns remained without a centralised water supply until the early twentieth century. In the 1940s and later, there were many small towns still without a public reticulated system, such as Heywood with a population of 950.

One example of a SRWSC scheme is the Wurdee Boluc system, which supplies water to Geelong and the Bellarine Peninsula. The SRWSC began investigating schemes in the mid 1920s and work began by the late 1920s. The Reservoir and associated channels and syphons were completed by 1928. In subsequent years the reservoir has been progressively enlarged and

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82 McIntyre and McIntyre, Country Towns in Victoria (1944), p. 119.
additions and improvements made including the construction of the East and West Barwon River Diversion weirs and tunnels.\textsuperscript{83}

The SRWSC also constructed township supplies as part of the vast Wimmera-Mallee water supply system (see below). As we shall see in Chapter 3, the SRWSC also developed many irrigation schemes in Victoria.

\textbf{Wimmera-Mallee Stock and Domestic Supply System}

A notable rural water supply scheme is the Wimmera-Mallee Stock and Domestic Supply System, which (as the name implies) principally supplies water for stock and domestic use, but has been extended to include some irrigation. Thought to be one of the largest schemes of its kind in the world, it supplies water by open channel to about 22,000 farm storages on over 15,000 rural properties and to some 50 towns spread over 28,500 square kilometres.

The scheme, situated in the dry Wimmera-Mallee region of Victoria, was commenced in 1887 following a dry period in the late 1870s, but its beginnings can be traced to the 1850s when the Wilson Brothers of Longerenong constructed weirs on the Wimmera River to divert water for domestic and stock use. In 1878 the Shires of St Arnaud and Dunmunkle constructed a timber weir on the Wimmera River at Glenorchy, while the Wimmera Shire began a weir on the same river at Longerenong. Following this, a local water authority, the Wimmera United Waterworks Trust, formed in 1882, built the Lake Wartook Reservoir in 1887. The trust used the natural watercourses - the Wimmera River, Yarriambiack and Dunmunkle Creeks, and the Richardson River - as the main distribution channels.

Settlement in the Northern Wimmera and Southern Mallee in the late 1880s and 1890s, placed further demands on the water supply, and led to many new channels being constructed. The 1902 drought placed enormous pressure on the new water supply, which resulted in the construction of Lake Lonsdale in 1903. The SRWSC took over control of the scheme in 1906 and undertook extensive development of the system using a range of components including artesian bore supplies, catchment tanks, artificial catchments (see section 2.4), channel and pipeline water supplies. It is said that ‘No matter where settlement occurred in the Mallee, the Commission devised a method of water supply to meet its needs’.\textsuperscript{84}

The SRWSC commenced a channel construction program for stock and domestic supply with branches from the Sea Lake and Long Lake main channels in 1906-7, Sea Lake being the first Mallee township to receive a reticulated water supply as a result. Following the 1914 drought the SRWSC constructed additional reservoirs at Fyans Lake and Taylors Lake; in 1919 (also a dry year) Pine Lake was authorised. The Waranga Western Channel, which brings water from the Goulburn and Loddon River systems, was extended westwards following the dry years of 1927-30 in order to supply the northern part of the system. New reservoirs, including Moora Moora Reservoir, Green and Dock Lakes, further extended the system between 1934 and 1935.

The construction of the Rocklands and Toolondo reservoirs in 1953 made it possible, by 1962, to draw the water supply from the Grampians reservoirs instead of the Waranga Channel. However the drought of 1967-68 made this new measure no longer effective and the channel was once again drawn on. The SRWSC managed the Wimmera-Mallee system until 1984 and it is currently managed by one of its successor bodies, Grampians Wimmera Mallee Water.\textsuperscript{85}

\textsuperscript{83} LCC, \textit{Historic Places Special Investigation. South Western Victoria Final Recommendations} (1997), p.89
\textsuperscript{84} Andrew Ward & Associates, \textit{Mallee Area. Review of Historic Sites}, LCC, 1986 p.28
\textsuperscript{85} GWM Water website: http://www.gwmwater.org.au
Heritage - Theme 2.3: Developing water supplies in rural areas

- Places associated with rural township water supply schemes include Aringa reservoir, Port Fairy, the Water Towers in Victoria Park, Cunningham Street, Sale (HO102, Wellington Planning Scheme), Water tower and tank, 12 Millard Street, Wangaratta (VHR H1833), Benalla Water Supply Depot, Riverview Road, Benalla (VHR H1048), Bairnsdale water supply system including the pumping station, tank and storage tower (VHR H2040), and the Rokeby Water Pumping station complex on the Tarago River, Old Telegraph Road West Rokeby (HO207, Baw Baw Planning Scheme)

- Objects associated with the development of rural township water supplies include the records of the former Water Trusts, many of which are now held by local historical societies.

- The Wurdee Boluc scheme is one example of a rural scheme designed and constructed by the SRWSC

- Places forming part of the Wimmera-Mallee Stock and Domestic Supply System including 12 storages such as Lake Wartook and Lake Lonsdale, and the network of channels and other infrastructure such as bores, catchment tanks, artificial catchments and pipelines

2.4 Developing water supply technology

As we have seen in section 1.2, early water supplies were relatively unsophisticated and usually involved drawing water from the nearest source available. However, as settlements have developed so too has the technology associated with the collection, storage, supply and distribution of water. This section considers the development of technology associated with large scale engineered schemes specifically associated with township and rural systems.

As we shall see, much of the early engineered schemes such as Yan Yean and Coliban used technology imported from overseas (usually from England), which was applied to Australian conditions. While this technology was, on the whole, successful problems often emerged that associated with local inexperience or a failure to adapt standards to suit Australian conditions.

Early small scale schemes

As noted in section 2.3 early township water supplies often relied on pumping water from the nearest available source, often a river. For example, the Western Wimmera Irrigation Trust, formed in 1888 constructed a pumping station on the Wimmera River to provide a water supply for Dimboola. A weir was built in 1902 to improve supplies. Many early weirs were of simple timber construction and were intended to divert or re-distribute water rather than create storages – Weir technology is discussed further in section 3.5 in the context of irrigation schemes.

Engineered schemes

The technology associated with the development of engineered water supply schemes is demonstrated by different systems across Victoria. What is extraordinary about many early systems such as Yan Yean and the Coliban is that many of the early components remain in use today, more than 100 years after they were first commissioned. This layering of technology, often within a single system, provides a fascinating insight into the development of water supply infrastructure. Key components of engineered schemes include Storage reservoirs, service reservoirs, transfer mains and distribution mains.

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66 Unless otherwise noted, the source of information about dam technology in this section is the ANCOLD website - www.ancold.org.au. Information about system components was provided by Paul Balassone of Melbourne Water.
Storage reservoirs

A reservoir is essentially the storage volume created by constructing a dam across a valley. With a dam in place, water can be stored in the valley upstream of the dam structure to form a ‘reservoir’ of stored water. Large dam technology was introduced into Victoria with the construction of the Yan Yean Reservoir. The Yan Yean Dam is an earthfill embankment dam with a ‘puddled’ clay core. It was the second large dam to be constructed in Australia and followed the construction of a dam at Parramatta west of Sydney, which used concrete arch technology. The Yan Yean scheme was also innovative as a gravity-fed scheme – that is, rather than relying on pumps to distribute the water, it relied on gravity to convey the water to Melbourne from the storage reservoir at Yan Yean.

Yan Yean had a significant influence on the development of later water supply schemes in Victoria. Almost all town supply schemes that followed relied on gravity and 26 out of the 35 large dams constructed in Victoria prior to World War II were of earthfill embankment construction. “Puddle clay” core dams are no longer built in Australia - the advent of modern construction machinery has rendered this type of dam, with its high labour content, uneconomic to construct.

Other types of large dam technology include rockfill embankment, concrete gravity, concrete buttress, concrete arch, multiple concrete arch and some that are variations or combinations – e.g. earthfill embankment with a central concrete gravity section.

The dam at Lower Stony Creek built in 1873-1874 in the Brisbane Ranges 33 km north of Geelong is notable as a very early example of concrete gravity dam, and was the first dam in Australia built with mass concrete, using Portland cement. It was designed by George Gordon immediately after he arrived in the colony to take up the position of Chief Engineer of Water Supply in the Department of Mines, and built by engineer, Edward Dobson. Another early example of this type of dam is Evansford Dam, which is part of the Clunes water supply.

Other features associated with reservoirs include the outlet tower, where water is drawn from and conveyed to the transfer main, and by-wash, which allows for overflows.

Service reservoirs, water towers and standpipes

Service reservoirs are smaller reservoirs where water is stored just prior to distribution to consumers. Historically, they were built to provide the dual function of balancing supply with demand and maintaining adequate pressure throughout the distribution network. This means that they can be filled gradually (with water from the storage reservoirs) during periods of low demand, but then have a relative large volume, locally available, for rapid distribution when demand is high. In addition, they can sometimes assist with improving water quality by allowing water to settle and filtering impurities.

For example, the service reservoirs at Preston, part of the Yan Yean system, fulfilled the dual roles of regulating pressure and improving water quality. The latter task was done by passing water through bar gratings which screened out “only the very roughest material in suspension”. Early in the twentieth century new screens “of the finest mesh used for water supply purposes” were installed at Preston. Eventually a new screening chamber was constructed in 1911.

Reservoir No. 1 at Preston was constructed in 1864 using puddle core earth banks lined with bluestone pitchers, while Reservoir No.2 was constructed in 1909 of reinforced concrete by John Monash’s Reinforced Concrete and Monier Pipe Co. The latter example experienced problems with leakages and service reservoirs constructed after this date by the MMBW were constructed of massed concrete.

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87 A ‘large dam’ is defined by ANCOLD as one that is more than 15m in height or more than 10m in height if certain conditions are met – see www.ancold.org.au
Service reservoirs are often in the form of water towers (sometimes known as standpipes), which because of their size have become landmarks in many towns – At Mooroopna and Nagambie, for example, the water tower is prominently sited in the central reservation of the main street.

Early water towers were constructed of brick or cast iron (or both), but later of massed or reinforced concrete. A total of sixteen reinforced concrete Water Towers were constructed by the RCMP Co. prior to World War I. Tatura has examples of both cast iron and reinforced concrete water tanks, the latter constructed by the RCMP Co. The example at Bairnsdale, also constructed by Monash’s company is one of the earliest in Victoria.

Transfer and distribution systems
Transfer mains are typically large diameter pipes or aqueducts that convey large water flows around the water supply system usually between storage Reservoirs and Service Reservoirs, while reticulation mains are the smaller pipes that convey water to individual consumers.

In many early schemes, reticulated supply was initially often only available to a restricted number of residences in some towns, and so public standpipes were provided for those not directly connected to the supply.

The Yan Yean system used cast iron pipes, which began to be replaced by wrought iron pipes from the late nineteenth century onwards. Some of the cast iron pipes of the original Yan Yean system are still in situ, but are no longer in service and there are some decommissioned wrought pipes throughout the Melbourne metropolitan area. Another early method of pipe construction was ‘wood stave’ – this was used for many rural water supplies such as at Sale and St Arnaud. By the twentieth century mild steel became the predominant pipe material, along with reinforced concrete and ductile iron.
Aqueducts were used as part of transfer mains in many systems constructed up to the middle of the twentieth century. The early aqueducts constructed as part of the Yan Yean and Coliban systems utilised local materials, usually stone. From the early twentieth century, concrete began to be the preferred material – for example, the aqueducts that from O’Shannassy system, commenced in 1910, were constructed in concrete. Features associated with aqueducts include flumes to carry the water across a stream or valley, and syphons to convey it down a steep incline. Aqueducts are no longer constructed and many of the early aqueducts have been enclosed or decommissioned and replaced with pipes although some remain in use.

The Wimmera-Mallee system used a series of open channels for its system of transfer mains and as part of its distribution network, but these are now being replaced with pipes as part of a massive project designed to improve the efficiency of the system.

**Wimmera-Mallee Stock and Domestic supply system**

As noted earlier in this chapter, the additions to the Wimmera-Mallee Stock and Domestic Supply System by the SRWSC in the twentieth century used a range of specific and sometimes unique technologies to provide water supplies to remote and arid areas. This included the use of artesian bores, pumping stations, catchment tanks and artificial catchments (known as the ‘ironclad catchment’).

**Bores and windmills**

The SRWSC put down exploratory lines in 1911 and 1913 and by 1915 there were 79 successful bores supplying water to 2500 people on farms and in townships between Underbool and the South Australian border. Each bore typically consisted on the above ground elements including a windmill, tank, standpipe with stopcock, rough and earth tank. Over time many of the original bores have been modified or decommissioned and in 1978 less than ten original examples were known to survive.

**Catchment tanks**

In the arid areas of the Wimmera and Mallee many waterways offer only intermittent supply and so the solutions devised by the SRWSC were aimed at gathering peak surface flow rather than constructing dams across waterways. Catchment tanks were one method of achieving this objective. In 1910 the SRWSC, at the request of the Government commenced construction of large catchment tanks at convenient points where underground water is not found and where channel supplies had not yet reached. By 1928 260 tanks had been constructed, which enabled the opening up of areas for settlement in advance of more permanent water channels.

**The ‘ironclad’ or artificial catchment**

In certain parts of the Mallee outside of the ‘bore’ area there was land to which channel supplies could not economically be extended and due to soil conditions natural water catchments and holding ground for storages could not be obtained. The solution developed by the SRWSC was the ‘ironclad catchment’, which involved watertight covered storages made up of galvanised iron sheets laid on sloping ground, turned up and clipped together at the edges, to capture water from rainfall. For an average farm the iron was to cover about ½ acre of ground and the storage tank would hold 65,000 gallons. One example, constructed near Nowingi in 1933 remained in use until 1974.

**Pumping stations**

While the Wimmera-Mallee system, like most township supply systems, relied predominantly on gravity to distribute water a number of pumping stations were built to bring water to land above the level or reach of the gravitational system. Between 1913 and 1947 over twelve pumping stations were constructed. The original installations were powered by steam,

90 Ibid, pp.29-30
converted to diesel and finally to electricity. An operation example of a steam engine has been retained at Lock 9 (Millewa A). 92

**Problems with technology**

The early systems were hampered by a variety of problems. For the Yan Yean system, James Blackburn designed two pressure-relieving valves, which failed to work resulting in pipe bursts. The problem was only remedied by the construction of a holding reservoir at Preston. At Ararat, the pipes were made from bitumen and compressed cardboard, which inevitably developed leaks and had to be replaced with cast iron. 93 The Coliban water supply system, centred at Bendigo, faced ongoing difficulties as a result of underestimating flow rates during peak rainfall periods – it is understood that the original calculations were based on British models, which did not take account of vagaries of Australian climatic conditions Further failures are discussed in section 6.6. 94

**Heritage - Theme 2.4: Developing water supply technology**

- Objects – Plans, specifications and other materials associated with the construction of the Yan Yean system now held by the PROV
- Dam technology – Yan Yean Reservoir, and the Lower Stony Creek Dam, north of Geelong
- Service reservoirs – Preston No.1, No.2 & No.3, High Street, Reservoir, Surrey Hills (HO34, Whitehorse Planning Scheme), Mitcham (HO119, Whitehorse Planning Scheme)
- Transfer and distribution mains - Cast iron and wrought iron pipes within the Yan Yean pipe reserve. Wood Stave pipes associated with the St Arnaud systems are thought to survive in Kara Kara State Park. Also the Maroondah aqueduct, and aqueducts and channels forming part of the Coliban system.
- Water towers – Cast iron and reinforced concrete water tanks/towers at Tatura (HO116 & HO117, Greater Shepparton Planning Scheme) and the reinforced concrete tank that forms part of the Bairnsdale water supply (VHR H2040) (There are numerous other examples in country towns throughout Victoria and in Melbourne)
- Wimmera Mallee system - Nowingi Iron-clad catchment, Nowingi (HO157, Mildura Planning Scheme) and Millewa A and Millewa C pumping stations (HO150 & HO151, Mildura Planning Scheme)
- The pressure relieving Valve Houses constructed for the Yan Yean system at Mill Park (HO25, Whittlesea Planning Scheme) and Preston Reservoir – the latter example retains the original machinery.

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92 Ibid, pp.31-4
12. Bitumised pipes were also used at Creswick in the 1860s (see Argus, 11 September 1862, p. 5).
94 The Argus newspaper reported at length on these problems during the 1870s.
3. HARNESSING AND DISTRIBUTING WATER FOR IRRIGATION

This theme looks at the development of adequate systems of irrigation in Victoria, from the early efforts of innovative individuals through to the large-scale irrigation areas developed by the State Rivers and Water Supply Commission (SRWSC). It traces the history of state legislation concerning irrigation in the 1880s, which made possible the Chaffey brothers’ irrigation scheme on the Murray and culminated in the creation of the SRWSC in 1905. It examines the subsequent collaborative role played by the Closer Settlement Board and the Department of Agriculture in developing large irrigation areas. This theme is important because it recognises the importance of irrigation to the development of agriculture and fruit-growing in Victoria in the late nineteenth and early twentieth centuries. It is also an important part in the larger story of water scarcity and the efforts settlers and governments made to remedy this.

This chapter incorporates the following Australian Historic Themes:

AHT 3 Developing local, regional and national economies, especially 3.5, 3.9, 311; 2.5 Promoting settlement.

3.1 Early irrigation schemes (1840s-70s)

An ample and reliable provision of water was critical for the cultivation of food, and hence for the survival, progress and development of the colony. The British reformer E.G. Wakefield, who was the architect of the South Australian settlement in the mid 1830s, was one of the first to recognise the need to conserve an adequate supply of water in the colonies for agricultural purposes. In the mid 1830s, possibly with the recent failure of the Swan River settlement in mind, he emphasised the paramount importance of water for the survival and success of the new colony in the southern part of Australia.95 Around the same time, surveying the country atop Pyramid Hill, north of Bendigo, the explorer Major Mitchell noted in his diary that the country was ‘suitable for irrigation’.96 The Polish explorer, Count Paul Edmund Strzelecki, also noted in 1845 ‘the suitability of various rivers for irrigation’ and was particularly impressed with the Gippsland river flats.97 The engineer James Blackburn had also recognised this need in his original plan for Melbourne’s water supply in the 1840s, in which he had incorporated an irrigation scheme from the Plenty River (though this was ultimately not carried out).98

Innovative settlers devised various home-made irrigation schemes from the 1850s onwards, with varying degrees of success. In 1857, for example, Scottish farmer David Milburn was pumping water by hand from the Maribyrnong River to water his property Grange Farm, Keilor. This system was improved with horse-driven pumps and later hydraulic rams, for which...

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he constructed a weir across the river. In 1859, Italian farmer Sydney Ricardo pumped water from the Yarra River by steam engine to irrigate his Heidelberg property and dug 'a series of contour canals, after the Italian system'.

G. Eason drew on a spring to irrigate some fruit trees at Scots Marsh, near Ballarat, and John Garden irrigated a vineyard at Taradale. In 1873, the successful biscuit manufacturer Thomas Swallow established a pioneering irrigation scheme on 320 acres of leased land at Shepparton Park 'to prove his theory of intense cultivation of dried fruits' for use in his factory. A smaller scale irrigation scheme was constructed in 1877 by James Frazer Watkin, at this property known as Belmont near Beaufort. This comprised a small reservoir and connected by a four inch main to the garden of his property, which is still in use today. In 1882, a farmer named Garden developed a large-scale irrigation operation at Cohuna, using a centrifugal pump and steam-powered engine. This made a significant impression on Alfred Deakin and encouraged Deakin's efforts in establishing irrigation schemes.

Other private irrigation systems were at work. In the late 1830s, The Chief Protector of Aborigines in Victoria, George Augustus Robinson, had observed and reported on Aboriginal water supply systems. At Yelta Aboriginal mission on the Murray River, Thomas Goodwin devised an early irrigation system in 1855, which used a windmill to feed water into channels for vegetable-growing in the late 1830s and early 1840s. On the Yarra flats in Melbourne, and river flats in the gold-mining districts, immigrant Chinese used rudimentary irrigation methods to grow vegetables for their market gardens. Groups of settlers also took upon themselves the task of harvesting water from rivers and creeks using diversion weirs for their collective use to water stock. In the East Loddon area, farmers built a weir on the river for this purpose in 1858, while in 1856 the Wilson Brothers at Longerenong diverted water from the Wimmera River into Ashens and Yarriambiack creeks – this latter weir was the beginnings of the Wimmera-Mallee Stock and Domestic Supply System as described in section 2.3.

There was little public interest in irrigation and it took considerable time for the Victorian government to fund and develop large-scale irrigation works. In the racially biased minds of many European settlers, a negative attitude towards irrigation in the 1850s and 1860s stemmed from derogatory attitudes towards Chinese labour. It was only after the decline of gold-mining, and the growing number of ex-miners who turned to farming in the drier country of northern and central Victoria, that the government was pushed to address the issue of water supply for irrigation.


100 Sydney Ricardo’s irrigation scheme was noted in the *Victorian Agricultural and Horticultural Gazette*, 21 November 1859, pp. 118-120; the quote has been taken from the *Argus*, probably October – November 1859.


107 *Water and Our Heritage*, 1988, no page numbers.

In 1860, the Victorian government invited essays that investigated the use of Victoria’s natural resources for colonial development. William Story wrote a prize-winning essay on the importance of irrigation. He stressed the importance of finding the most advantageous sites for water storage before Crown land had all been sold; he also forecast the establishment of local trusts for administering water supplies.\(^{109}\) Another prize essayist, William Acheson, proposed an elaborate scheme to drain the salt water from Lake Corangamite into the Barwon River, converting it to a fresh water storage, which could be used for water supply and irrigation across a large area from Lake Corangamite to Geelong. Acheson also proposed diverting the Goulburn River and using this supply to irrigate the area between the goldfields and the Murray River.\(^{110}\) An earlier scheme for irrigation by F.C. Christy, which proposed using the Moobaloo River to irrigate the volcanic plains near Geelong, was read before the Royal Society of Victoria in 1856.\(^{111}\) These ambitious schemes were largely academic; there was neither the means nor the motivation to make them a reality.

The first practical steps towards the development of a large-scale irrigation scheme came in the 1870s with the formation of the Grand Victorian North West Canal, Irrigation, Traffic and Motive Power Company Ltd. Its founder, Benjamin H. Dods, was an ambitious Scottish hydraulic engineer whose dream it was to build a canal from Murchison on the Goulburn River that flowed through to the Wimmera and then south to Portland and the sea.\(^{112}\) Whilst the scheme was ultimately impractical, the debate surrounding the project, maintained by the company’s energetic secretary Hugh McColl, raised public awareness of and interest in irrigation.\(^{113}\)

Meanwhile, settlers continually sought to increase the area of arable land. Where the country was dry it needed water; where it was swampy it required drainage. Large swamps were drained for farming from the 1870s, both privately and by the local councils. In south-west Victoria, for example, numerous swamps resting on the basaltic, but otherwise rich pasture lands were drained in the 1870s, including Lake Gorrie and Tower Hill swamp; work on the latter was carried out by immigrant Chinese labourers. Here, miles of channels were dug through the stone for drainage, as well as stone culverts over myriad tunnels. Likewise, in Gippsland in the late nineteenth century, the extensive Koo Wee Rup swamp was drained for use as farmland.

**Heritage - Theme 3.1: Early irrigation schemes 1840s-1870s**

- Early irrigation systems at Longerenong Homestead, Burnt Clay Road, Murtoa (VHR H2990) and Belmont, Beaufort-Amphitheatre Road, Beaufort (VHR H0644)

- Chinese market gardens (1850s), Bendigo [VHR]

- Milburn Weir (c.1884), near Arundel Road, across Maribyrnong, Keilor (HO35, Brimbank Planning Scheme)

- Former Yelta Aboriginal Mission site (1855)

### 3.2 Irrigating Victoria (1880s onwards)

The passing of a series of Acts in 1880s, which were championed by the Minister of Water Supply, Alfred Deakin, laid the foundations for the construction of large-scale irrigation

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111 His paper was read to the Royal Society of Victoria in 1856; from Dingle (1984), p. 119.


schemes that would profoundly change the development of agriculture and patterns of settlement in Victoria.

The Water Conservation and Distribution Acts, 1881 and 1883
The drought years of the late 1870s, and the ongoing struggle of farmers on their new selections, raised concerns about how to best irrigate the dry northern plains of Victoria. To investigate this problem, the Government appointed a Water Conservancy Board in 1880 with two members: George Gordon, formerly Chief Engineer of Water Supply, and Alexander Black, Assistant Surveyor-General. Following recommendations in their report of 1880, a number of weirs were constructed on major waterways in north-central Victoria, including the Broken River, the Loddon River, and the Avoca River.\(^\text{114}\)

Following Gordon and Black’s report, the Minister for Water Supply, Alfred Deakin, introduced new legislation (the *Water Conservation and Distribution Act 1881*) that was designed to help establish local waterworks trusts, and which allowed local trusts to borrow funds from the government for the construction of irrigation works. The trusts could then charge water rates to users in order to recoup their costs and pay the interest on the loans. The 1881 Act also protected the waterways for future use.\(^\text{115}\) An Order-in-Council, dated 23 May 1881, effectively alienated the frontages of virtually all the rivers, lakes and water courses in Victoria that were not already alienated from the Crown.\(^\text{116}\) As L.R. East pointed out, this was the first such legislation to provide expressly for irrigation works.\(^\text{117}\)

The largest waterworks trust was the United Echuca and Waranga Waterworks Trust, which was formed in 1882. Its grand plans to dam the Goulburn and divert water to the Waranga Basin were not put into effect until 1891.\(^\text{118}\) Over the next five years, 23 trusts were formed and a number of significant works carried out, particularly in the Wimmera. Here, the Wimmera United Water Trust took over responsibility of the Glenorchy Weir. It also built the Wartook reservoir (1887) and the Longerengong Weir (c.1880s), and a network of irrigation channels.\(^\text{119}\) Labour was readily found from among the large number of former gold miners, who had become expert in digging troughs and wells.

The components of irrigation works were similar to those of water supply systems. Early systems simply pumped water from the river and then through a weir into a channel. They comprised a storage reservoir (for irrigation this was often constructed on an existing waterway and a weir installed at the downstream end), which flowed into a network of channels, including main channels and private channels running off the main channel. Feeder channels were also constructed, but in many cases, where possible, existing water courses were used for this.\(^\text{120}\) An efficient irrigation system required a very slight slope to the land. In Victoria, much of the land adjacent to the Goulburn and the Murray - two of Victoria’s largest rivers, both with a relatively strong and reliable stream flow - was relatively flat and well suited for irrigation.

\(^\text{114}\) East (1961), p. 7; Dingle (1984), p. 120.
\(^\text{116}\) East (1961), pp. 5-6.
\(^\text{119}\) Dingle (1984), p. 120. The Western Wimmera Irrigation Trust later took over the Wartook Reservoir (East (1961), p. 8).
\(^\text{120}\) Dingle, 1984, p. 120.
The 1881 Act was amended by the *Water Conservation and Distribution Act 1883*. Under this legislation, ‘irrigation trusts could be formed by three-fourths of the landowners owning two-thirds of the land in a district submitting a petition defining the proposed irrigation district and outlining a scheme for water supply. The Minister would then order a survey and report on the project, including an estimate of the amount of water likely to be available for irrigation after stock and domestic animals had been satisfied.’

Irrigation was still being carried on privately, for example along the Murray. Fruit-growing was being carried out successfully before the arrival of irrigation water. At Echuca in 1885, it was reported:

"Fruit trees of all kinds thrive, the orange and lemon being very prolific, and should water ever be carried unto these plains, the lands would be easily and profitably converted to any use. This is particularly proved by the extensive irrigation works of D. Chrystal and Leech."

**The Irrigation Act 1886**

In order to best plan for the future needs of water supply, the Victorian Government appointed a Royal Commission on Water Supply in 1884, which was chaired by Alfred Deakin, the Minister of Water Supply, with Stuart Murray acting as secretary. Deakin investigated in detail the irrigation systems of a number of other countries, including North America, India, Egypt and Italy. He recognised the need to abolish private water rights in order to provide the best system of public water supply.

As a result of this Royal Commission, the Government passed the *Irrigation Act 1886*, which overruled common law riparian rights regarding the use of water for other than domestic and stock purposes.

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123 East, 1961, pp. 8, 10.

• An adjacent owner was given a new statutory right to take water for domestic, stock and household garden use;

• All landowners were entitled to apply for a licence to divert water for irrigation or other purposes;

• Upstream owners were deprived of their ability to obtain a right to divert water by long use;

• As a necessary consequence, downstream users were deprived of their right to sue upstream users in the absence of damage.  

The Act’s significance was that it encouraged large scale private irrigation development.  

Under this Act, the government approved and provided advance funds for irrigation works to be carried out by the newly established local water trusts. There were nearly ninety irrigation trusts set up under the 1886 Act. The government also funded so-called ‘national’ works. The first state-funded works, commenced in 1887 and supervised by Engineer in Chief of the Water Supply Department, Stuart Murray, were the Goulburn Weir on the Goulburn River, and the Laanecoorie Weir, on the Loddon River, which formed the foundation of a vast irrigation system planned for the Goulburn Valley.  

Typical works carried out in the 1890s included building new weirs, installing pumps and pumping stations, digging feeder channels and installing sluices. To increase the available water supply, work on the Waranga Basin reservoir was commenced by 1891.

The Mildura Irrigation Scheme
Alfred Deakin had been greatly impressed with the grand schemes for water supply and irrigation that he discovered in the western states of the USA on a visit there in 1884. Hoping to emulate these developments in Victoria, he invited the brothers George and W.B. Chaffey, who had established a successful irrigation settlement in California, to establish a similar

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128 East (1961); this work was first proposed in 1881.
settlement in Victoria. The Chaffeys were granted 50,000 acres of land at Mildura and formed the Mildura Irrigation Company. Three thousand people had been attracted to the settlement by 1890. Supported by special legislation, known as the Waterworks Construction Encouragement Act 1886, the Chaffeys imported steam pumping equipment (high-lift pumping plants) to raise the water from the Murray, and had irrigation channels dug. The township of Mildura was designed to emulate the Californian town of Ontario, complete with ornamental street tree planting and an order of temperance.

In 1896 (following the collapse of the Chaffey Brothers companies in 1895) the Government called for a Royal Commission into the Mildura Settlement. As a result, the First Mildura Settlement Trust took over control of the settlement. One of the first actions of the Trust was to arrange for the continuation of the lining of the earthen channels with concrete.

Heritage - Theme 3.2: Irrigating Victoria (1880s onwards)

- Goulburn Murray Irrigation District system (1882 onwards) – Pumping plant at Murchison, Waranga Basin, Stuart Murray Channel, Cattanach Channel, Waranga Western Channel, Laanecoorie Weir

- Chaffey Bros. and First Mildura Irrigation Trust system (1880s and 1896 onwards) - Pumping stations including Psyche Bend (VHR H0548), Billabong (H0547) and Lock Nine (H0549), former Chaffey residence ‘Rio Vista’, 199-205 Curton Avenue, Mildura (H0729), former Irrigation Trust offices, Mildura and street plantings in Mildura

3.3 The Water Act 1905

Irrigation became more widely accepted after the drought years of the late 1890s and early 1900s, but some problems persisted. There was insufficient water in most of the channels; there was a general lack of knowledge amongst farmers about irrigation; and there was some reluctance on the part of trusts to charge local farmers for the water that was made available to them. A major problem with irrigation works was the huge up-front capital outlay. Farmers were reluctant to invest in such a costly scheme, even with the promise of future gains to be made. Many irrigation trusts had borrowed large sums from the Government under the 1886

Irrigation Act in order to finance irrigation works, but there were enormous problems in recouping this money from struggling local farmers.\footnote{Smith (ed.), \textit{Cyclopedia of Victoria} (1903), vol. 1, p. 242. The trusts had borrowed a total of not less than 588,861; and of this sum 315,115 was written off as an irrecoverable bad debt of the State.}

The passing of the \textit{Water Act} in 1905 led to the formation in 1906 of the State Rivers and Water Supply Commission (SRWSC) which would develop and oversee waterworks and irrigation. The first offices of the new organisation opened at Tatura and Kerang. The SRWSC took over nearly all the irrigation works in the country towns and virtually nationalized the rivers and river banks, brought far more skill to the providing of irrigation. Later, the first Eildon Weir on the Upper Goulburn, and the great Hume Weir upstream from Wodonga, multiplied by ten the storage of Victoria’s irrigation water in the years 1902–1934.\footnote{Geoffrey Blainey, \textit{Our Side of the Country} (1984), p. 143.} In 1905 the SRWSC completed the Waranga Basin in northern Victoria.\footnote{\textit{Australian Encyclopaedia} (1957), vol. 3, p. 187. This storage was enlarged in 1936.}

The \textit{Water Act 1905} abolished the ailing local trusts, except the First Mildura Irrigation Trust, which remains in existence today. The Act provided for better management of irrigation systems and incorporated provisions for education of farmers about irrigation, integration with Closer Settlement schemes, and government assistance with housing needs. This work was managed by the SRWSC, which comprised three Commissioners. In addition to its responsibility for irrigation, the SRWSC assumed control of the management of local water supplies for domestic, industrial and stock purposes, and took on a duty to investigate and carry out land reclamation works, and to investigate the availability of underground water.\footnote{East (1961), pp. 14-16; see also Dingle (1984), p. 125.}

At the end of 1907, Elwood Mead, a leading American expert on irrigation management, was appointed chairman of the SRWSC. On Mead’s recommendation, the SRWSC promoted closer settlement as integral to the development of irrigation, and the intensive use of water. Mead also introduced a ruling in 1909 which bound all those with access to irrigation water to have to pay a set fee, regardless of whether they used the water or not.\footnote{Key Solutions, \textit{Fruits of Our Labour} (2003), p. 34; East (1961), pp. 17-18.} In 1910, the Chief Engineer of the SRWSC, John Dethridge, invented the Dethridge Meter Wheel (shown in Figure 23), which effectively measured individual usage of irrigation water and made water...
rates easier to calculate. Several large new reservoirs were built over the next decade as a way of storing greater amounts of the winter rain for the dry summer periods, and assuring a supply for irrigationists.

**Closer settlement and soldier settlement**

After 1905, the SRWSC purchased large areas of land in the north of Victoria to develop as irrigation areas. Legislation in the 1890s had permitted the Government’s acquisition of grazing land for the purpose of closer settlement. The SRWSC subdivided land for irrigation settlements at Merbein, Shepparton, Tongala, Rochester, Cohuna, Red Cliffs, Murray Valley, Robinvale and Werribee. In many cases, for example Red Cliffs (which was one of the largest soldier settlement schemes in Australia), the land was acquired by the SRWSC specifically for soldier settlement and was taken up by soldiers returned from the First World War. Irrigation also enabled closer settlement around Maffra and Sale in Gippsland in 1926, initially with little local support. Settlers on irrigated blocks were mostly occupied with fruit-growing and dairying. The Werribee irrigation area was largely taken up with vegetable-growing.

Former soldiers were involved in the construction of water supplies and irrigation schemes in the 1920s through their employment with the SRWSC under Repatriation Schemes.

After World War II, additional soldier settlements were established in irrigated areas. Such a settlement began at Robinvale in 1946. Another soldier settlement, comprising 22,500 acres, was established near Cowwarr in Central Gippsland in the early 1950s. Others were established in the Murray Valley.

**Postwar expansion of irrigation**

There was massive expansion of Victoria’s irrigation water storages after World War II when in the decade from 1950 to 1960 the total irrigation storage capacity increased fourfold from 1,040,000 ML to 4,880,000 ML. As a result of ‘enthusiastic government support’ a new reservoir was completed every two or three years up to 1971.

The major irrigation areas in the 1950s were at Werribee, the Wimmera River, Taylors Lake; Swan Hill; along the Murray both sides of Echuca; the Goulburn Valley; Waranga, and on the Macalister River in Gippsland. Irrigation water also fed market gardens in the Springvale-Dandenong area, and farms on the Mornington Peninsula.

By far the largest storage reservoir constructed during this era was the ‘Big Eildon’ reservoir with an effective capacity of 3,390,000 ML. Other major storages added included Rocklands (1953, including its associated off-river storage, Toolondo), part of the Wimmera Mallee Stock and Domestic Supply system, which also represented the ‘first actual diversion in Australia of a coastal river to run inland’ and Cairn Curran (1955) on the Loddon River, between Newstead and Maldon to provide water for the Goulburn Murray Irrigation District. In 1958 the

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138 East (1961), p. 21; Victoria’s Resources, vol. 6, no. 2, June-August 1964, p. 91; Dethridge also designed moveable weirs at Torrumbarry and Maldura.


144 Hallows, Peter & Thompson, Donald, A history of irrigation in Australia, Mildura, 1995, p.44


146 Australian Encyclopedia (1957), vol. 3, p. 188; East (1961), pp. 25-26
Glenmaggie Reservoir near Maffra was enlarged with the addition of flood gates and was described at the time as ‘a massive concrete dam … conserving water from a catchment area of 730 square miles, the storage supplies the Macalister Irrigation District in Gippsland’\(^\text{147}\) and ‘provides water for dairy produce on a large scale.’ \(^\text{148}\)

By the 1970s it was recognised that irrigation in Victoria changed ‘from an expansionary phase to a mature one’. The dam construction section of the SRWSC was wound down and the emphasis shifted from to improving the efficiency of the system and to dealing with major issues such as water loss through seepage and evaporation and salinisation.\(^\text{149}\)

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**Heritage - Theme 3.3: The Water Act 1905**

Irrigation scheme infrastructure associated with the various schemes such as dams, channels, bridges, flumes, locks, weirs etc. Some examples include:

- **Goulburn Murray Irrigation System (post-World War II extensions)** – ‘Big’ Eildon Dam, Cairn Curran and Lake Eppalock
- **Werribee River Irrigation system (1912 onwards)** – Pykes Creek Reservoir, Melton Reservoir and distribution system
- **Macalister Irrigation System (1920 onwards)** – Lake Glenmaggie reservoir and irrigation scheme infrastructure and closer settlement throughout Maffra, Sale, Nambrok and Denison districts.
- **Soldier and closer settlement associated with irrigation schemes** – for example at Red Cliffs, Robinvale, Shepparton, Cowarr, Nambrok, Cohuna and Kerang.

**3.4 River Murray Waters Agreement (1914)**

In 1914, the state governments of Victoria, New South Wales and South Australia signed the River Murray Waters Agreement with the Commonwealth Government, which agreed to contribute funds for the construction of two reservoirs, including the Hume, the Yarrawonga Weir, and many weirs and locks along 1300 miles of the Murray River. This would then

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\(^{148}\) *Under Southern Skies* (c.1954), p. 20.

\(^{149}\) Hallows, Peter & Thompson, Donald, *A history of irrigation in Australia*, Mildura, 1995, p.44
enable each state to develop new irrigation areas. Together they formed the Murray River Commission. The resultant legislation was the *River Murray Waters Act 1915*.

**Heritage - Theme 3.4: River Murray Waters Agreement**

- Hume Dam (1919-1936)

### 3.5 Development of irrigation technology

As we have seen early irrigation systems in Victoria were simple and small in scale, however, the support of the Government as discussed in this section quickly enabled more technically complex schemes to be designed and constructed. The storage and distribution aspects of the larger irrigation systems constructed from the 1880s onwards utilised similar technology to that discussed in section 2.4 and so this section will focus specifically upon weir and pumping technology.

In contrast to dams, weirs are smaller structures constructed across rivers or creeks with the intention of diverting the water flow from the stream into a pipeline, tunnel or aqueduct. Weirs are usually only capable of harvesting a proportion of the actual flow in a watercourse, and so are designed so that excess flood flows pass over the top of the structure. Unlike reservoirs weirs do not store water, but simply impound a small pond of water to facilitate the diversion and to allow for some settlement of silt before the water is re-directed.

The first weirs in Victoria were constructed using technology brought from America and adapted to Australian conditions using locally specific materials. Early examples were constructed of timber, using simple pile technology or stone-filled crib construction. Some of these failed and were replaced with weirs constructed of massed or reinforced concrete. One example is a weir on the Campaspe River, originally constructed in timber in the 1840s, which was replaced with concrete in the 1940s. As schemes developed the weirs became more sophisticated in design. A notable example is the Torrumbarry Lock and Weir, which was designed and built by J.S. Dethridge. Dethridge also designed the Mildura Lock and Weir (which is the only other lock and weir of similar design to Torrumbarry) and the Meter Wheel that bears his name (see section 3.3). Torrumbarry Weir is unusual because it could be entirely removed during high-water to allow dead trees from the Barmah/Mellewa Forest to pass down stream.

Another feature of irrigation schemes was the use of pumps to raise or lift the water for distribution. The original pumps, powered by steam, introduced by the Chaffey Bros. in the 1880s were still in use in the 1930s, but were converted to electric power when Mildura was connected to the State electricity grid after World War II.

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151 Paul Balassone, Melbourne Water, pers. comm..

152 Heritage Victoria VHR H993 – File No. 605418
Heritage - Theme 3.5: Development of irrigation technology

- Torrumbarry Irrigation System (1906 onwards) – Torrumbarry Lock-Weir No. 26 (VHR H0993)
- Chaffey Bros. and First Mildura Irrigation Trust system (1880s and 1896 onwards) - Pumping stations including Psyche Bend (VHR H0548), Billabong (H0547) and Lock Nine (H0549)
- Robinvale (1940 onwards) – Pumping stations B, C, D, E & F ‘Re-lift’
- Campaspe Weir, Bendigo-Echuca Road & Burnewang Road, Campaspe (H7825-0029)
4. HARNESSING WATER FOR INDUSTRIAL PURPOSES

This theme traces the critical role of water-power and steam power in many industries in Victoria from the beginning of settlement. It recognises the importance of water in the manufacture of various products, and hence the contribution made by water supplies in boosting production and contributing to Victoria’s economic prosperity. It also recognises the workings of early technologies that used steam power and pumps. This theme is important because it recognises the importance of reliable water supplies not only for human and stock consumption and agricultural purposes, but also for a wide range of industries in the period before electricity.

This chapter incorporates the following Australian Historic Themes:

AHT 3 Developing local, regional and national economies, especially 3.13 & 3.14.

4.1 Using water in early industry

While the settlement of Victoria was primarily pastoral, industrial developments quickly emerged. In James Blackburn’s initial plan for Melbourne’s water supply, he incorporated a means of using water to generating power (and to irrigate the land), but this was later dropped. 153 Securing a water supply required the generation of power. Windmills that drove pumps for water collection were erected in Melbourne and Portland by the 1840s. 154 Steam power (from river water) was used to power the pump from the Yarra in the 1850s that filled the water tank on Eastern Hill. 155

Where centres of population emerged by the 1840s, it wasn’t long before flour mills lined the rivers, for example on the Yarra, the Barwon, and the Plenty. These mills used wooden water wheels built from local timber. By 1859, there were a total of 89 flour mills in Victoria; of those 74 were steam driven, twelve were water-powered, and three were windmills. 156 In some cases mills drew water from a ‘mill dam’, which in turn was fed from a watercourse or other water supply. The Goorambeet Flour Mill in the Goulburn Valley stored water in a huge underground tank that was fed from the roof catchment and supplemented by a pipeline to the Broken Creek. 157

Industry followed settlement. Numerous flour mills were established in the Goulburn Valley from the late 1870s, following the opening up of the area to selectors. These included Thomas Swallow’s Shepparton Flour Mills established in 1876, which provided flour for his Swallow and Ariel biscuit factory in Port Melbourne. 158 Following the development of an irrigation area at Maffra in Gippsland, the Maffra Sugar Beet Factory promised a bountiful production in the

1920s, but this was short-lived. As discussed earlier, steam locomotives were also large users of water and required a ready supply at railway stations for regular refuelling.

Figure 25

'Diamond Hill crushing mill, Bendigo


In the later part of the nineteenth century, the Yan Yean system provided a reliable and seemingly limitless supply of piped water that enabled the operation of all kinds of machinery. In 1889, a hydraulic power and pumping station was erected by the Melbourne Hydraulic Power Company on the north bank of the Yarra to provide high pressure water for operating lifts and cranes in Melbourne’s CBD, South Melbourne and Kensington. In 1927 a tank associated with this operation was moved to the Spencer Street power station as part of the Melbourne City Council’s consolidation of the hydraulic power supply where it remained in use until 1967.

The superior quality of water coming from a large reservoir, rather than from a river, improved production at some factories, for example the Bendigo breweries. One enthusiast explained that the water from the Bendigo water-works is ‘so suitable to brewing purposes that the Sandhurst [Bendigo] beer is famous all over Victoria’.

In the many accounts of the colony’s progress recorded in the boom years of the 1880s, there are endless examples of other water-powered industries, including paper mills (notably the extensive Barwon Paper Mill, near Geelong), timber mills, soda water and cordial factories, breweries, boiling-down works, sheep-washing and wool-scouring. There were red gum sawmills on the Murray and a wool-scouring factory on the pristine Surry River near Portland. At Malmsbury there was an intriguing water-powered stone sawing machine. At Footscray, the borough council stated: ‘several important manufactories have been established...

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160 Dingle and Doyle, Yan Yean (2003), p. 72; these lifts were operating by at least the 1870s.
162 Cannon (ed.), Vagabond Country (1982), pp. 47, 63; see the website for the Fyansford Paper Mill.
163 Victorian Municipal Directory 1885, p. 78.
… woolwashing establishments … Footscray is specially adapted for manufactories, having good water frontage and drainage, and being easy of access by land and water. Industry was often criticised for polluting the rivers with noxious wastes, especially the Yarra where industry was banned by 1854. Industry was also anathema to the popular ideal of the picturesque or romantic river. But many nevertheless welcomed industrial works as important to the progress of the colony.

Most of the steam powered industries converted to electricity in the early to mid twentieth century.

**Heritage - Theme 4.1: Using water in early industry**

- There are a number of mills and mill sites on the VHR and VHI – examples include Dight’s Mill, Kew (VHR H1522) and Anderson’s Mill, Smeaton (VHR H1521), Barwon Paper Mill Company (VHR H0743), Days Mill, Murchison (VHR H1523), and Goorambeet Flour Mill in the Goulburn Valley (1884-1921 - underground water tank survived in 1983)
- Overhead water tank at the former Spencer Street Power Station (VHR H2117)

### 4.2 Using water for gold-mining

As alluvial gold-mining developed in Victoria it required increasing amounts of water to flush out the alluvial material. Table 4.1 provides a brief overview of the types of gold mining activities carried out and the water requirements. As noted in this table, early shallow alluvial gold mining relied on using and diverting natural steam flows, however, as the early claims were worked out more capital intensive gold extraction processes were developed.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Water requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow Alluvial – panning (c.1850s-60s)</td>
<td>Relies on existing flows</td>
</tr>
<tr>
<td>Puddling (1860s onwards)</td>
<td>Requires small dams and races to supply water</td>
</tr>
<tr>
<td>Hydraulic Sluicing (1850s onwards)</td>
<td>Sluicing commenced in the 1850s, but by the 1870s mines were using hydraulic hoses requiring large volumes of water. This resulted in the need for more elaborate engineered systems with greater capacity (e.g. Coliban system)</td>
</tr>
<tr>
<td>Deep lead and Quartz mining (1850s onwards)</td>
<td>Water not required to extract gold – often has to be pumped out of mines rather than brought in.</td>
</tr>
<tr>
<td>Hydraulic sluicing (1920s onwards)</td>
<td>Improved technology enabled larger areas along the banks of waterways to be scoured away in search of gold.</td>
</tr>
</tbody>
</table>

### Development of puddling and hydraulic sluicing

The technology of small scale alluvial mining had changed little since ancient times and a wooden cradle was the most favoured means of separating the gold from dirt in Victorian fields because it was portable and easy to set up – one man rocked the cradle and bailed water into it while another shovelled earth into the hopper of the cradle as required. Miners initially diverted water along races from the creeks and streams, in an attempt to secure sufficient water to wash out the gold, while horse-drawn ‘whims’ also drew up a supply of water from wells dug deep in the ground.

164 Victorian Municipal Directory 1885, p. 61.
Panning and cradling for gold, Bendigo, 1850s


Figure 26

‘The old whim horse’

[Victorian School Readers, Eighth Book]

Figure 27
The peculiar conditions of goldfields in the Bendigo and Forest Creek areas led to the development of revolutionary new technology known as 'Puddling'. Puddling became very extensive - Bendigo alone had 1000 machines at the beginning of 1854, and 1500 by the end of that year. In the early 1860s, a number of puddlers were steam powered. However, puddling had greatly declined by the 1870s.

An unfortunate by-product of the puddling process used by the miners was an odious sludge that threatened to engulf the settlements they supported. The sludge, which contained far more solids than water, literally filled the creeks with silt. By 1856 a network of sludge drains fed the main channel of what had been Bendigo Creek. Kelly described the situation in 1857: "... the Serpentine Rivulet (Bendigo Creek) which flowed through the city, was so choked at its different windings with sludge and refuse, that a heavy fall of rain converted the whole space into a lake". The sludge, which was highly mineralised and would not support growth, also flowed out on to grazing and agricultural land and smothered the vegetation. Decades passed before any sort of healthy ecosystem returned to some of the streams and rivers. Fisher did not return to parts of the Loddon until 1910.

In the 1850s, this work was carried out by individual miners. By the 1860s, however, the larger companies obtained steam engines to pump the water for sluicing. An early example was worked at Ballarat in 1853. These engines pumped the water through the hillsides and old mine workings in the search for alluvial gold. Manual whips and horse-powered whips that were used for bringing the water to the surface were soon replaced by steam-driven ones. Miners at Sandhurst (Bendigo) and Mount Alexander (Castlemaine) were greatly advantaged in the 1870s when the Coliban water system came on line. This was fed from the reservoirs using a gravity system along open channels to the mines.

Deep lead and quartz mining

By the 1860s, deep-lead mining, or quartz mining, had become more profitable and large steam-powered crushing machines were used to crush the rock when it was brought to the surface. By this stage the goldfields had become crowded with iron machinery.

Hydraulic sluicing (1920s onwards)

Renewed efforts to find gold came in the 1920s and 1930s, when many of the old mines were worked over again. Companies went in with steam engines and once used hydraulic sluicing to flush out any gold from the old mines. By the Second World War, most of the mines ceased operations and the steam engines were removed, leaving behind a heavily disturbed, disfigured and eroded landscape.

Heritage - Theme 4.2: Using water for gold-mining

- There are numerous hydraulic gold sluicing sites on the VHR and VHI – some examples include the Red Hill Site at the Castlemaine Historic Reserve (H1230), Humbug Hill at Creswick (H1228), Pioneer and Union at Mitta Mitta (H1229), and Oriental Claims near Omeo (H1225).
- Water wheels including the Garfield Water Wheel, Castlemaine (VHR H1356, Morning Star metal pitchback water wheel at the Morning Star Gold Battery site, Heyfield (VHR H1265), and Sir John Franklin Water Wheel, Gooley's Creek near Mansfield (VHI H8122-0013)

165 For a description of 'puddling' please see Appendix 1
Pumping Station, Duke of Cornwall Mine (VHI H7622-0224) (1860s)

4.3 Hydro-electricity schemes

Small-scale experimental attempts at generating hydro-electric power were first made in the nineteenth century, for example by the talented Samuel Wilson of Ercildoune homestead, near Ballarat. There were some more attempts in the early 1900s. As Jane Lennon points out, the earliest successful scheme was that of the Cassilis Company, located on the Victoria and Cobungra Rivers, which provided power to the mine and treatment works in Powers Gully. Lennon explains: A dam constructed on the Victoria River supplied water by race to a pressure dam located on a spur immediately above the power station on the Cobunga River. From the power station, a transmission line extended 27 kilometres to the mine and works. Groundwork for the scheme commenced late in 1906 and it was operational in 1909 – the first such scheme in Victoria. A small hydro-electric scheme was established at Wallaby Creek Quarters in the 1920s.

In 1910 a scheme was proposed for Snobs Creek, but one was eventually established in the Rubicon district in 1928 when five generating stations opened on the tributaries of the Upper Goulburn River and fed into a sub-station at Sugarloaf near the new Eildon Dam. The Rubicon Hydro-Electric Scheme, commissioned in 1928, provided 20 per cent of Victoria’s power in the first ten years of operation. However, it wasn’t until the post-war period, when there was the available capital, the technology and the man-power that Victoria’s hydro-electricity capacity was greatly expanded. The Eildon Dam, built in 1927 was enlarged in 1955 in part to allow for a hydro-electric plant. Likewise the Hume Dam was enlarged in 1961 for the same reason. The Dartmouth Dam, completed in 1978, was constructed for the combined purposes of water storage and hydro-electric plant.

Heritage - Theme 4.3: Hydro-electricity schemes

Rubicon Hydro-Electric Scheme (VHR H1187)

4.4 Industrial water use in the postwar period

Since the replacement of steam power with electricity in the early twentieth century, water has played a less direct role in the generation of power for industry, although many industries are now using hydro-electric power. Water nevertheless remains a fundamental requirement for many industrial processes, for example in timber pulping, mining, food processing, breweries, paper-making and the manufacture of many building materials such as bricks, cement, concrete, plaster and medium-density fibreboard. For the relatively new ‘recycling’ industries, such as the manufacture of recycled paper, large amounts of water are needed for pulping and also at the flotation stage. Industries such as textiles continue to rely on water for washing, but the number of textiles mills and woollen mills in Victoria has fallen significantly in the postwar period. Snow-making in the Victorian alpine region uses relatively large amounts of water, but only for a limited period each year.

Heritage - Theme 4.4: Industrial water use in the postwar period

Fletcher Jones water tower (1960s), Warrnambool (VHR - H2101)


