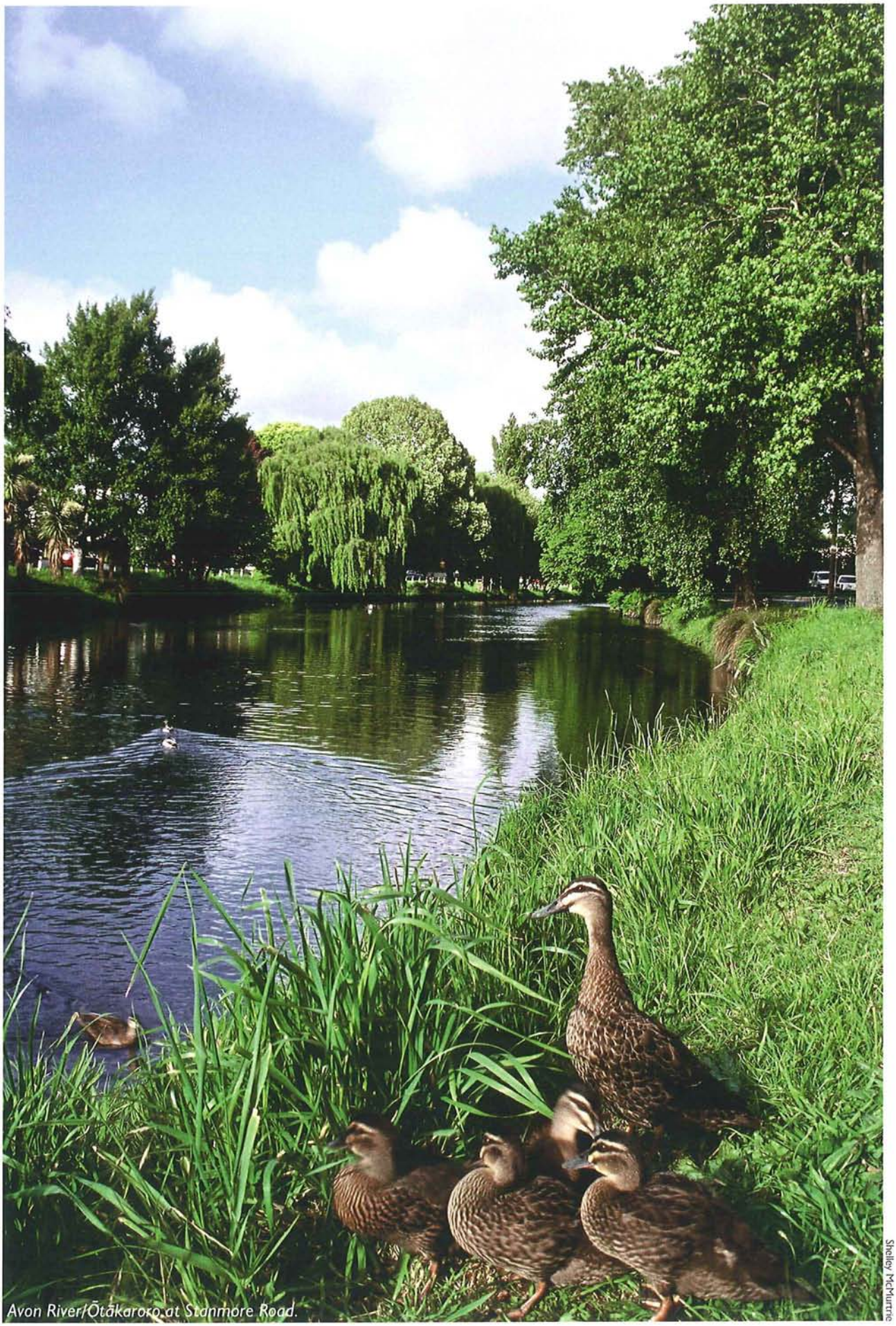
# 8 Lowland Waterways



Avon River/Ōtākaroro at Stanmore Road.

Shelley McMurtrie

## 8.1 Introduction

Waterways have long been a feature of Christchurch. Development of this city since European settlement has always been dominated by the need to drain the land and manage waterways. Initially, management of waterways was to prevent them becoming a health hazard to the early settlers. Drainage was such an important issue that Christchurch first established its own Christchurch Drainage Board in 1875, accompanied by individual legislation to manage the extensive network of waterways.

Today, this waterway network is unique in New Zealand, being one of the most extensive networks fed by spring-fed rivers. Within the city there are three main rivers, and a large system of artificial waterways and pipes (Table 8-1). The majority of the smaller waterways are located on private land, which has important implications for restoration, design and management.

Many waterways in rural areas such as the Marshlands area are deep, timber-lined drains (Figure 8-1A), which control groundwater levels as well as provide storm flow capacity. In urban areas, waterways are typically timber or concrete-lined if they are deep (Figure 8-1B), but may be earth-lined if shallow.

All tributaries should be managed as natural, self-sustaining systems that support a range of values. Improvements to waterways will generally involve naturalisation and restoration, rather than piping.

A significant constraint on achieving ecological, recreational, and landscape values, and attempting to facilitate natural processes for lowland waterways, is lack of space (i.e. sufficient buffer width between development and the water's edge). For greenfields development (new subdivisions in urban growth areas), waterway corridor width is a crucial design parameter, over which the developer has some level of control. A generous corridor width will facilitate natural functioning of the waterway in terms of its ecology, and enhance other values. To better protect waterways from catchment modifications a waterway corridor of reasonable width should be protected.

Unfortunately, most waterways that flow through existing urban areas have a restricted corridor width. This invariably results in a profile with steep banks, the use of structural materials for bank stabilisation and often a straight, uniform channel offering little habitat heterogeneity. In these situations, the potential for ecological restoration is reduced. This should not preclude waterway naturalisation, but the potential limits to ecological restoration should be recognised.

*Table 8-1: Total length of the three main river systems, smaller waterways, and artificial waterways in Christchurch.*

| Waterway | Length (km) | Catchment Area (km²) |
|---|---|---|
| Avon River/Ōtākaroro | 25 | 70 |
| Heathcote River/Ōpāwaho | 22 | 100 |
| Styx River/Pūrākaunui | 18 | 50 |
| Natural tributary waterways | 140 | |
| Artificial waterways | 150 | |
| Stormwater pipes | 500 | |



*Figure 8-1A: Many rural streams have been entrenched and timber lined in order to control (e.g. lower) groundwater levels and provide for storm flow capacity. Cavendish Road Drain, Marshlands.*

*Figure 8-1B: Timber lined drains are relatively common throughout the Christchurch urban waterway system, and are an artifact of past views of land drainage and waterway management. New timber-lined drains, however, are no longer acceptable.*

*Table 8-2: Summary of the Proposed City Plan waterway categories. Christchurch waterways were classified in the early 1990's and each category was assigned a 'setback'. Refer to City Plan General City Rules 9, section 5.2.4 (Christchurch City Council 1999).*

| | Category | Features | Examples |
|---|---|---|---|
|  | **Utility Waterways (to be piped)** | | |
| | 3 m setback | Degraded waterways with minimal values, and little or no potential for naturalisation. No or very poor low flows. Require piping. | Extensive piped system around Christchurch. Includes some man-made drains that were never originally natural waterways, such as Horners Branch Drain. |
|  | **Open Utility Waterways** | | |
| | 5 m setback | Modified natural waterways and artificial drains, including timbered drains, concrete-lined channels, concrete dish channels and pipes. Vary in condition, with some having good base flows. Offer naturalisation opportunities. | Timber-lined waterways in the Marshlands area, Styx Railway Drain, and utility waterways around Hendersons Basin. |
|  | **Environmental Asset Waterways** | | |
| | 7 m setback | Include both natural waterways and some artificial drains, which often have good base flows. Unlike the downstream rivers which are often alongside public land, the tributaries are located mostly on private land. | Tributaries connecting to the main rivers: Jacksons Creek flowing to the Heathcote/Ōpāwaho, Okeover Stream at the University of Canterbury, and Papanui Stream between Halliwell Avenue and Dudley Creek. |
|  | **Upstream Rivers (Rural Zone and Other Zones)** | | |
| | 20 m setback rural zones,<br>10 m setback other zones | Surface widths of less than 10 m at normal flow. Generally natural in character, meandering and spring-fed. Under base flow conditions they can often have clear water, riffles and some pools. | Upper reaches of the main rivers: Dudley Creek from corner of Warrington and Hills Roads, Wairarapa Stream, Waimari Stream, Knights Stream, and Nottingham Stream. |
|  | **Downstream Rivers** | | |
| | 30 m setback generally,<br>15 m setback at Mona Vale | Broad, expansive surface width of 10 m or more at normal flow. Downstream rivers are generally located adjacent to public land. Both lower reaches of the Avon/Ōtākaroro and Heathcote/Ōpāwaho are subject to tidal influence. | Lower reaches of the Avon/Ōtākaroro, Styx/Pūrākaunui, and Heathcote/Ōpāwaho Rivers. Halswell River/Huritini to the CCC boundary, and the Ōtūkaikino (south branch of the Waimakariri River). |
|  | **Hill Waterways** | | |
| | 10 m setback | Steep slopes, ephemeral waterways with erosion-prone soils. Most only flow after rain events, although several springs and seepages are located throughout the hills. Provide good restoration opportunities, especially in the gullies and headwaters. | All waterways located on the Port Hills. These range from natural waterways, such as Taylor's Mistake Stream, to channelised waterways, such as the lower reaches of Victory Drain. |

## 8.2 Waterway Categories

Waterways have been classified into categories in the Proposed City Plan (Christchurch City Council 1999, Table 8-2). General City Rule 9, section 5.2.4, relates to the 'waterway setback' rule where resource consent (discretionary) is required to build, fill, or excavate alongside a waterway.

## 8.3 Issues for Waterway Restoration

In the past, many waterways have been designed with little or no consideration to values other than drainage. Sibleys Drain (a concrete-lined channel that carves its way through a residential subdivision in Bowenvale Valley, Figure 8-2), and Wilderness Drain (a large timber-lined channel that occupies a three metre wide corridor through the residential Spreydon area) exemplify this tendency. The common practice among adjoining residents of erecting paling fences on both sides of a utility waterway expresses their low opinion of its appearance and potential values.

Waterway naturalisation rather than piping is the preferred improvement option where opportunities for naturalisation exists, both now and in the future. Preferred elements of a naturalised waterway include the following:

- planting of shrubs and trees along stream margins
- narrow low flow channel on a sinuous alignment
- a heterogeneous channel form
- open and see-through fences.

In particular, in areas with reliable groundwater levels and spring-fed base flows such as Papanui and Marshlands, waterway naturalisation is always the preferred improvement option. However, proximity of existing development may mean waterway piping is the only practical improvement option.

Street frontages and public open spaces are locations that merit particular attention to landscape and visual amenity. These areas are often the only places where passersby may view waterways. Such areas can be used for interpretation and help provide a more natural environment within an urban landscape.

The restoration of waterways along street frontages may be limited by space, but they still have good restoration potential (Figure 8-3A). Where waterways pass through reserves or other land accessible to the public, a wide corridor is needed for waterway naturalisation. The additional space in public reserves can potentially allow for the creation of a more natural, meandering waterway with a good riparian zone (Figure 8-3B); factors which are often hard

*Figure 8-2: This concrete-lined drain offers no ecological or landscape values. Sibleys Drain through Bowenvale Valley.*


*Figure 8-3A: Stream restorations along a street are limited by space, but can still offer some restoration potential and create a visual amenity. Dudley Creek at Jameson Ave.*

*Figure 8-3B: Streams within public reserves are good candidates for restoration due to the space available. Jacksons Creek at Cameron Reserve.*

to realise in areas where space is limited. Such a waterway can also contribute to the recreational values of the reserve. It is important to discuss reserve contribution with the Parks and Waterways Unit.

Waterway piping should be considered only as a last resort for any waterway through publicly owned land where public access is available. Redevelopment can provide opportunities for day lighting: the opening out of a deeply incised waterway, or replacement of a pipe with a naturalised waterway.

A long term objective is to replace all waterways in urban residential areas that are in a purely functional state, with naturalised waterways or stormwater pipelines; whichever is the appropriate treatment in terms of identified criteria. Long term costs must be considered to ensure sustainability of the system. It is generally a requirement for development within residential areas that any existing utilitarian waterway be naturalised or piped. New utility waterways are no longer considered acceptable in residential areas.

The following important drainage functions need to be considered if undergoing waterway restoration:

- stormwater capacity
- groundwater control
- surface runoff interception.

*Figure 8-4: The Ōtūkaikino supports diverse invertebrate communities now absent from most urban streams in Christchurch. This includes the mayfly,* Deleatidium *(right), which prefers clean substrates and good flows.*

### Rural Waterways

Waterways within rural areas, or very large concrete-lined waterways (e.g. Sibleys Drain and City Outfall Drain), will be retained as utility waterways for the foreseeable future. Every opportunity should be taken to restore rural utility waterways and make them a feature of the property, particularly at time of subdivision or land use change. Rural streams that are currently in good health should also be protected from the impacts of development as much as possible. For example, the Ōtūkaikino (south branch of the Waimakariri River; Figure 8-4) and its tributaries should be protected from catchment development.

### Low Flows

Very low flow conditions or the temporary drying out of waterways may become an issue in some systems. Note however, there are many headwater streams that are naturally ephemeral (temporarily dry out), and thus should be appreciated for this feature as well. Restoration of naturally ephemeral streams should also be considered (Figure 8-5).

*Figure 8-5: Waterways that are naturally ephemeral (dry out at some times of the year) should be appreciated for this feature, and are still good candidates for restoration. Headwaters of Wairarapa Stream.*

For waterways that are not naturally ephemeral, augmenting flows may be a consideration. This can be achieved by intercepting and diverting flow from a neighbouring catchment or stormwater pipeline but the following need to be considered first:

- Removal/diversion of water from a stream will negatively impact on that system, thus water should not be diverted from stream systems with some ecological potential. Piped waterways and utility waterways of little ecological potential can be considered for water interception.

- Tankata Whenua may have reservations about the mixing of waters, and should always be consulted.

It is important to carry out a thorough investigation before considering the diversion of flows, involving consultation with freshwater ecologists, hydrologists, engineers, and local communities.

There are other factors that are not related to waterway design that can improve low flow levels in Christchurch's waterways. These mainly relate to reducing water usage and wastage in order to retard the lowering of groundwater levels. Information can be obtained from the Parks and Waterways Unit.

### Design Considerations

Refer to *Chapter 9: Restoring Waterway Form, Chapter 10: Restoring Wetlands,* and *Chapter 11: Riparian Planting,* for design guidelines for the ecological naturalisation or restoration of lowland waterways and wetlands.

## 8.4 Maintenance of Rivers

Aquatic vegetation is harvested from the lower reaches of Christchurch's rivers by weed-cutter boats. Harvested weed must be unloaded periodically via conveyer onto the bank. An open area of waterway bank at least 10 m wide, that is accessible from the water level to the road edge, is needed at intervals between 200–500 m to convey cut weed. Boats are launched by crane at selected sites. Bank works in the vicinity of a launching site need to provide for boat access to and from the water.

There are specific maintenance requirements for known inanga spawning sites listed on the Parks and Waterways river maintenance documents. There is a prohibition on cutting bankside vegetation during the inanga spawning season; February to May.

As significant amounts of litter enter waterways via piped stormwater outfalls, litter traps have been installed at many large outfalls. Any bank works proposed in the vicinity of outfalls of 1 m diameter or more must be suitable for litter trap installation and access for clearing by a truck with lifting gear.

Sediment accumulates throughout the waterway system. Where there are known or anticipated problems, designers should consult with the Parks and Waterways Unit regarding removal options.

Refer to *Chapter 19: Operations and Maintenance,* for information and a checklist regarding maintenance of lowland rivers and smaller waterways.

## 8.5 Water Races

Water races are primarily designed to transport water to farms for stockwater use. However, besides these practical uses they can also have significant ecological values. The Paparua water race system (Figure 8-6B), managed by Selwyn District Council, diverts water from the Waimakariri River. It extends into the Christchurch district and contributes to the base flows of tributary waterways of the Heathcote/Ōpāwaho, Avon/Ōtākaroro, and Styx/Pūrākaunui Rivers. Information on water races is available from the Parks and Waterways Unit.

A study of the ecological values of water races by McMurtrie et al. (1997), found that a variety of native vascular and aquatic plant species were thriving (22 vascular, 10 aquatic). Diverse, healthy invertebrate communities were observed at several sites, including some pollution-sensitive species at sites close to the diversion from the Waimakariri River. Some locations were also home to three species of indigenous fish (torrentfish; Figure 8-6A, upland bully, longfin eel), and reasonable numbers of immature brown trout.


Shelley McMurtrie


*Figure 8-6A: Torrentfish were found in the Paparua water race, close to the Waimakariri River.*

*Figure 8-6B: The Paparua water race diverts water from the Waimakariri River, and contributes to base flows of some urban streams. Sections with good flow and coarse substrate can support reasonable fish and invertebrate communties.*

It is important to always consider creative options for retaining and enhancing water races. Supplementary uses for water races and their water include:

- augmenting stream base flows
- augmenting groundwater for shallow well users
- providing water for rural fire fighting
- enhancing landscape and recreational values
- enhancing ecological features (e.g. refuges for rare plants and fish)
- contributing to and enhancing the network of surface waterbodies and associated riparian networks that exist in the Christchurch region.

If contemplating the closure or relocation of a water race, consider the above uses as a means of providing additional benefits for a development. Should closure or relocation be considered the best option, then statutory procedures must be followed under Section 427 of the Local Government Act. Consult the Parks and Waterways Unit at the earliest opportunity.

Agriculture New Zealand et al. (1997) investigated the management of the Paparua water race system, and along with McMurtrie et al. (1997), made recommendations for the management and more equitable rating of water races.

## 8.6 References

Agriculture New Zealand Ltd., Glasson Potts Group Ltd. & Pattle Delamore Partners Ltd. 1997. Paparua Water Race System Review. Report prepared for the Selwyn District Council and Christchurch City Council. Agriculture New Zealand Ltd., Glasson Potts Group Ltd. and Pattle Delamore Partners Ltd., Christchurch.

Christchurch City Council 1999. *City of Christchurch City Plan. The Proposed District Plan for the City of Christchurch*. Christchurch City Council, Christchurch.

McMurtrie, S., Milne, J., Ward, J. & Meurk, C. 1997. Assessment of Ecological Values of the Paparua Water Race System. Report for the Christchurch City Council. Report No 2759/2. Lincoln Environmental, Lincoln.