An ecological garden – a new future for a one kilometre concrete channel

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Key Points

- Transformation of one kilometre of concrete trapezoidal channel
- Ecological, cultural and landscape restoration
- Not bounded by any intention to recreate a pre-European waterway or its idealised form
- Design approach was highly conscious of the process of the creation of a new landscape and was conceived of as an *ecological garden* as much as a waterway restoration project

Abstract

As part of a new development in Western Sydney one kilometre of concrete trapezoidal channel was transformed. The design sought to achieve not only an ecological restoration but also a cultural and landscape restoration.

The restoration tells a story about waterways and our historical and cultural relationship to creeks, flood waters and these spaces in our environment. Rather than completely removing any evidence of the concrete channel, sections were retained, but 'punctured' with random 'potholes' in the channel, which were planted out. These elements sought to retain a physical memory of what the channel once was and to draw attention to its deliberate removal, rather than to simply eliminate any evidence of the concrete channel.

The trapezoidal form of the channel was highly artificial. Flooding and its impacts on existing development significantly constrained options that would allow any restoration of a low flow channel and a floodplain. Hence our approach to ecological restoration was not bounded by any intention to recreate a pre-European waterway or its idealized forms.

Our approach was to design a waterway landscape for visual interest using a geometric ecological tapestry in the creek itself. The waterway was designed as a landscape for people. The design took its inspiration from both cultural and ecological references - camping on grassy banks of creeks and creeks which are a mixture of softscape, hardscape and water. The design approach was highly conscious of the process of the creation of a new landscape and was conceived of as an *ecological garden* as much as a waterway restoration project.

Keywords

Waterway restoration, ecological garden, cultural restoration, landscape restoratio

Introduction

This paper outlines the design process and design thinking in the removal of one kilometre of trapezoidal channel. The channel restoration was part of a new residential development in Western Sydney, approximately 30km west of the Sydney's CBD. As part of the sustainability *and* landscape initiatives of the new development, it was proposed to replace the concrete lined channel with a naturalised waterway. The proposal was based on achieving ecological, habitat and landscape improvements to the existing channel.

The waterway is a tributary of Breakfast Creek and consists of concrete lined channel both upstream and downstream of the one kilometre restoration site.

A concrete lined channel

The concrete lined channel was typical of channels constructed in greenfield residential in the 1970s and 1980s in Western Sydney and across many parts of Australia. The former creek was channelised into a trapezoidal channel and the base was concrete lined. The trapezoidal channel was constructed to convey the 1 in 100 year ARI flows entirely within the channel without overbank flooding and hence was disconnected from its 'floodplain'. Houses were built with minimal buffer to the top of bank and in some cases were constructed right up to the top of bank. The channel banks were steep typically 1 in 3, were grassed and had minimal vegetation. Trees that had established were typically hardy casuarinas that had self-seeded. Council periodically cleared trees to maintain flood conveyance.

Figure 1. Tributary of Breakfast Creek prior to restoration

Initial stages of restoration

After agreement was reached between the developer and Council about the restoration of the waterway the design team consisting of a flood modeler, civil engineer, waterway engineer and landscape architect undertook a number of preliminary investigations. As existing development was immediately adjacent to the channel it was not possible to raise flood levels within the project site.

Flood modelling was undertaken in Tuflow to determine what increase in channel width was required to compensate for the loss of hydraulic efficiency if the existing concrete lined channel incorporated more vegetation and rougher bed and banks. The upstream and downstream levels were fixed and hence the overall grade of the channel was fixed. The civil engineer developed an initial base digital terrain model based on the initial flood modelling, and after a series of iterations it was confirmed that the channel could be naturalised without impacting on flood levels.

Design approach

During this initial stage, the design team also considered what should be the approach to the new waterway. A key design approach was not to attempt to recreate what a natural waterway may have been in Western Sydney. There are minimal documented descriptions of the local pre-European stream forms of Breakfast Creek and its tributaries. It is likely that across Western Sydney there was significant diversity of stream form

given the wide differences in topography, stream order, catchment size and vegetation. Little was known about the existing tributary of Eastern Creek.

The design team was significantly restricted by flooding constraints to working within a very confined corridor, waterway width and bed slope. The waterway corridor alignment was also predominantly fixed by existing development, levels and established trees. There was no opportunity to re-connect the waterway with any sort of historical 'floodplain'. Furthermore, there was limited opportunities to remove the concrete channel upstream and downstream of the site in the near to medium term as this was outside the boundary of the land owned by the developer and it was not a priority for Council to remove the concrete trapezoidal channel from the other waterway reaches.

Based on an analysis of these constraints the design approach was not to attempt to re-create an imagined Western Sydney stream form. Given it had limited connectivity to other natural waterways the design thinking was that the major benefits were at the local scale – and that these were best expressed by incorporating cultural, landscape and ecological components into the design. The form and shape of the recreated water was based on deliberate design-based decisions that played with the interaction of culture, ecology and landscape.

Cultural legacy

An example of the deliberate design approach that was taken was the approach to the concrete channel. While it was desirable to remove the concrete channel from an ecological and landscape perspective, the design team did not want to completely 'erase' the most recent history of the waterway. We were interested in the juxtaposition of natural waterway forms and the waterway's more recent engineered and utilitarian past. We wanted to reveal a portion of the site's histories and also to reveal the processes of regeneration by retaining a part of that history.

The specific manner that was done in this instance, was for sections of the concrete channel to be 'punctured' with random 'potholes' in the channel These potholes formed deliberate mini wetlands and these were planted out with macrophytes. This is shown in Figure 2.

Figure 2. Recreating a 'chain of ponds' – left potholes formed but not planted during construction and right 24 months after construction and planting has established

As can be seen in Figure 2 the landscape design was deliberately 'rough' and 'raw'. The objective was not to beautify the concrete channel, but to draw attention to the partial removal of the channel and to create a highly artificial 'chain of ponds'. In the process we were deliberately mocking our *own* lack of understanding of the pre-European form of the waterway.

The restoration allowed us to tell a story about waterways and our historical and cultural relationship to the creek and their role in the urban environment. These elements retained a *physical* memory of what the engineered channel once was and aimed to draw attention to the end of a specific era of waterway management and the beginning of a new era and a new landscape aesthetic.

An ecological garden

Another example of the deliberate design approach that was taken was the design approach of the waterway as a landscape. It was designed as a 'garden' with ecological values. The form of the waterway was strongly influenced by the desire to create visual interest in the waterway. We were extremely conscious of the desire not to replace the concrete lined bed with 'green cement', whereby the mass of concrete was simply replaced with an uninspiring and visually uninteresting mass of a single species of plant which dominates the waterway and has minimal ecological diversity.

This is a significant risk in Western Sydney where conditions are well suited to the establishment of typha and many waterways are almost entirely dominated by Typha which contain minimal diversity and minimal landscape interest and hence minimal community interest. An example of this channel form is shown in Figure 3. This site was close to our project site and visiting this waterway and others like it, had a strong influence on the design approach that we adopted.

Figure 3. A typical typha dominated channel in western Sydney

An obvious criticism of the engineered waterways from the 1970s and 1980s is that they have been significantly straightened and channel complexity reduced. This has partly resulted in the most recent

generation of waterway engineers and designers to avoid any geometric forms in waterway design, instead seeking more 'natural' curvilinear geometric form.

However, while visiting a number of natural creeks in national parks on the fringes of Sydney we were intrigued by the strongly geometric forms that we encountered. This included channels constrained by cliff lines into straight channels, channels with almost near horizontal changes in the bed profile caused by geological faults in the underlying bedrock. These forms created strong points of interest in the natural waterways.

Taking these natural elements as design inspiration, we consciously designed geometric forms into the waterway as the underlying form for the shape of the channel bed. This was done in two conscious ways. The first was through a low flow channel, which 'meandered' in a geometric shape and form - varying between straight sections and right-angle bend in its form at 'meander' bends.

The second geometric form was strongly related to a strong desire to avoid creating 'green cement'. The design approach that was taken to avoid this was to deliberately design the bed of the waterway to have a geometric mosaic of areas with different levels. The approach to the design to the bed of the waterway, where the concrete was being removed, was analogous to that of designing a garden bed. We designated clearly defined areas for certain types of planting. This is shown in Figure 4.

Figure 4. An ecological tapestry – left during construction and right 18 months after construction

We did this through the shapes and also by the levels of the bed of the waterway. Some of the areas were set higher so they would only be inundated infrequently, while some were designed to be inundated regularly but to ensure they had dry spells, while other areas were set to create wetland areas and which would stay wet for long spells. By varying the levels, we could vary the amount of moisture in the different areas and be more certain of creating a richer tapestry of planting, which responded to the different hydrological conditions of the creek.

As the channel had a persistent trickle base flow we deliberately constrained this flow into specific areas in the design so that we created large areas of the channel bed which were not conducive to typha or other dominant macrophyte species such as phragmites, rather than allowing this to provide conditions suitable for typha across large areas of the base of the channel.

Conclusions

The waterway restoration was consciously designed as both a landscape for people and for ecological diversity. The design took its inspiration from cultural, landscape and ecological references – the history of the waterway itself; camping on grassy banks of creeks; waterways which are a mixture of softscape,

hardscape and water. The design approach was highly conscious of the process of the creation of a new landscape and was conceived of as an *ecological garden* as much as a waterway restoration project.

As part of this process we were conscious of the design paradoxes that emerged as part of the waterway restoration project: the past in the present/the present reconfigured as a past; nature reconfigured as culture/culture reconfigured as nature and we used these paradoxes to tell a story of time and place which is not exactly what it seems at first glance.

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