

LOW IMPACT DESIGN ON A CATCHMENT WIDE BASIS IS IT BETTER THAN SITE BY SITE?

ABSTRACT

This paper outlines the advantages and disadvantages of low impact design approach to management of stormwater quality and quantity in two catchments currently being studied within Manukau City. The soils in these catchments like other parts of Auckland are of low permeability and therefore present a high degree of constraints to implementation of on-site treatment of stormwater. The paper also discusses the issues relating to ownership, management and maintenance responsibilities of on-site and publicly owned stormwater assets.

The approach taken by Manukau City Council in both retrofitting and developing greenfield catchments with low impact design stormwater systems is also discussed in this paper.

KEYWORDS

Low impact design, Stormwater quality, Flood control, Stormwater ponds.

PRESENTER PROFILE

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1. Introduction

Like many greenfield areas in the Auckland region which are currently under development, there has been limited opportunity in Manukau City to establish onsite

stormwater treatment and flow control systems. The reasons for this are outlined in this paper and until local authorities and the ratepayers accept the future maintenance and management risks associated with extensive onsite stormwater systems, it is unlikely that such systems will be adopted in many of the new development areas in the Auckland region.

There is also a great need to educate many professional disciplines that are involved in stormwater management who and believe that they all fully understand the stormwater requirements for their proposed development, especially during the planning stage. Assumptions made by ecologists, planners, urban designers and engineers are often not thought through including implications for the entire lifecycle of the assets, and all the constraints presented in the catchments.

Sometimes it is very late in the planning process when appropriate advice is sought to resolve problems associated with proposals for stormwater infrastructure and this can result in unnecessary waste of time and significant costs.

The paper provides examples of two catchments, Otara-Flat Bush catchment and the Puhinui catchment where catchment based stormwater quality treatment measures and flood management measures have been implemented. In the Flat Bush greenfield catchment detailed planning has been undertaken, and catchment based flood control and stormwater quality systems are being systematically implemented ahead of development.

2. Low Impact Design and Applicability for Manukau Catchments

The term Low Impact Design (LID) is based on the definition of the Auckland Regional Council (ARC) Technical Publication 124, which defines LID as being an alternative natural approach to site design and development, that protects and incorporates natural features into erosion and sediment control and stormwater management. The 'term low impact design' can be confused with stormwater controls on individual development sites and at a catchment level. For this reason it is important that the term 'low impact design' should not be applicable to individual sites as low impact design is seen at detailed site level.

For LID to function well and have long term benefits, the site needs to have soils with high permeability, relatively flat topography and minimal flood flow control requirements in the catchment.

The two catchments discussed in this paper have low permeability soils (clay and silts) and flood control requirements as key factors that drive the overall strategy for a catchment based and cost effective stormwater systems.

3. Puhinui Catchment

The Puhinui catchment covers around 2000 hectares and its main drainage system comprises a central stream (Puhinui Stream) which was highly modified during 1970s and 80s to increase the efficiency of the stream to carry flood waters. The sites for the proposed stormwater management ponds and the extent of the catchment are shown in Figure 1 below.

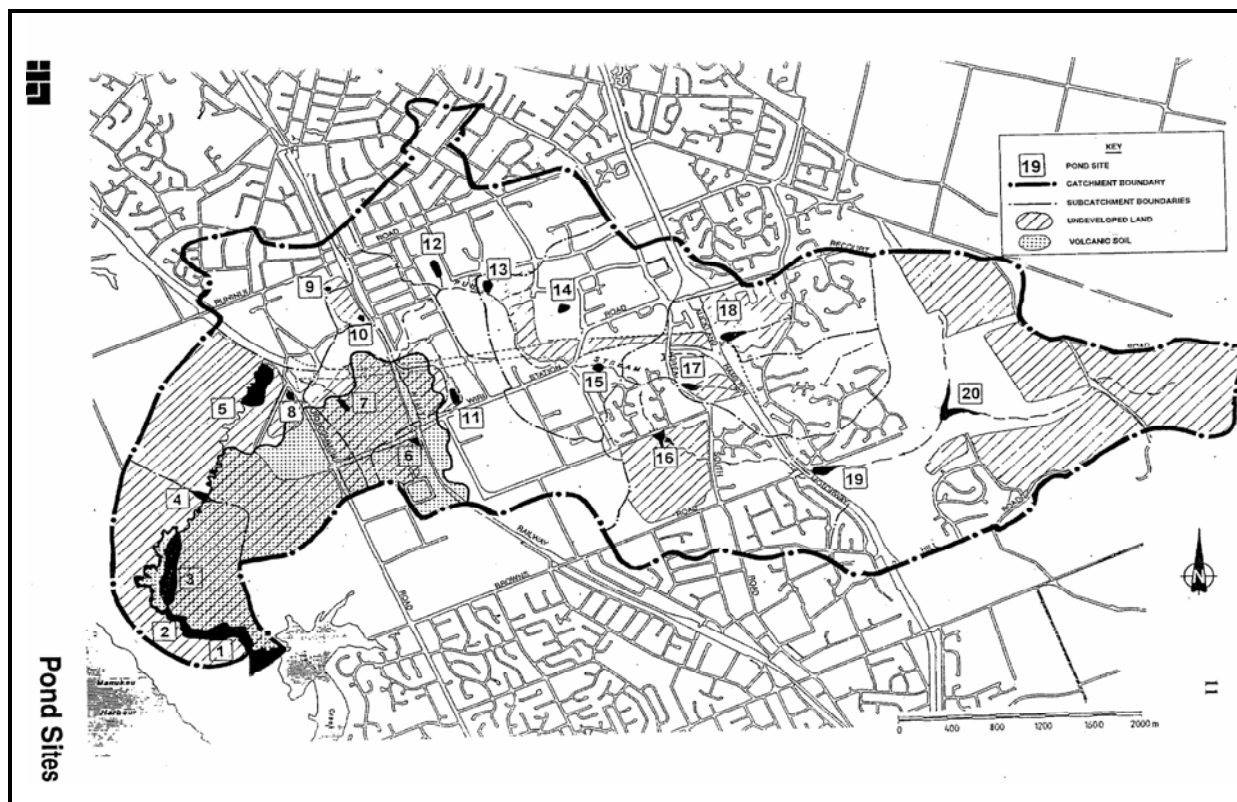


Figure 1 - Puhinui Catchment Boundaries and Stormwater Pond Sites

In early 1990s after the Resource Management Act 1991 came into force, the Council undertook an assessment of options to provide stormwater quality control systems in the Puhinui catchment. This study undertaken by Beca in 1992 proposed a series of stormwater control ponds across the catchment. Two stormwater ponds that were built in the 1970s did not meet current requirements as these ponds (Hayman Park and Wiri Ponds) were constructed without forebays and the Wiri Pond was located online in the main stream. The proposed stormwater quality treatment ponds can easily accommodate flood control volumes as these ponds are located within Public Open Space and in drainage reserves. This gives the Council the ability to modify and enlarge these ponds to meet current requirements.

The advantages of catchment based planning for water quality in Puhinui catchment are:

- Council's ability to apply financial contributions to all developers to obtain funding for the water quality infrastructure.
- Council's ability to upgrade and incorporate modifications to stormwater ponds to meet current day requirements.
- Council's ability to manage and maintain the structures to the required standards.
- The ability to incorporate stormwater structures as part of the overall development of parks and reserves and provide facilities with amenity values to the public.
- The rates paid by property owners can be directly related to these assets and enable on-going maintenance costs to be met.

The Puhinui catchment has been progressively developed over the last 40 years and the Council has undertaken improvements to specific stormwater projects including:

- Upgrading of the Wiri pond to create an off line forebay, and enlarging and cleaning the existing pond.
- Construction of the Everglade pond to provide for water quality treatment and flood control measures for a residential catchment upstream of highway 1.

- Construction of several stormwater treatment ponds along the State Highway 1 – 20 link with New Zealand Transport Agency, including cost effective treatment of run-off within the catchment.

The upgrading and enhancement of Hayman Park pond is currently being investigated to allow for city centre development, including the future railway, bus interchange and Manukau Institute of Technology campus area which discharge into this pond.

4. Flat Bush Catchment

The Flat Bush catchment is around 2000ha and the stormwater management concept developed by Beca in 2001 is shown in Figure 2 below.

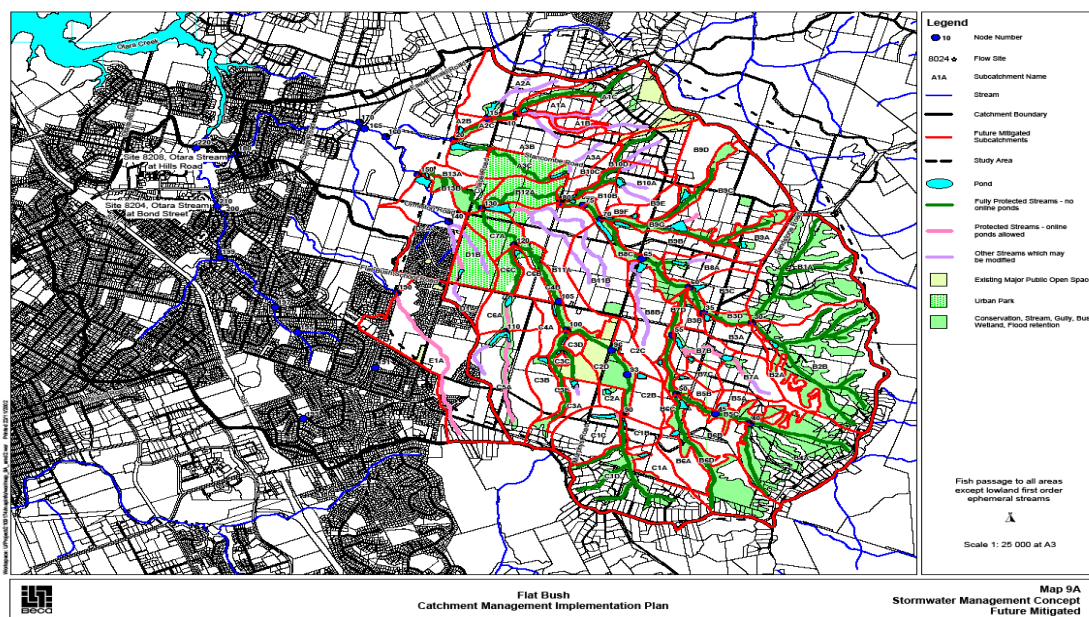


Figure 2 - Stormwater Management Concept Plan for Flat Bush Catchment, Manukau City

The Flat Bush catchment was well planned for stormwater management during late 1990's and early 2000. The planning of this catchment was on the basis of the following key outcomes:

- That the post development run-off from the catchment does not exceed the pre-development peak discharges.

- That stormwater management areas [referred as green fingers] are preserved and enhanced to provide ecological corridors, avoid structures and buildings and provide for flood conveyance.
- That all stormwater flood control and water quality devices are located off-line and the peak discharges from these sub catchments are controlled.

The early identification and setting aside of stormwater management areas at a catchment level helped to provide the Council with the following controls

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- Require developers to either contribute [financial contributions] costs towards all of the stormwater assets or to vest these assets free of charge.
- Provides certainty for Council future assets and maintenance requirements and the forward planning of this.
- Minimise adverse effects on the downstream catchment

This catchment based design for Flat Bush can be considered to be a low impact design approach although individual sites do not provide any stormwater treatment or flood controls.

The total value of stormwater ponds, stormwater management land and riparian planting in this catchment is estimated at \$70M and therefore these assets will carry a significant maintenance requirement. If individual on-site approach had been taken to control the effects of stormwater, then a similar value of works would have to be carried out and maintained by private property owners. This would require an extensive monitoring and compliance regime and educational programme for the owners of on-site devices. This approach could result in the property owners requesting rebates on their rates and therefore is considered to be not practical to implement in large catchments like this.

SUMMARY

Low impact design measures are inappropriate for catchments where there are significant flood control and low permeability soils present. In these catchments, it is

considered that catchment based solutions owned and managed by Councils are the most practical.

If on-site treatment systems with private ownership are to be proposed then it is important to consider an extensive monitoring, compliance and education programme.

The Puhinui and Flat Bush catchments in Manukau are examples of catchment with stormwater treatment solutions which are based on a low impact design approach that really works.

REFERENCES

Beca Carter Hollings Ferner Ltd, 1995 – Comprehensive Catchment Treatment Pilot Study prepared for Auckland Regional Council and Manukau City Council [for Puhinui Catchment].

Beca Carter Hollings Ferner Ltd, 2001 – East Tamaki Comprehensive Catchment Management Plan prepared for Manukau City Council.