

STORMWATER MANAGEMENT: A COLLABORATION TOOL

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ABSTRACT (200 WORDS MAXIMUM)

The opportunities of stormwater management can be utilised by many disciplines when developing concepts for urban design, landscape architecture and master planning.

Combining the needs of stormwater management with the various disciplines requires lateral thinking as well as opportunities to get involved early in the development process. Unique aspects of a project can be reflected in the application of stormwater management design and ongoing interaction with the natural resource of rainfall.

Well established tools are available for the design of best practical options to deal with the primary stormwater management needs. The management of larger rainfall events have been successfully considered by using catchment wide studies. The key to successful design is to integrate with other disciplines for the longevity of the project and benefits for the wider community involvement.

Education facilities and opportunities can be introduced to open the minds of the public to the importance of good stormwater management.

This paper presents case studies on the development of stormwater management to meet the needs of the urban planner, landscape designer and master planning of unique areas.

KEYWORDS

Stormwater management, urban design, landscape architecture, master planning, collaborative outcomes

PRESENTER PROFILE

Bronwyn Rhynd is an environmental engineer and managing director of Stormwater Solutions Consulting Ltd with a wide range of experience over the last 15 years of designing and supervising the installation of stormwater management systems, including low impact and innovative solutions for the built environment. She has experience in resource consenting from the application (to consenting authorities) through to expert witness for hearings on various projects involving stormwater management and best practice issues. She has undertaken several projects where collaboration with various project disciplines has resulted in award winning outcomes.

1 INTRODUCTION

Stormwater management can be incorporated into many other disciplines that are utilised to create unique open spaces and recreational areas that support the built environment. If introduced early into the design process the results can be beneficial to all aspects of the project as they can be combined to meet the design outcomes and ultimately help fulfil the design "story".

There are many good examples of stormwater management devices that meet the needs of the treatment and conveyance however if combined with other disciplines these devices can become extraordinary features that become a statement in the landscape design. This can also be reinforced with good educational prompts that educate the public into the operational aspects and functionality of the device itself.

Examples of these collaborative externalities that become part of the landscape are presented in a case study of Judges Bay as a "jewel of the Auckland inner city".

2 STORMWATER MANAGEMENT & COLLABORATION OPPORTUNITIES

2.1 CREATING THE OPPORTUNITIES

When the design aspects of a project are reviewed they are considered as being tools to enhance the natural and built environment, whether this is for a commercial, residential or recreational project or point of view. These design aspects often do not consider the engineering design that is required to create the urban or landscape "vision".

By including the stormwater designers in the early stages of creating the design goals the benefits are that the engineering design outcomes will be in sympathy or in synergy with the urban design outcome. This is a very simplistic view of the creating an opportunity however an uncommon approach to stormwater designing and it takes great vision by urban designers to recognise the importance.

Collective design ideas and outcomes can be exchanged at the early stages of the project. Providing a forum for the design team, which includes all aspects of the project, can be held at the beginning of the project so that the understanding of each discipline can be exchanged and a cross discipline understanding can be created to provide linkages through all stages of the project.

The industry wide movement toward more sustainable and resilient designing has highlighted the natural resources as being fundamental design building blocks. Stormwater is a natural resource that is sustainable, albeit up for debate in some fraternities, and a good building block for landscape features. The use of capture, treatment and conveyance within the landscape is a natural choice for stormwater design to become part of early design process within projects.

With the creation of resilient building rating systems such as "green star" rating the focus on harvesting of rainwater has brought the attention of architects to stormwater device design. The integration into the architecture concepts has been embraced to a certain extent however can be extended into linkage between the natural and built environment by incorporating this aspect to both urban and architectural concept design stages as a holistic approach and integrating the two fundamentals of design for a project.

The use of running water can bridge the gap between understanding and integration of cultural needs. This cultural aspect is often expressed by various parties that may also not be involved with any design process, for projects other than infrastructure. The value of acknowledging the cultural aspects has been emphasised historically with success for many projects. By reviewing how the creation of the "need" to include the cultural aspects into the design process can be a way of creating the same opportunity for stormwater integration.

The use of stormwater management to include the cultural aspects of Maori ideology is a great synergy between the built environment and natural being of the land. It is a simple

way to include the needs of both meeting the cultural needs whilst implementing great design strategies. Treating the runoff before discharging to the receiving environment and essentially restoring the "toanga" of the stormwater runoff water within the catchment, can meet this cultural aspect of the design outcome or process.

2.2 STORMWATER DEVICES MEETING THE NEEDS

There are many methods of providing stormwater management within projects that range from green field developments through to retrofit (projects). The options considered for best practice can be developed with ease as many are tried and true stormwater treatment devices complete with regulatory approval in previous projects.

The regulatory review of projects is based on purely meeting the needs of the environment under the ultimate RMA goal of protecting and/or minimising the risk of environmental degradation. Therefore under the banner of *"avoid, remedy or mitigate any adverse effects of activities on the environment"*¹, the tried and true method of implementing stormwater management devices meeting these needs is fairly simple.

Providing innovation and diversion from the traditional methods is where the benefits for a project can really excel. The innovation and adaptation of the traditional approach to implementation of stormwater management is still meeting the regulatory needs however can provide benefits other than merely management of stormwater. This aspect can link into creating design tools for other project disciplines to create unique areas (within a project).

The management of stormwater can often be clearly defined in catchment management plans, which have been considered with other aspects such as fresh water management and geology to provide an integrated approach for the catchment. The implementation of the CMP ultimate goal for the catchment can be undertaken by providing a traditional approach to stormwater management design or stepping outside the norm. By implementing both of these design approaches the stormwater devices chosen as best practice can meet the CMP goals, however one may have an advantage over the other when looking at the project from the social environment needs, or indeed other project outcomes.

2.3 EDUCATING THE PUBLIC

Part of understanding the need for stormwater management is education as to why there is the need to implement stormwater management. Within projects there are opportunities to provide education facilities for the delivery of information on the stormwater device or catchment management of which the device is part of. This facility can also become part of the landscape feature or "way-finding" within the project.

Signage, or way-finding collateral, can provide a great way to inform the public on what the landscaping feature of a raingarden is all about. Visually they can see what the device is providing from a landscaping point of view however from a stormwater management treatment perspective this can be lost without the use of a "picture board" which is included in the signage of the project. This is best located in the public spaces as the volume of public foot traffic can benefit the most, however all is not lost within a small private commercial space either. The more times this information can be provided to the general public the more the information can be translated to others and further projects can have this facility built in.

¹ "[Section 5](#)". *The Resource Management Act*. Parliament of New Zealand. 1991
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Proving information is linking the built to the social environment and by doing so “completing the circle” as well as providing the transfer of information. This provision of information can also provide the results that are required of reduction of contaminants by way of understanding of the public in what has to be undertaken to reduce the risks of water pollution. And hence the RMA goals of avoid, remedy or mitigate adverse effects is understood by the public, or at least hopefully explained in order to provide a vehicle for understanding.

3 CASE STUDY – JUDGES BAY

3.1 BACKGROUND

In 2009, Auckland Council initiated the Citywide Coastal Upgrade Programme aiming to protect and enhance the unique features of our coastal environment, with Judges Bay Beach Replenishment project being included in this programme.

The Auckland Council’s vision of Judges Bay project is to develop a quality open space destination, by providing an all-tide beach and improving visitation experience to this unique beach that is rich in Maori and European settlement history.

The project was carried out in two stages. Stage 1 was to create a new beach to provide all-tide swimming, and to upgrade the stormwater outlet to the bay. Stage 1 was completed in 2010 by Tonkin and Taylor Ltd.

Stormwater Solutions Consulting Ltd (SSCL) was involved in the stage 2 of the project which focused on foreshore landscape improvements. SSCL were to provide stormwater management expertise in support of the consortium design team led by Reset Urban Design.

3.2 STORMWATER MANAGEMENT NEEDS

Two fundamental needs of stormwater management (i.e. treatment and conveyance) are required for any development within the Auckland region, which is no exception with respect to the Judges Bay project.

There was no treatment for the stormwater runoff implemented for the Judges Bay catchment prior to this Judges Bay Beach Replenishment project. One of the project goals was to improve the water quality within Judges Bay therefore by treating stormwater runoff before releasing it (to the bay) it was established that this goal could be met.

Primary conveyance network is needed to convey runoff from the contributing catchment that drains towards the bay. At present there are two main branches, one from Parnell Rose Garden and the other from the Judges Bay Road. The design criterion for this conveyance system is to ensure that the service level is maintained for the rainfall event of 10% AEP.

In conjunction with the primary conveyance network the runoff during the larger rainfall events will need to be conveyed via overland flow paths. The overland flow paths will provide a conveyance system for surface flow towards the bay with the design criteria that they are not to be obstructed or provide a hazard for the built environment.

3.3 DESIGN AND COLLABORATION FOR STORMWATER MANAGEMENT

3.3.1 PRELIMINARY DESIGN STAGE

A consortium design team led by Reset Urban Design was formed for the Judges Bay Stage 2 project, which give SSCL the opportunity to be involved in the project right from the preliminary design stage, which included reviewing the initial concepts for landscape and urban design. This enabled SSCL to work closely with the landscape architects and other disciplines to deliver a design plan that incorporates the stormwater management needs with added aesthetic and cultural values.

At the beginning of the preliminary design stage, a quick initial assessment of the stormwater management system proposed in the concept plan, as shown in Figure 1, was undertaken.



Figure 1: Judges Bay Concept Plan

The outcome of this assessment together with the onsite investigation outcomes, several stormwater management design issues were apparent, such as the following:

- Constructability of stormwater treatment pond
 - The construction of a stormwater pond would be difficult due to the slope constraints.
 - The supporting catchment for the pond was small, less than 1 ha, therefore unlikely that the pond health could be maintained on a long term annual basis.

- If the pond was constructed the foot print would encroach onto open space area that was currently used for picnicking and social activities
- Extent of stormwater treatment
 - No stormwater treatment was proposed for the lower portion of Judges Bay Road
 - Stormwater management was limited to Stage 2 “deliverables” catchment however the top of the stormwater treatment train was proposed to be a pond.

These design issues are an example of where the benefits of including stormwater management into the project team early can be an advantage. Several solutions were proposed for the above issues as follows with the developed design plan shown in Figure 2

- Treatment pond alternative
 - A cascaded raingarden to provide the same level of stormwater treatment that a wet pond will provide, 75% suspended solids removal
 - The cascaded raingarden will have a smaller footprint and can merge with the contour of the ground
 - Landscaping and planting of the raingarden will merge with the surrounding environment
- Stormwater treatment catchment
 - The lower Judges Bay Road stormwater runoff treatment will occur through an underground proprietary unit
 - Any residential treatment required for Judges Bay Road catchment will occur through the proprietary device
 - The proposed raingarden will provide treatment for the catchment above by diverting runoff from the cesspits within Judges Bay Road



Figure 2: Judges Bay Developed Design Plan

3.3.2 COLLABORATION WITH OTHER DISCIPLINES

A collaborative approach was adopted for the project to ensure that each discipline worked in harmony with each other whilst proving the design outcomes each (discipline) were aiming to achieve. This also resulted in a stormwater management system that not only met the stormwater management needs, but also included design aspects from other disciplines.

Examples of the outcomes of collaboration is presented for some for the design elements, however more were undertaken for this project:

- Treatment versus constructability

Three treatment swales were initially positioned adjacent to the Judges Bay Road angle parking area, to provide treatment for road runoff. This posed a construction challenge for the roadside footpath at the lower portion of the road without significant amount of earthwork excavation. There was an archaeological site established within this vicinity therefore earthworks was needed to be minimised. SSCL worked with the landscape architects to swap swales with footpath to enable footpath being constructed without large areas of earthworks, and also replace the lowest swale with landscape features to maintain the consistent visual impression along the footpath.

- Access to treatment facilities

Due to the requirement of minimising earthworks the treatment devices adjacent to Judges Bay Road were to be located behind the footpath. Therefore SSCL designed a swale inlet to convey road runoff under/across the footpath to enable the swales to perform as initially intended.

- Returning history to the project

Historically there was a stream along the alignment of Judges Bay Road. Iwi and local historians wanted to recognise the stream within the project. SSCL suggested that the stormwater management could replicate the stream by bringing the stormwater runoff to the surface for treatment prior to discharge through a traditional piped conveyance system, which is currently within the carriageway.

The upstream conveyance system was diverted to the raingarden for treatment and road runoff collected within the swales therefore during rainfall events the surface treatment system replicates the stream. This is also reinforced with visually with the landscaping and planting selection within these stormwater management devices.

- Iwi and cultural inclusion

The cleansing of the stormwater runoff from this urban catchment was important not only to Iwi but to other cultures. This was a fundamental design criterion for the project and one which was undertaken in collaboration with all disciplines to ensure that the best practical solution was selected for stormwater treatment.

- Way-finding and information boards

The stormwater treatment devices are a large feature on the landscape for this project with respect to the area adjacent to Judges Bay Road. The way-finding boards provided a great vehicle for information sharing of what these features were for and how the integration of stormwater treatment was undertaken for the project. These boards have been well received by the public and created great interest to the cleansing of water within the bay.

3.3.3 CONTINUE SUPPORT DURING CONSTRUCTION

To obtain Auckland Council's approval, SSCL designed a stormwater management system based on the best knowledge of as-built information available. However, during the construction, the contractors found numerous additional infrastructure components that had been built over the years without (as-built) records being lodged with council. As the stormwater designers for the project, SSCL were called in to help.

The continue support offered by SSCL included the following:

- Onsite investigation when the contractors found the discrepancy between the plan and the actual services location
- Quick adjustment of the design to ensure connectivity can be maintained for upstream/downstream network, and the required clearance to other services can be achieved.
- Quick assessment of the network conveyance capacity to the service level.

The ability of having on-site knowledge of the designers on hand during construction period was evident for this project and one that all projects could benefit from.

4 CONCLUSION

There are many opportunities for stormwater management to be utilised by the varied disciplines within projects that vary from urban design, landscape architecture and master planning. Combining the needs of stormwater management into these disciplines

requires lateral thinking as well as provision of opportunities to get involved early on in the project.

The unique aspects of projects can be developed within the stormwater management design. A project that interacts with the natural resource can provide other cultural and social benefits which results in a built environment that reflects the design outcomes, with the externality of providing stormwater treatment, conveyance and management.

Judges Bay Replenishment project provides an example of the outcomes of working in collaboration with many disciplines. The outcome is that there is a unique urban environment that celebrates the inner city jewel and provides treated stormwater entering the bay which previously had poor water quality with no reference to the history or culture of the area.

The introduction of information and way-finding boards within the project has provided the public with knowledge of the benefits of the stormwater devices that were chosen for the environmental benefit. This information sharing has completed the circle with respect to social interaction for the project.

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