INTEGRATING LID INNOVATION IN A STREETSCAPE PROJECT – ALBANY CIVIC CRESCENT

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ABSTRACT

North Shore City Council seeks to integrate stormwater management into the projects carried out by other council divisions. This paper presents a showcase project which demonstrates to developers that it is possible to integrate stormwater treatment into a high quality streetscape design in a manner which adds to the amenity and functioning of the streetscape without greatly adding to cost.

This project integrates innovative LID within a high-profile streetscape design involving transport, water and parks teams. It is now complete and the finished treatments are shown in operation.

The paper covers:

- setting design objectives at the concept stage;
- keeping design responsive to the land use context;
- integrating stormwater treatment with transport and landscape design;
- maintaining integrity of the design through changes during design and construction;
- funding these elements and their cost;
- demonstrating that by collaborating with the landscape architects and arborists early on in the overall design process we were able to achieve a better overall outcome;
- illustration of innovation including bioretention tree pits – collaborative design, construction and operation
- how developers have already been influenced by this showcase project.

KEYWORDS

LID, Integration, urban design, bioretention tree pits, raingardens

PRESENTER PROFILE

Andy Irwin, Project Manager for Civic Crescent Upgrade and New Bus Station, has been with North Shore City Council since 2005 after many years in local authority highway roles in the UK. Working from the Transport Infrastructure Group, he has provided liaison between the Stormwater and Transport groups.

1 INTRODUCTION

This paper provides a detailed record of the integrated design process that was devised for this project. It is hoped that this will enable other practitioners to see the benefits of an integrated design and to be aware of some of the problems that can be encountered.

By developing the concept design through a working group including councilors and design professionals from transport, urban design and stormwater disciplines, objectives were set out and cost-effective, sustainable joint solutions were found.

The paper also describes the innovative stormwater treatment system and the variety of features included. The photo record illustrates the construction and finishing of these features and also shows some of the problems to be aware of and avoid.

2 DISCUSSION

2.1 PROJECT BACKGROUND

2.1.1 PLANNING BACKGROUND OF ALBANY CENTRE

Civic Crescent, Albany is located at the centre of the Albany sub-regional centre in North Shore City.

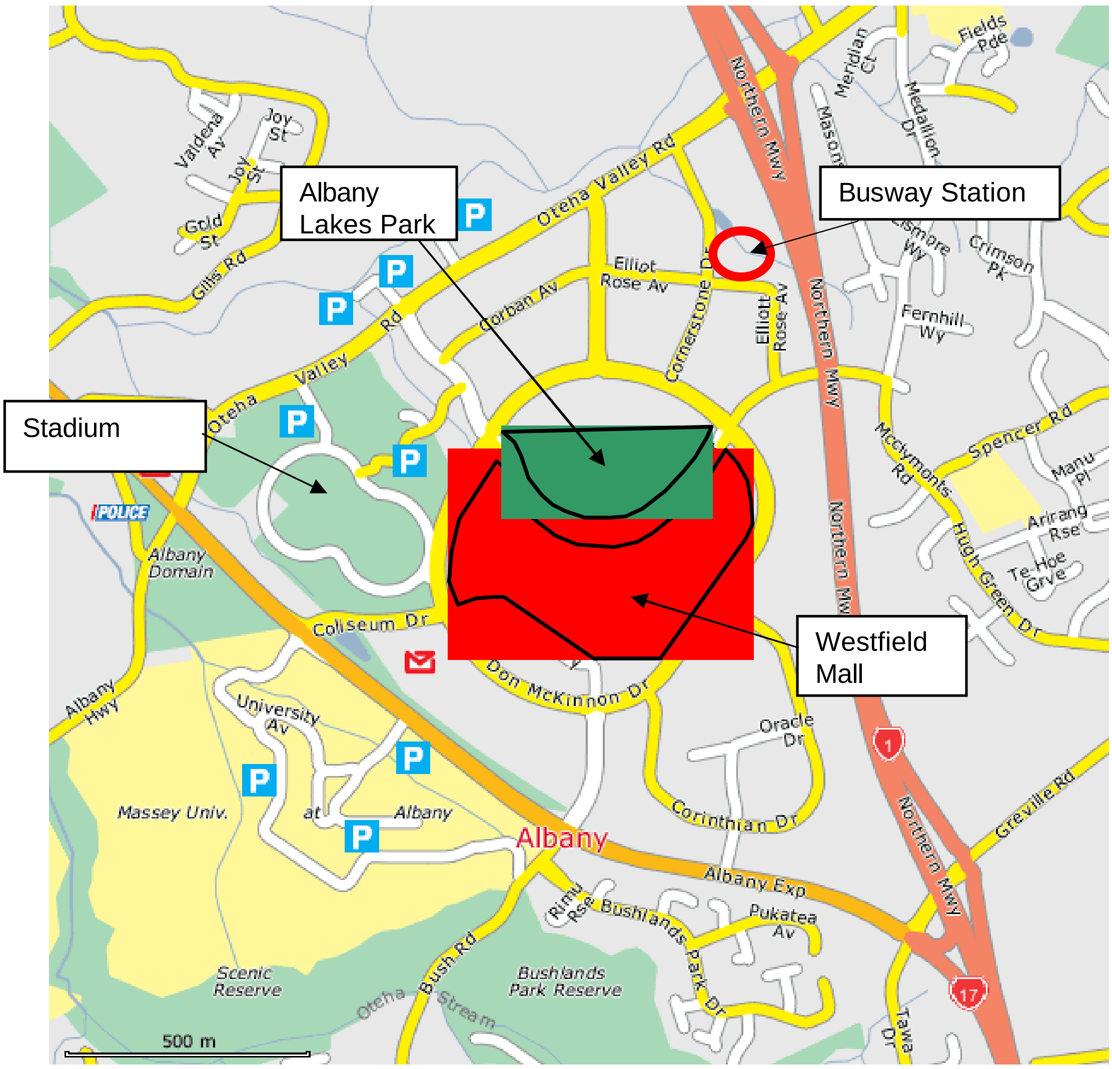

Figure 1: Location

Since the 1980s it was envisaged that the land now known as the Albany Centre would be a new sub-regional centre for North Shore City to cater for future growth. The establishment of Massey University in 1993 and North Harbour Stadium (opened in 1997), the extension of the motorway north and rapid residential growth within the area brought about many changes.

The Albany area has become the fastest growing area in North Shore City. The 2001 Census counted 21,612 residents in Albany Community Board area, an increase of 55.9% since 1996. In 2002 there were 17 080 Full Time Equivalent jobs.

Civic Crescent was constructed as a special collector road, to be a low speed zone with angled parking on both sides of a two lane divided carriageway, planted with London plane trees, designed to encourage active frontage development edging a business zone containing the major retail focus of the centre. (See Fig 4: Civic Crescent , Albany 2004)

Stormwater management was focused on the Albany Lakes treatment and detention ponds north of Civic Crescent. Site developers would be required to treat stormwater on site before discharging to the ponds.

The District Plan had set zoning for the development of the centre. A Plan Change was proposed to set the policy and rules for new development, which finally became effective in 2009 after hearings substantially modified the scale of permitted development.

Apart from the main road network and the area of the Lakes Park, all the land to be developed is in private ownership. This includes the land for the local roads to provide access to development land. For this reason, the Albany Streetscape Design Guidelines were produced, based on the District Plan rules, to guide developers planning these roads.

2.1.2 PROJECTS AFFECTING CIVIC CRESCENT

The Albany Centre Vision and Development Strategy 2004 set out future development. One project under this was Albany Bus Stops and Bus Priority Measures. This identified the routing of bus services through the centre and the location of a suburban bus station on Civic Crescent together with bus priority lanes to maintain bus service reliability into the future.

Other Projects to run at the same time were Albany Lakes – Stormwater Improvements, which was to change the shape of the lakes and to improve their function; Albany Lakes – Landscaping, which was to create an urban park around the lakes incorporating a feature bridge based on a eel weir; and a project monitoring the consent conditions of a development by Westfield plc on the south side of Civic Crescent.

These four projects proceeded at the same time. Changes to each of the projects in the course of their development affected the other projects. In particular, the Westfield development involved prolonged negotiation, as the developer's objectives did not necessarily coincide with the concept plans for the centre.

The transport project developed a concept plan, which was approved by the Council in 2005 for construction. This was developed principally to achieve public transport objectives. However, elements of the design proved incompatible with the frontage and streetscape layout that evolved as Westfield's proposal was modified through the consent process, and it was also seen to be unsatisfactory for other streetscape objectives of sense of place and linkages. (See Fig 5: Civic Crescent, Albany 2006)

It was decided that the upgrade of Civic Crescent should be subjected to a concept review before proceeding to preliminary and detailed design. The timescale for this would be very tight, as it was intended that it should be constructed prior to the opening of the North Shore Busway and the Westfield Mall Stage 1.

2.2 DESIGN PROCESS

2.2.1 CONCEPT DESIGN REVIEW

It was clear that a successful design for Civic Crescent would depend on developing clear objectives based on the Albany Centre Vision Development Strategy; coordination with the Albany Lakes Stormwater and Landscaping projects and the Westfield development; and responsiveness to the vision of council governance.

A professional services contract was designed to achieve these objectives by establishing a Working Party including the principal internal stakeholders and setting a series of internal and external stakeholder liaison workshops.

The contract was let in August 2006 to Maunsell (now Aecom) with Jasmax as their urban partners. A series of workshops was held to determine the design objectives and priorities. Key to their success was the inclusion of three councilors also belonging to the Albany Lakes Working Group. Through this process the objectives set were:

Figure 2: Jasmax Concept design sketch

- To create a bus station facility on both sides of Civic Crescent
- To maintain reliability of bus services as traffic in Albany Centre grows

- To develop the urban environment encouraging public transport usage, walking and cycling in accord with the Albany Structure Plan

- To manage general traffic speed, volume and parking provision to protect the urban environment

- To interface with the frontage of development by Westfield on the south side

- To interface with the frontage of development by NSCC on the north side

- To incorporate stormwater management

The draft Concept Design Report was completed by October 2006 with the Working Party recommending a preferred option supported by the three councilors. The report was reviewed and finalized by December 2006.

The concept design dealt with the transport objectives through five options of road layout.

The urban design concept responded to the context for the street and led directly to the coordinated design of streetscape, landscaping and stormwater treatment. The workshops agreed the principles of the design and decided that three options should be developed, to allow the council to determine the level of capital investment appropriate to community objectives under the LTCCP.

The design options were reported to the council's Infrastructure and Environment Committee in November 2006, and a preferred option and project estimate were approved.

2.2.2 PRELIMINARY AND DETAILED DESIGN DEVELOPMENT

Further workshops were held in the preliminary design stage, through to February 2007. These ensured that the three councilors were involved with other stakeholders in guiding the design team. Decisions were needed on cost savings, when the concept design estimate exceeded the budget. The working party was able to determine how savings could be made without harming the design objectives and allowing the design concept to be achieved more fully in the future.

Reference to the urban design concept and development of the preliminary urban design solution ensured that a robust design was produced, without trading off design objectives against cost. Stakeholder meetings also aided cost effective solutions to be developed, particularly in stormwater treatment. Meetings with Westfield allowed agreement on movement and access to the Westfield to be agreed while design and construction of that development progressed. Meetings with the Albany Parks design team and Westfield enabled collaborative design to link the Lakes Park to the Westfield mall through the road space with a strong complementary design theme. This included landscape design; the result of that collaboration is discussed below. (See Fig 4)

The Scheme Assessment Report went to ARTA and LTNZ in June 2007. General issues with transport programme overspends and later delivery led to LTNZ requiring firm detatiled design estimates, risk modeling and peer review of selected projects to ensure the quality of NSCC projects. This project was selected for this review. The process, which was not anticipated in the programme, continued to September 2007. This led to the decision not to commence construction until the Westfield mall opened in November

2007 and had been trading for a while. However, it allowed the design to be refined further and ensured the project went forward with robust risk management and with transport subsidy approved by LTNZ in November 2007.

Outline Plan approval included recommendations to work with council's urban design specialist and arborists to achieve best outcomes.

Figure 3: Jasmax detailed design sketch

2.2.3 FUNDING

Transport projects within North Shore City generally incorporate stormwater design that is limited to the requirements of the Infrastructure Design Standards Manual and ARC Air, Land and Water Plan. In this project, NSCC chose to exceed the requirements of the existing discharge consent in order to improve the quality of water discharged to Albany Lakes. This meant that the stormwater treatment at the discretion of NSCC could not be submitted to receive LTNZ transport subsidy.

About a third of the trees would be replacements for the failed existing trees – these would be required as environmental mitigation. The remaining trees would provide additional landscaping benefit so were not appropriate for transport subsidy.

Discussion with internal stakeholders led to Parks committing to contribute capital budget to provide the additional trees, and Stormwater to contribute capital budget to improve water quality.

For the purpose of the transport funding application, a conforming design was produced which included replacement trees only and a conventional kerb and channel piped discharge drainage system that would meet consent conditions.

The estimate for this conforming design was accepted for transport subsidy, with the Parks and Stormwater contributions covering the cost of enhancement of the design.

2.2.4 CONSTRUCTION AND FURTHER DEVELOPMENT OF DESIGN

An open tender process led to the appointment of Transfield as main contractor in April 2008, with Contrax as specialist paving subcontractor. CAM was appointed separately to design and build the bus shelters which form a major part of the project. Each of these contractors was involved in discussions on refining the design as construction progressed.

The design team continued to work on interface issues, particularly with the Albany Lakes team, where construction was proceeding at the same time as Civic Crescent.

Construction commenced in June 2008 and was completed in time for inauguration of bus services in November 2009 and a joint celebration for the completion of Albany Lakes Park.

2.2.5 STORMWATER DESIGN PROCESS - COLLABORATION

The concept for stormwater design was developed through collaboration with NSCC Stormwater planning officers. The existing discharge consent for the Albany Lakes provided the basic conditions, together with the existing road drainage. By themselves, these would not require anything beyond conventional drainage measures. However, the Integrated Catchment Management Plan for Lucas Creek and the concept for the Albany Lakes Park laid out NSCC's determination to improve the quality of water discharged to the Lakes. Further, streets to be constructed by developers within the Albany Centre in accord with design rules for Albany in the District Plan would require stormwater treatment. It was seen as important to be able to show developers NSCC's commitment to excellent stormwater treatment and streetscape design. The timing of the Civic Crescent Upgrade made it clear that this would be a demonstration project to set the standard for developers.

The design team took these issues into account and expressed the objectives for stormwater, streetscape, landscape design and sustainability. These would aim to include innovative designs for bioretention devices to treat road runoff and permeable paving in parking bays.

The urban design concept included large street trees to form a legacy avenue along the park edge. This complements the design of the park itself and forms a transition from the open, soft landscape of the park to the vertical, hard built form of the Westfield mall. It was recognized that design for planting the trees would be important, as existing plane trees in Civic Crescent were failing badly. The trees on the north side were originally intended to be within the road reserve, close to the cycle path next to the road. However, this would have required expensive diversion of a power cable.

Some trees would be planted within the median. It was also decided that the median would be used to accommodate raingardens to treat runoff from the southern carriageway, which drained towards the median.

Oriental plane trees were chosen for their mature size and form, deciduous habit and dappled shade in summer. NSCC engineers recommended combining the streetscape, landscape and road drainage functions by making use of the tree pits for bioretention treatment. The heavily compacted clay subgrade would require large tree pits with base drainage to allow the trees to mature successfully. This would combine well with the base drainage collection from raingardens. The extra cost for bioretention tree pits would therefore be little more than other tree pits in the scheme. In addition, although the compacted clay would make infiltration negligible, it also meant that impervious lining of pits and swales would be unnecessary. Root deflector barriers were specified only along edges of pavement to prevent damage.

As the trees mature, their roots will expand beyond the confines of the tree pits. The long-term care plan for the trees will provide for future intervention. It is expected that this will involve cutting expansion slots into the packed clay and filling with soil medium to guide and promote root growth. The landscaping around the trees allows for this. Although it cannot be calculated at this time, the expanded medium may compensate for a degree of clogging of the treatment volume for biofiltration, helping to maintain stormwater treatment effectiveness.

Bioretention tree pits became the principal stormwater treatment feature, in the detailed design phase. Sizing of the tree pits and catchment calculations revealed that permeable paving of parking bays would not be required in addition to the bioretention devices, so it was decided that conventional block paving would be used to save cost and simplify construction. This meant that almost all runoff would be treated by bioretention before discharge to the Lakes.

Detailed drainage design was carried out by Aecom. Jasmax designed the planting, with support by NSCC Parks arborists who procured the plants and collaborated on species selection. The design team revised the species selection to take account of plant stock availability and condition, while maintaining the design objectives.

NSCC stormwater engineers advised on design requirements, making use of the NSCC Bioretention Guidelines which were in draft form at first. The unusual circumstance of discharge to the Lakes, which would provide all the detention necessary for the discharge consent. Therefore, the raingardens and tree pits did not require the usual surface detention capacity. NSCC had been developing a bioretention soil specification with Living Earth for commercial production. It was decided that Civic Crescent would use this soil mix as the filter medium.

Continued liaison with stormwater and parks project teams helped to develop mutual understanding of each others projects. This allowed the flexibility to propose treating road runoff using tree pits located outside the road reserve. It was also critical to staging construction along the interface between the road and the park.

Detailing of interrupted kerbs, flow dissipators, footpath grilles and such were carried through by Jasmax to manage materials and appearance to be coherent with the streetscape design. Through the outline plan recommendations, urban design was monitored to maintain consistent quality.

Late in construction, consideration was given to the south berm at the western end of the site. Westfield had applied for resource consent for a further stage of development. It was determined that future development on this part of the road frontage might lead to additional parking bays and wider footpath paving, leaving little exposed soil around the plane trees, which were not designed as part of the stormwater treatment system. A collaborative team of arborists, landscape architects, engineers and suppliers produced a design to produce a suitable growing environment for large street trees with footpath and parking bays covering most of the future root zone. This design was not constructed due to the consent process for the Westfield development not progressing to require this feature. However, the design concept has been retained for future implementation if development of the frontage requires this.

This design would make use of structural cells to create a root expansion zone beyond the state of maturity of the trees at the time. These would support permeable paving above, providing aeration and irrigation to the roots. Such treatment could be applied retrospectively to other locations where large tree species may require root expansion zones to develop their full mature size, with paths or parking bays on the surface.

2.3 STORMWATER TREATMENT SYSTEM

2.3.1 DESCRIPTION OF ELEMENTS

The treatment system finally produced incorporated several unusual features. The combination of these features is new to New Zealand.

The site slopes from east to west and from south to north.

Photograph 1: Median raingarden with tree pits

Most of the south footpath drains across grass verge before reaching the carriageway. At each end of the road, a median intercepts runoff from the south carriageway. Interrupted kerbing drains this into the median, which contains several tree pits. The median is formed as a swale, planted with apodasmia similis (oioi) in the centre and a mix of dianella nigra and machaerina sinclairii along the side slopes. This contributes to the safety of the road by discouraging pedestrians from crossing away from the defined crossing points.

Tree pits are filled with the Living Earth raingarden mix medium, which continues through the swales between pits. Tree pits are 1.5 m x 1.5 m square, with 1.2 m medium over 100 mm sand filter, 50 mm 7-3 aggregate and 210 mm 20-5 aggregate. Between tree pits, medium depth is reduced to 0.6 m. The swale is 300 mm deep, with 1:3 side slopes.

Base drainage of the tree pits collects outflow to a catchpit at the end of the swale. A grating at the end of the swale is set at a level to take overflow in heavier rainfall. In heaviest rain, overtopping of the kerb allows overland flow to cross the northern carriageway. (See Photos 3,4)

Interrupted kerbs on the north side allow carriageway runoff to discharge across grassed areas which are at carriageway level rather than top of kerb level. (See Photos 5,6)

A kerb runs along the edge of the cyclepath adjacent to parking bays, bus stop bay and back of grassed verge areas. At intervals, wide shallow channels cross the path. These are covered with steel grilles. Each channel discharges to a grassed swale that divides to lead to two tree pits within the edge of the park. The swales are planted with fine fescue that, when established, will not require mowing. These tree pits are filled with Living Earth medium. Fibre circles are fixed at the base of the trees instead of loose mulch during early growth. The trees were planted as 150 l stock. A continuous base drain links all the tree pits to discharge into stormwater pipelines leading to the Lakes. During heavy rain, water that cannot infiltrate the medium enters the base drain directly from 100 mm diameter overflow pipes with litter guards. The swales and pits are formed with a bund that will overflow when the standpipe inlet capacity is exceeded. This excess flow then discharges as sheet flow across the grassed slope of the park towards the Lakes. Pits are 2 m x 2 m square, with depth and materials as median pits. Bunded depth is 300 mm, with pipe overflow at 160 mm. (See Photos 7,8,9,12,13)

Where the cycle path divides from the footpath behind the bus stops, a bioretention trench has been formed between the paths. This again includes some tree pits and treats runoff form the central paved area, the bus stop area and the bus shelter roof drainage.

Photograph 2: Bioretention swale with tree pits between cycle path and bus station.

The Lakes Park is designed to contain a 100 yr ARI storm without discharge to Lucas Creek exceeding a specified flow. The Lake outfall structure meters the maximum outlet flow. The Lakes may then overflow into a wetland area at the west end of the park. This is retained by a bund around the edge of the park, with a weir level for rainfall significantly in excess of the 100 yr design storm (or for significantly impeded outflow). The weir has been landscaped into the road edge where plastic cell reinforced grass forms a maintenance vehicle crossing for access to the park. West of this, the road falls below the bund level and a bioretention swale links the remaining tree pits to the end of the park edge. A low bund beyond the terminal catchpit overflow grating ensures that excess flow discharges back onto the road, to avoid flooding a power distribution station at the end of the road.

Overland flow for major drainage from the east end of the road follows the north kerbline to the paved area at the crossing to the park, then discharges towards the upper lake. From the western end, overland flow follows the north kerbline to the roundabout at the west end, which it crosses to join the outflow channel from the Lakes.

2.3.2 TREATMENT FUNCTIONS

During frequent light rain events, much of the runoff will be filtered across grassed areas. This, with slight runoff to raingardens and bioretention swales and tree pits, will be absorbed by soil and evaporated or transpired.

The first design level is the water quality event, 1/3 of 2 yr ARI (24 hr) event. Raingardens, swales and tree pits are designed to treat this water by bioretention, with treated outflow piped to the stormwater pipelines collecting all catchment runoff to the Lakes.

The second design level is the 10 yr ARI (24 hr) event. Flow in excess of the infiltration capacity of the raingardens, swales and tree pits is prevented from flooding carriageways and footpaths by overflow gratings, which discharge untreated flow to the piped system to the Lakes. The exception is the tree pits on the park edge, where overflow standpipes do not have the full capacity for the 10 yr event and excess flow is permitted as sheet discharge across the grassed slopes towards the Lake. This is deemed not to be a significant nuisance, nor to affect service levels for vehicle or pedestrian traffic.

The third design level is the 100 yr (24hr) event. Overland flow along the north kerbline does not exceed the depth above top of kerb or the flow*velocity limit for footpath safety. Most of this overland flow is captured by the Lakes and the discharge to Lucas Creek is controlled. In a more extreme event, flow in excess of the storage capacity of the Lakes bund may overflow into the west end of Civic Crescent. It is not expected that movement except by emergency vehicles would use the road in such an event, and the south carriageway should remain passable.

2.4 PROJECT OUTCOMES

2.4.1 LANDSCAPE BENEFITS

Urban design was throughout vital to this project. Sense of place, quality of streetscape, sustainability and linkage were to guide all aspects of design. The design team therefore worked to ensure that stormwater management contributed towards this. Sustainability included the issue of capital and operational costs, and so the landscape benefits were vital to this.

<u>Grassed areas</u>: Many of these have been set at carriageway rather than footpath level, helping to separate path users from traffic lanes. This increases road runoff to these areas, reducing the need for irrigation during dry periods. Grass is establishing well in these areas.

<u>Median Gardens</u>: Planting with oioi, machaerina and dianella creates a good structural vegetation for the medians. The swale form is balanced by the height of the vegetation,

and these combine to deter pedestrians from crossing where traffic risk is greatest. Vegetation is suited to the moisture conditions, with the more susceptible flax on the drained side slopes of the swale. Parts of the medians at each end of the road do not collect runoff and so are conventional garden areas. The plants there are slower establishing, showing how runoff benefits the vegetation.

Footpath Gratings: The wide, shallow channels crossing the foot and cycle shared path are covered by galvanized steel gratings. These break up the asphalt surfacing of the path, being edged by black oxide coloured concrete bands, contributing to the urban design concept.

Grassed Swales: Fine fescue grass is establishing well. This should grow without need for mowing, providing stormwater benefits. The grass remaining taller than the mowed areas of the park should discourage people from walking through them when the soil is saturated. The smooth shape of the swales ensures that they blend well into the edge of the park. Overflow pipe inlets are unobtrusive within the grassed tree pits.

Tree Pits: The surface of the tree pits is continuous with the grassed or garden areas that they are in, softening their appearance. The trees are mostly establishing well. However, those that are part of the treatment train are generally healthier than those that do not receive as much runoff irrigation. One exception is near the bus stops, where the outlet pipe from the swale has become blocked and the nearest tree has died. This highlights the need to take care of stormwater features through the construction process. It has been possible to provide effective tree pits for the establishment of large trees in poor ground while saving the cost of separate stormwater drainage, and reducing the irrigation requirement through summer.

2.4.2 CONSTRUCTION LEARNING POINTS

Working through the construction of this innovative project has led to considerable learning.

- Staging of construction through a long period requires planning of measures to protect stormwater elements.

- Planting seasons dictate the completion of rain garden and tree pit systems – planting late in the season has led to a few tree failures, and slower establishment of raingarden vegetation. Programming and progress can make this difficult to prepare for.

- Filling of pits and trenches with filter medium requires interim protection while road and path construction continues. Filter socks at kerb inlets can help divert flow to the outfall catchpits. Tree pits were topped with filter cloth covered by topsoil to prevent silt contamination until planting.

- The unexpected almost always happens. During construction, a wastewater microtunneling project in road berm at the uphill end of Civic Crescent led to silt contaminated runoff entering the site. Unplanned runoff within the catchment should be considered and prepared for, whether from such events or from adjoining development land. (See Photos 10,11)

- A large tree planting size (160 ltr) was chosen, both to allow early contribution to the form and scale of the streetscape and also to resist vandalism – the Westfield mall includes bars fronting Civic Crescent and late night public order problems have developed. However, the site is exposed to strong southwest winds up Oteha Valley, and this has caused stress and shape problems. Smaller stock might have reduced this early establishment stress, but would have risked vandal damage.

- Use of interrupted kerbs and cross-path channels to collect runoff from the road surface considerably reduces maximum channel flow. We could have made more positive use of this in reducing the slope of the kerbside channel from the standard 10% to the same as the carriageway. This would have been most useful in parking bays, to encourage parking closer to the kerb. This is just one example of how innovative stormwater design can free up other design and detail choices.

2.4.3 OPERATIONAL MANAGEMENT

The collaborative approach to design and construction is to be continued through the operational life of the road. Service agreements will be established to define responsibilities for future management. This is essential for a stormwater treatment system such as this, where stormwater moves through road assets to stormwater assets, being treated by parks assets.

Vegetation is still under the contractor's establishment maintenance programme. Regular inspections by the client are following the establishment and ensuring care and replacement of vegetation is carried out well, in preparation for handover.

As the design has been developed through collaboration, the planning of operational management is an extension of this partnership. Management plans will assign responsibilities for inspection, routine maintenance, repair and renewal, and decision-making over future planning. This latter is significant in regard to future land use and transport developments affecting the site, to ensure the integrity of the design concept is maintained and developed further.

2.4.4 IMPACT OF THE PROJECT

The completion of this project gives the opportunity to study the effectiveness of the stormwater treatment system in service. Initial indications are that the planting medium is operating successfully. Stormwater in heavy rain events has behaved as predicted and water ponding in treatment devices has dispersed in a reasonable time after the events. It will be feasible to study elements in future research projects.

The project has already been effective as a demonstration of NSCC's commitment to LID in road projects. Developers responsible for constructing the local roads in the centre have been willing to adopt the Streetscape Design Guidelines and produce designs that include similar concepts.

Davies Drive, north of the park, has already been built. The design was influenced by the streetscape concept approved for Civic Crescent, with the Streetscape Design Guidelines. It includes permeable paved parking bays and raingardens with smaller trees planted in bioretention tree pits as part of a comprehensive streetscape.

Other land use consents have included landscaping from the building edge out to the roadway, to allow whole-street design. Some of these include raingardens as part of on-site stormwater treatment.

Civic Crescent together with the Lakes Park and stormwater treatment devices elsewhere in the Albany Centre provide a worthwhile tour to see LID in action.

The project also forms a demonstration that can be used in planning other streetscape and town centre projects. It is relevant to arterial corridor improvement projects, showing how collaborative design can produce cost-effective LID streetscapes. Integrating design for paths and parking with landscaping and stormwater treatment makes the most of road space, particularly where underground services limit available space. Setting stormwater treatment objectives at concept stage also ensures that it forms part of an integrated design, rather than being a late design task added onto a finished concept.

3 CONCLUSIONS

The complex nature of the design objectives for this project and its importance in setting a standard for sense of place and transport linkage in the Albany Centre led to a collaborative integrated design.

The key to success was establishment of the Design Working Party. The combination of design specialists with stakeholder managers and decision makers led to setting the objectives and the collaborative process.

It provided an opportunity for innovation and to showcase stormwater treatment to promote good design elsewhere in Albany Centre and North Shore.

ACKNOWLEDGEMENTS

Figures 2,3 and 4: Jasmax Ltd., Auckland

REFERENCES

Bioretention Guidelines (North Shore City, 2008)

http://www.northshorecity.govt.nz/Services/WaterServices/StormWater/Documents/Bioretention-Guidelines.pdf

PHOTOGRAPHS

Photo 3: Median raingarden during construction showing tree pits, continuous medium trench and sideslope soil

Photo 4: Median raingarden terminal drainage.

The carriageway on the right drains to the raingarden. The carriageway on the left drains through interrupted kerbs across grassed area to tree pit swales.

Photo 5: Cycle path at east end.

The carriageway drains through interrupted kerbs across the grass area (these tree are not in bioretention pits). Channels with steel grilles drain to swales leading to tree pits in park edge.

Photograph 6: Bioretention swale with tree pits between paths. Grassed areas on right. Footpath channel discharging to swale and bioretention trees pits foreground and left.

Photo 7,8,9: Bioretention tree pits during construction.

Compacted clay ground conditions can be seen. Standpipes are the overflow drains. Flexible pipe is the base collector drain. Cutting and filling the trench between tree pits provides broken ground for future root expansion, but the need later will be for radial slot trenching.

Photograph 10: Damage from excessive surface water flow during construction. Filtercloth protecting tree pit medium exposed. Park slope eroded before grass was established.

Photograph 11: Result of blocked outlet pipe. Standing water on surface long after rainfall. Tree dying through saturation.

Photograph 12: Forming swale to tree pits.

Photograph 13: Tree pits grass established. Fibre circle weed suppression. Overflow pipe inlet.

Figure 4: Landscape Masterplan