Activating water sensitive design for New Zealand

ALBANY, AUCKLAND FIELD WALK

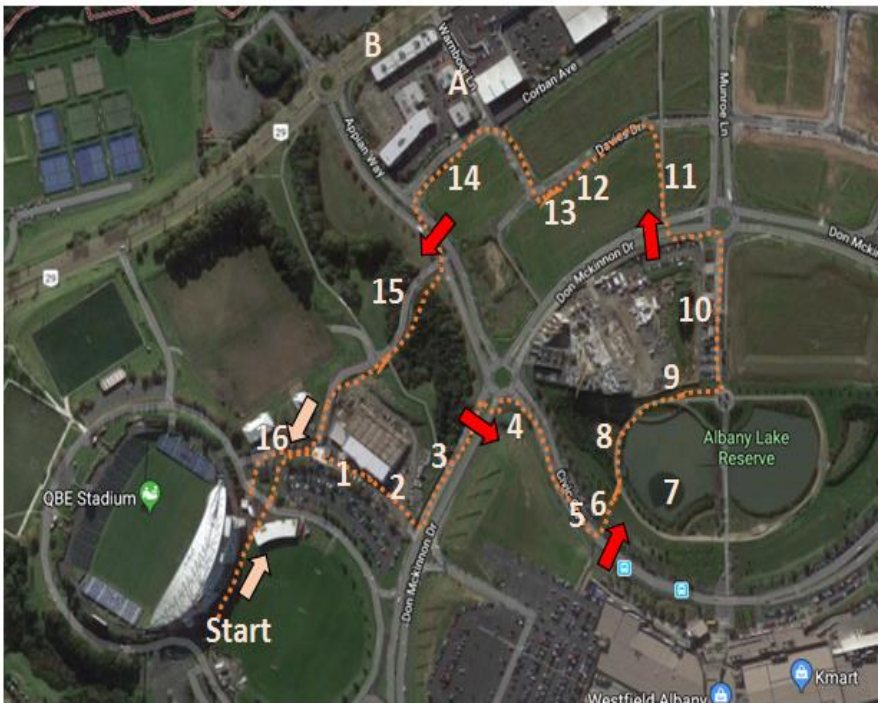
Building better homes towns and cities science challenge

Activating WSUD Aotearoa NZ

Manaaki Whenua Landcare Research · NIWA Taihoro Nukurangi · Batstone Associates · Koru Environmental Consultants Ltd

Key

- Dotted line indicates route
- 15 Numbers indicate sites
- Arrows indicate direction of travel
- Red arrows indicate road crossings – extreme caution needed



North Shore City Council began the Albany Lakes project in 2008/09 'leading by example' as NSCC required developers to provide on-site stormwater mitigation, so wanted to show-case how stormwater management could be incorporated into a CBD environment and add value to an area. '*The Albany Community Board were resolute in their determination to deliver a public asset reflecting community aspirations and of a high industry standard*' – the lake area won a 'Community Boards

Best Practice Award in 2009. Key outcomes the Board wanted included a strong sense of place and international reputation; safe and effective transport links by car, bus, cycle and foot; a diverse range of activities supporting economic development, generous public spaces that are a pleasure to walk around (providing 'respite'), and environmentally sustainable use of land, buildings and infrastructure (NSCC). The area drains into Lucas Creek and Waitemata Harbour. (References - June 2009 LIUDD Urban Safari field notes Chris Stumbles NSCC, Woods, Stormwater360; Irwin 2011 – table below).

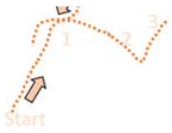
Works and Features

Feature	Grassed Berms	Median and Rain Gardens	Foot path Gratings	Grassed Swales	Tree Pits	Vegetated Slopes	S/water Pond	Weir	Wetland Planting	Feature Stream
Main S/water Function	Carriageway and Footpath Treatment	Carriageway Treatment (consent requirement)	Conveyance from road to swale	Carriageway Treatment (consent requirement)	Carriageway Treatment. Pavement shading.	Carriageway Treatment.	Catchment treatment (consent requirement)	Pond function		Pond recirculation
Other Function	Urban design feature. Park link. Traffic Managemⁿᵗ. Services corridor.	Aesthetics. Feature planting. Urban design. Traffic Managemⁿᵗ.	Urban design / architectural feature.	Park contours and urban edge interface. Specimen / feature trees. Aesthetics. Trees statutory requirement.		Park contours and urban edge interface. Includes different grasses for aesthetics.	Water feature. Recreation.	Art bridge. North / South axis. Link to escarpment and Lucas Creek. Pedⁿ link. Focal point.	Aesthetics. Cultural (flax harvesting)	Aesthetics. Cultural.

WSUD walk: Albany

1 - Aquatic Stadium Permeable surface: Hoggin

1



2 - Fruit trees amid topsoil mounds with infrequent mowing

2

3 - Clay coring to increase infiltration on compacted park

3

Activating WSUD Aotearoa NZ

WSUD Albany Sites visited

1 - Aquatic Stadium: Hoggin

Hoggin is a compactable groundcover made from a mixture of clay, gravel, and sand or granite dust that produces a buff-coloured bound surface. In Auckland Hoggin is typically limestone GAP6 (<6 mm diameter) 'increasingly used as a low cost and environmentally friendly alternative to concrete and block paving'; it should be underlaid with coarser material if it is designed to provide drainage; compaction affects permeability; control of runoff concentration /slope is important to avoid scour (Wynyard Quarter hoggin scoured into raingardens and areas with very low permeability).

2 – Trees amid topsoil mounds with infrequent mowing

Mounds create visual interest, enhance separation of areas, slow through traffic (especially if wheeled), and, if made from topsoil, increase water storage/availability for trees, but the trees should be planted on the sides of mounds (not in between as here) – greater topsoil depth is an effective way to increase tree resilience where subsoils are physically degraded, as typical across this area. These could be fruit trees, if higher and specialist maintenance (pruning) and removal of ground-fall fruit was built into maintenance. These costs might be offset by reduced mowing which also allows herbs to flower, providing food for predator insects and honeybees. A formalised orchard is also planted on the southwestern banks of Albany Lake to connect with historic European harvests.

3 - Clay coring to increase infiltration on compacted park

This area of grass is compact clay and has been cored (solid or hollow tines placed into soil to about 50-10 mm depth) to increase infiltration, aeration and bearing capacity, allowing mowing with less rutting or bogging the mower. However this is unlikely to be effective because the soil is compacted right through the profile and water cannot run sideways (low slope and compacted topsoil) and it cannot go down; filling the holes with sand would also be largely ineffective. Bad soils suit a low-mowing strategy as taller grass transpires more water and compacting risk is reduced by physical cushioning and less frequent trafficking (allowing recovery) between mowing cycles.

4 - Rock-lined detention area at end of major grassed swale

Ugly scruffy dome for highly visible site, no plants, herbicided weeds. Ugly, but narrowly functional as it is resistant to erosion, it is easy to check overflow is clear, and easy to maintain using glyphosate. Would have been useful to get a landscape architect involved!

Presumably installed prior to 2009 and not part of Albany upgrade.. above this site are the dreadful Westfield carparks where isolated landscaping trees are installed right beside catchpits and isolated from surface water (a huge missed opportunity).

5 – No-mow road median bioswale with integrated trees, 2009

These extensive, central raingardens and swales extend along Civic Drive and form the first part of a treatment train. They were constructed in 2008/09 and designed to provide pre-treatment of water and reduction of stormwater volumes flowing into the Albany Lakes. The swale has 600 mm media depth which is increased to 1000 mm under trees with no change in surface level – an elegant way to save money and excavation (see photo). However any central median is expensive and disruptive to traffic flows to maintain if maintenance requires traffic controls to ensure safety of the workers.

6 – Grass swales with integrated tree basins, 2009

Surface runoff from the road flows under footpath through wide (c. 400 mm) grates onto a robust but attractive concrete erosion pad. The width and drop help ensure that litter/clippings don't block the grates. In a few places the grates have been bent by heavy vehicles. Each inlet drains to two tree pits via grassed swales – during construction protection was provided by erosion cloth (photo below). Topsoil depth across the grassed areas and beyond is 300 mm – this supports more healthy, resilient grass and allows tree roots to spread out from the tree pits. 6A (left photo) uses a grass species that requires no/infrequent mowing (a *Festuca*) but is more expensive to establish ; 6B (centre photo) is a traditional, intensively-mown grass verge (deciduous trees). Large-leafed deciduous trees are used throughout, creating an unnecessary blockage risk and additional autumn maintenance.

7 – Ponds with forebay, stage and amphitheatre (completed 2009, $10.6M)

Kahikatea are included in areas around the lakes to reflect historic Maori use of area for harvesting of berries; flax cultivars for traditional weaving were to be planted on the north-western banks through Judy Te Hiwi (Pa Harakeke). Rocks are safe roosting areas for cormorants; avoiding mown lawn discourages mallard ducks and geese. The lakes were originally for Stormwater treatment but an amenity overlay was added (this multi-functional approach was also used at the younger Westgate park development except topsoil depth there is inadequate, not 300 mm and some trees that require better drainage, like puriri and titoki are dying).

8 – Overflow from detention ponds through no-mow shrubland

The plantings in the park were conceived as the 'heart and lungs' to nuture and soften surrounding development and provide connections to the natural environment. This overflow area connects through to riparian area and Lucas Creek; it requires much lower than traditional mown lawns in parks, but does require weed removal; plant growth may be limited by low-quality soils. Note the bird on the rock!

9 – Newly-planted bioswales/landscaping

The gardens lie within permeable Hoggin and intensively irrigated and mown lawns; some may act as bioswales and receive runoff; the areas were planted recently – a time of year that means plants are highly susceptible to drought stress. This will be an interesting area to watch over the next few years. The construction is adjacent to an area contractors' park which has several large raingardens with single (deciduous) specimen trees…

10 – Abandoned, rubbish-filled raingardens with unpruned trees

The raingardens have supported healthy tree growth but an absence of maintenance is evidenced by: large volume of gross litter; no tree canopy lifting which is needed to allow the groundcover plants under the canopy to remain dense; sediment accumulated in inflows; weeds growing – particularly on inlets; construction material and road signs in the raingardens. The raingardens on the side furthest from the construction was inundated by sediment runoff from bare land in about 2014, and this created excessive (days) of ponding.

11 – 2007/9 landscaping struggling in local respread topsoil

Cabbage trees are highly tolerant of exposed conditions, as are nikau once established – but even these species are struggling in the very shallow topsoil – look for the place where the surface is exposed and look at the cracking and lumps of pale coloured which indicates hostile physical conditions.

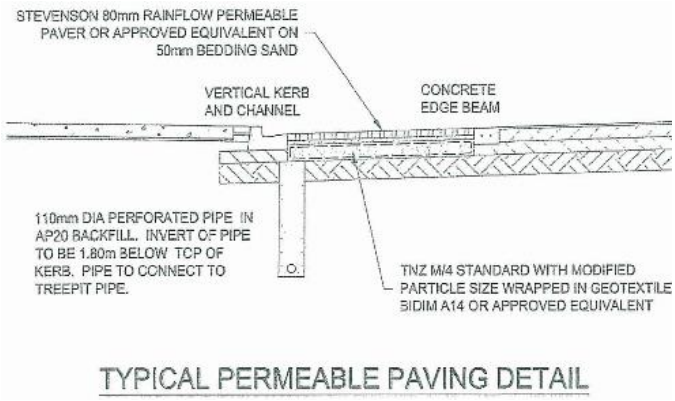
Cabbage trees can cope with pruning back, and dead libs have been removed to tidy them up (they could have been given an organic mulch with 30% compost in the mix). Note the path is lower than the landscaped area in general.

12 – Raingardens and separate tree pits with highly fertile media 2008

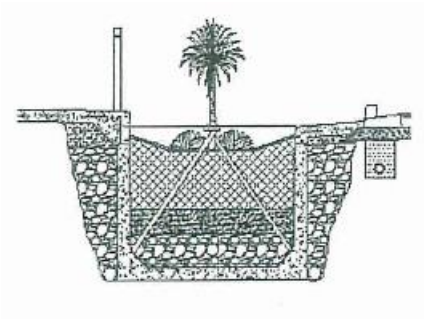
Cast *in situ* concrete frames form the outer skin of these raingardens and tree pits. Inlet location with road shape means only a few inlets 'do the work'. Raingardens are visually indistinguishable from tree pits and landscaped areas except raingardens had denser plant growth due to more water and less drought stress when establishing in dry 2008/2009 summer and higher fertility, more air in winter. High fertility has resulted in sedges dominating (NZ iris *Libertia* and oioi *Apodasmia* have been smothered) and edges requiring cutting to maintain inlet function and road visibility. Once tree pits are full they overflow to raingardens or standard catchpit. Overflows are placed inside raingardens and have decorative flat tops, not nasty domes. These raingardens have a high proportion of treatment volume and low volume of concrete compared with earlier raingardens (stop 14). Media had high proportion of compost (c. 40% v/v) – localized piping / preferential flow can be seen where the media is inadequately compacted due to concrete outcrops) and there has been shrinkage/significant depth reduction. Organic mulch was used and shifted in some gardens initially.

13 – Permeable paving

Stevenson 80 mm 'rainflow' permeable pavers are placed on 50 mm bedding sand and modified porous base course. Permeable paving is vulnerable to sediment running from adjacent earthworked areas during adjacent later building construction. Areas receiving shade have substantial adventive plants (including cosmopolitan native species).



14 – Oldest raingarden 'bear pits' in 'U' concrete culverts 2006



These were designed a/c to TP10 (2003) to remove 75% TSS and erosion control for 1 yr ARI (65 mm depth over 24 hours); the local pipe system is designed for the 20 yr ARI. Excess Stormwater is directed to adjacent roads. They are grossly overdesigned for such small catchments with excessively wide concrete edges between road and raingarden (that create lovely sheet flow); excessive entry aprons; very large and ugly overflows outside the raingarden that cannot be masked with vegetation; and very deep ponding (originally 300 mm) created by baffle boards – contrast with the younger raingardens on Davies Road that have much larger 'treatment volume' to concrete ratios. Pebble mulch. The bollards and chains that protect people from the bear pits add maintenance cost and risk.

Cabbage tree and sedge survival is variable; initial vandalism of cabbage trees may have been exacerbated by rope & stake supports; plant ground cover is now marginally adequate. The single species used, *Carex secta* is vulnerable to Roundup drift. Media is typical 'TP10' with relatively high fines content and low to moderate organic content (described as 'loam/sand media on coarse sand transitional layer on gravel drainage).

Corban Ave raingardens in 2006 shortly after installation; Davies Road raingardens at about 12 months of age (2009)

15 – Riparian fingers retained and buffered with native planting

A feature of North Shore developments of the time; sometimes combined with stream reconfiguration and online ponds in oldest areas.

16 – Carpark mown grass and tree swales

These swales are old but low maintenance; clustered trees boost stormwater performance through increasing Evapotranspiration T, functional soil depth as roots extend, also increase aesthetics and provide service of reducing reduce parked car temperatures. Native trees can provide habitat (fruits of totara, bark and insects are important for native animals) but all trees are vulnerable to collar damage from weedeaters; permanent ground covers

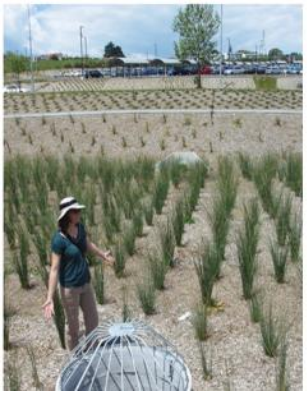
are better than mown grass. The grass is typically mown too short (much less than 100 mm height), however a relatively dense grass cover and absence of over-sprayed areas around grates is avoiding creating bare areas.

Nearby sites for your next visit …

NB: There are other WSUD sites of interest in the area, including Mitre 10 raingarden and Albany Park n Ride treatment train which had (in 2009) swales and 71 Enviropod catchpit filters to reduce loading on a 148 cartridge Stormfilter system (Stormwater 360), decreasing maintenance requirement. The area used to discharge into a small wetland; extension of the park and ride saw this replaced by a very large raingarden adjacent to Lucas Creek

Mitre 10, shortly after construction (c. 2009/10?) and after retrofit of rocks at inlet pipes (right – photos courtesy Chris Stumbles). Raingarden and landscaped area had different soils; raingarden mix was free-draining with reasonable bearing capacity but weedy to start with (no mulch); mulched landscaped area had ponded water and very low bearing capacity

Park n Ride swales (2012 photo – should not plant in straight lines like this)


Albany park and ride station large raingarden (part of treatment train). Right photos are from 2012 and show overflow and rock-lined outlet structures

Ugly detention basin / raingarden receiving runoff from artificial turf: High maintenance, narrow benefits


Lucas Creek reshaping of flood zone and riparian area to reduce erosion/bank instability by increasing floodplain width, adding habitat features (right photo is 2012)

The above slides are exerpts from Blom C and Irwin A 2011 'Piloting new approach in asset management' August 2011 https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=1160

- University of Auckland papers/theses , e.g. Fassman, Lio, Hellberg & Eason 2009 'Monitoring of the treatment train at the Albany Park n Ride' Stormwater09
- 2017. IdeaAnthro http://www.ideanthro.com/content/2017/5/30/fine-balance-part-2 https://www.youtube.com/watch?v=cSECmgRq9_E
- Roelofs RB, Simcock RC, Cheah J 2017. Permeability of Raingardens – field measurements and observations in Auckland. http://www.stormwater360.co.nz/assets/Uploads/Roelofs-et-al-Permeability-of-Raingardens-Field-Measurements-And-Observations-In-Auck.pdf