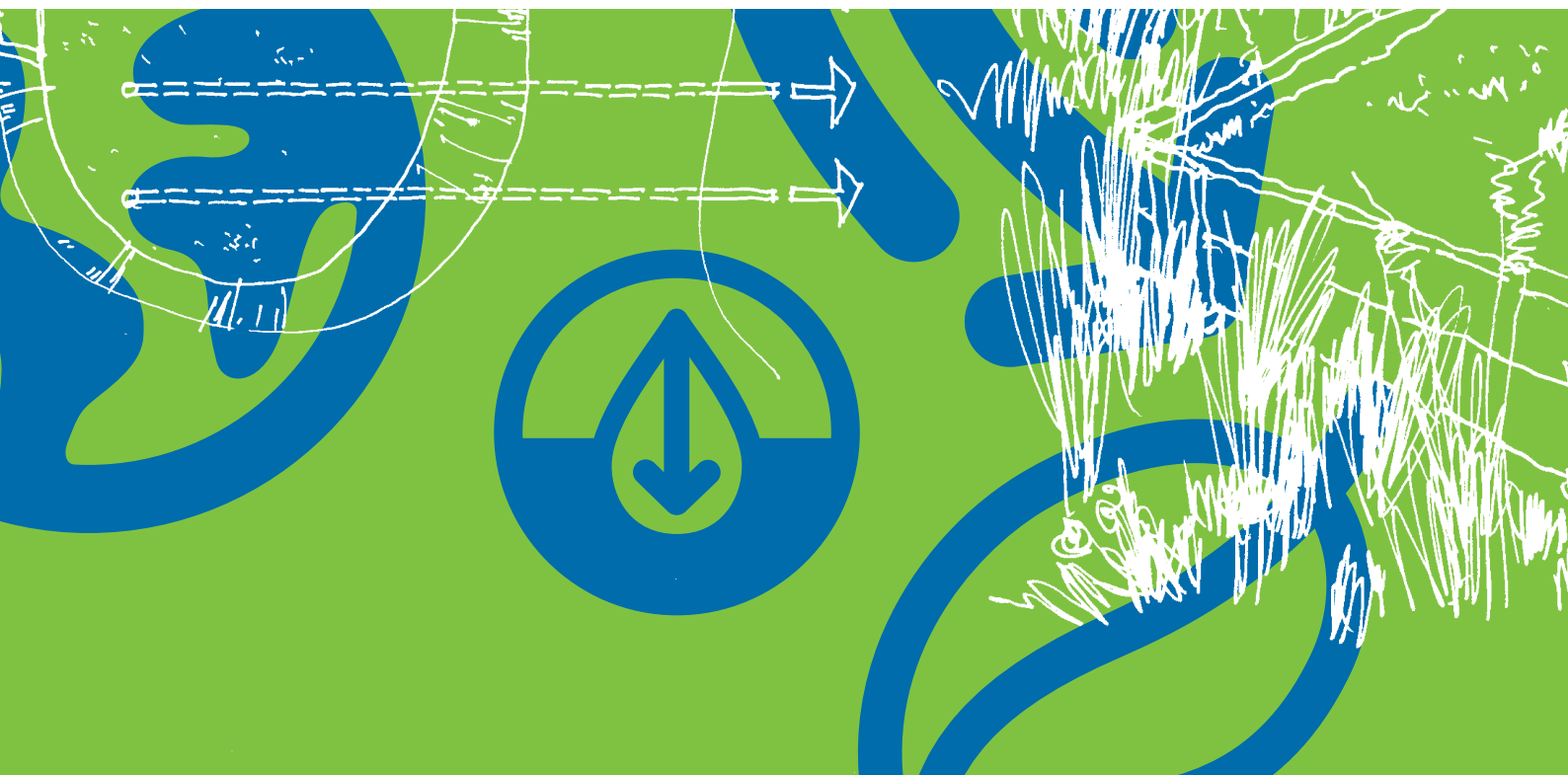




## Water Sensitive Designs

small improvements, new ideas, concepts and sketch designs for stormwater filtration systems

**waterbydesign**





# Water Sensitive Designs

small improvements,  
new ideas, concepts  
and sketch designs  
for stormwater  
filtration systems

## Protect & Enhance Waterways



Infiltration



Flow Management



Water Quality



Habitat



## Enhance Landscape Amenity



Community Interest



Visual Impact



Sense of Place



Landscape Amenity

## Maximise Benefits to Community



**Microclimate**



**Stormwater Reuse**



**Safety**



**Passive Recreation**



## Manage Capital & Lifecycle Costs



**Resource Efficient**



**Space Efficient**



**Efficient Maintenance**



**Material Sustainability**

By promoting infiltration throughout catchments and adjacent to creeks we can help restore the natural watercycle and lessen the impact on downstream waterways.



**Infiltration**

# Tree Pit

**application:** road verges / footpaths

**advantage:**

- promotes infiltration
- stormwater treatment
- economical to build
- improve tree growth /shade

**note:** this can be modelled in MUSIC using a bioretention node with low hydraulic conductivity and no extended detention depth

**idea (sourced or via):** BCC & Matt Nolan EDAW



**Infiltration**



**Water Quality**

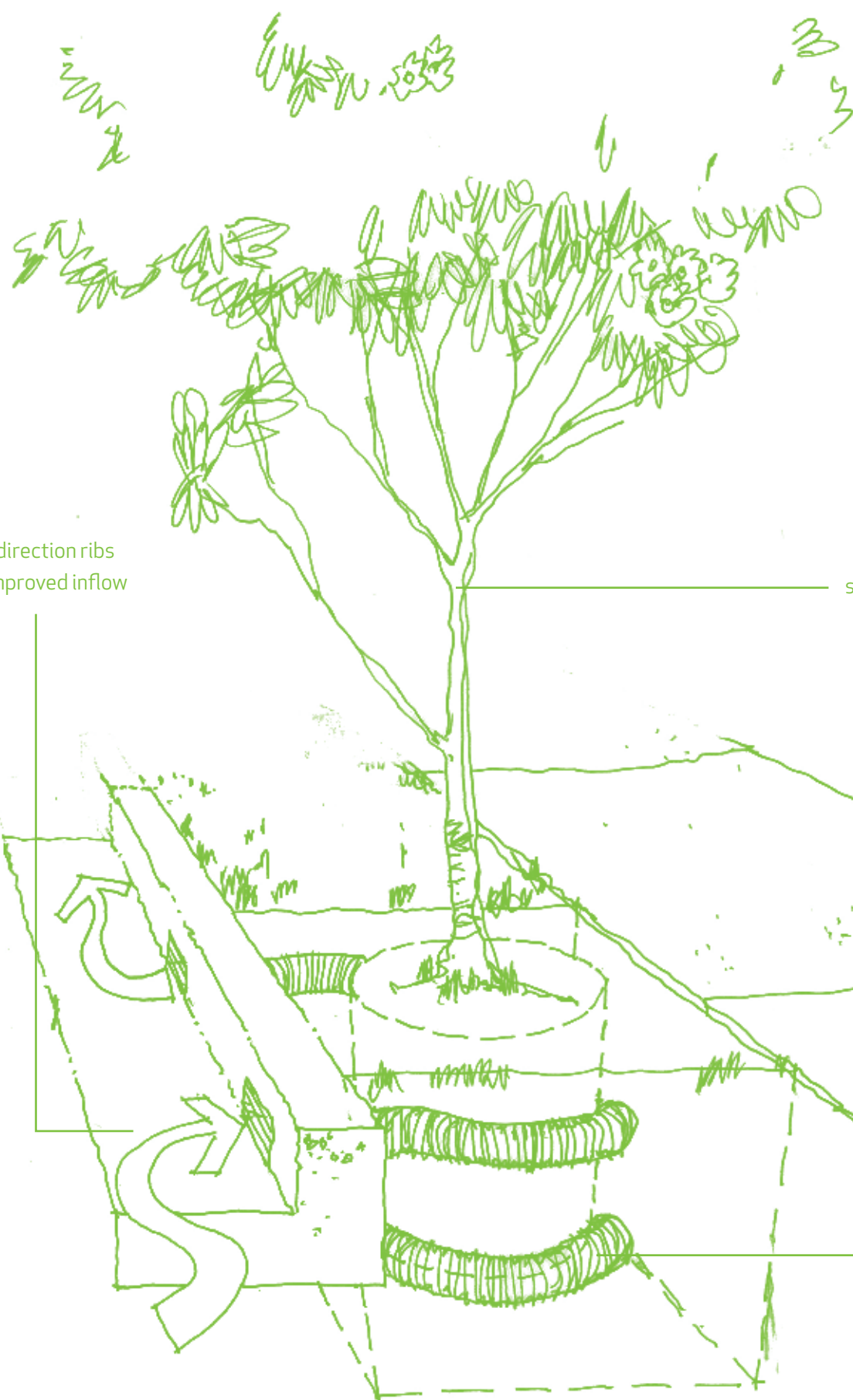


**Resource Efficient**



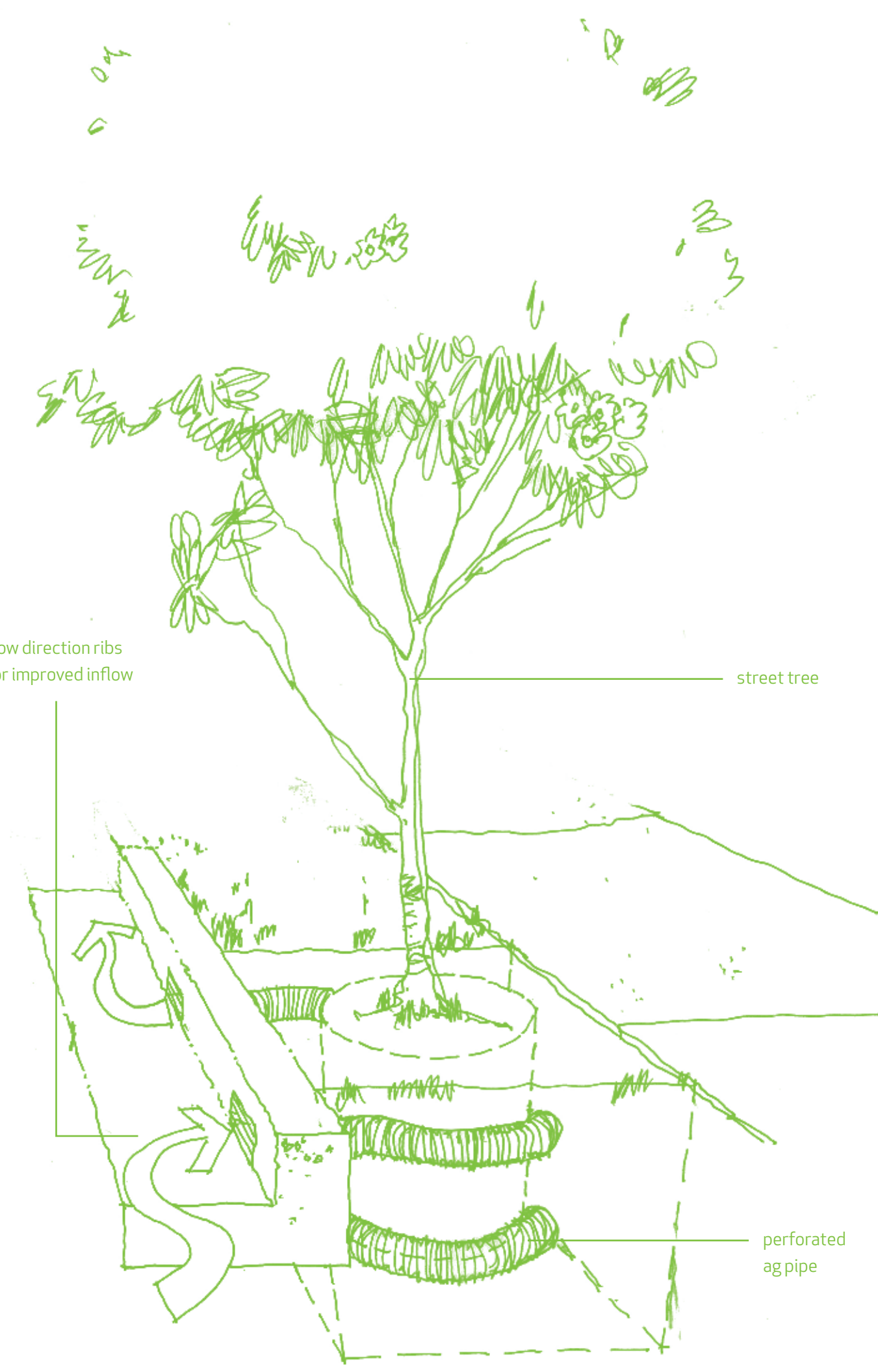
**Microclimate**





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# Infiltration Basin

**application:** stormwater outlets next to riparian zones

**advantage:**

- infiltration & sheet flow to riparian zone
- stormwater treatment
- lower cost
- shade
- hydrological benefit

**note:** hydrological benefit can be modelled in MUSIC by adding infiltration to a bioretention node

**refer:** Water by Design - Field Guide for suitable tree species in your local area

**idea (sourced or via):** BMTWBM & BCC



**Infiltration**



**Water Quality**



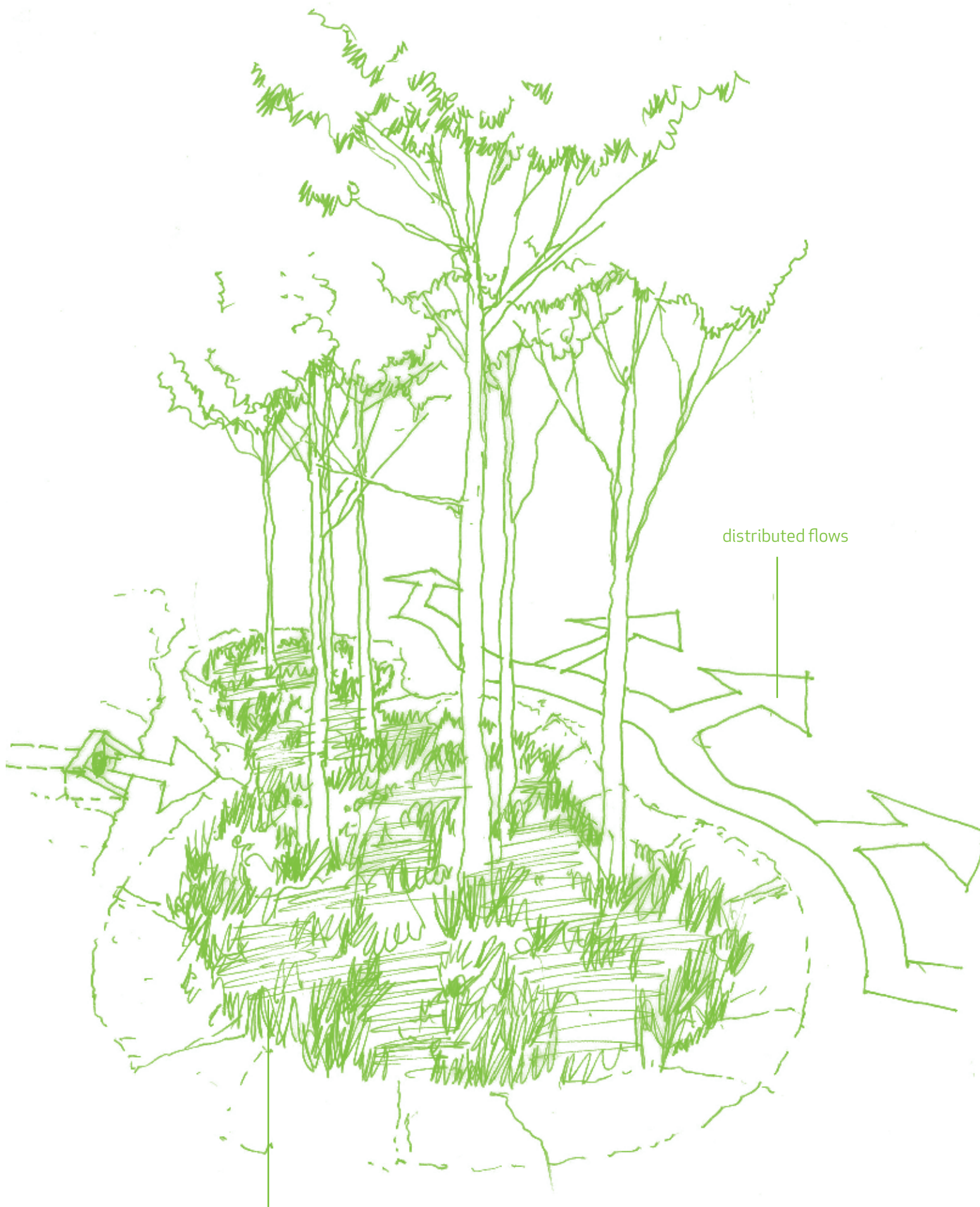
**Resource Efficient**



**Microclimate**



**Flow Management**



distributed flows

insitu sandy soil

# Infiltration Swale

**application:** adjacent to riparian zones

**advantage:**

- promotes infiltration
- stormwater treatment
- hydrological benefit
- lower cost

**note:** hydrological benefit can be modelled in MUSIC by adding infiltration to a swale node



**Infiltration**



**Water Quality**



**Resource Efficient**



**Flow Management**



# Coastal Bioretention

**application:** coastal bioretention systems on sand

**advantage:**

- maximise infiltration
- low cost
- minimise stormwater pipes

**note:** groundwater level / adjacent landuse and structures



**Infiltration**

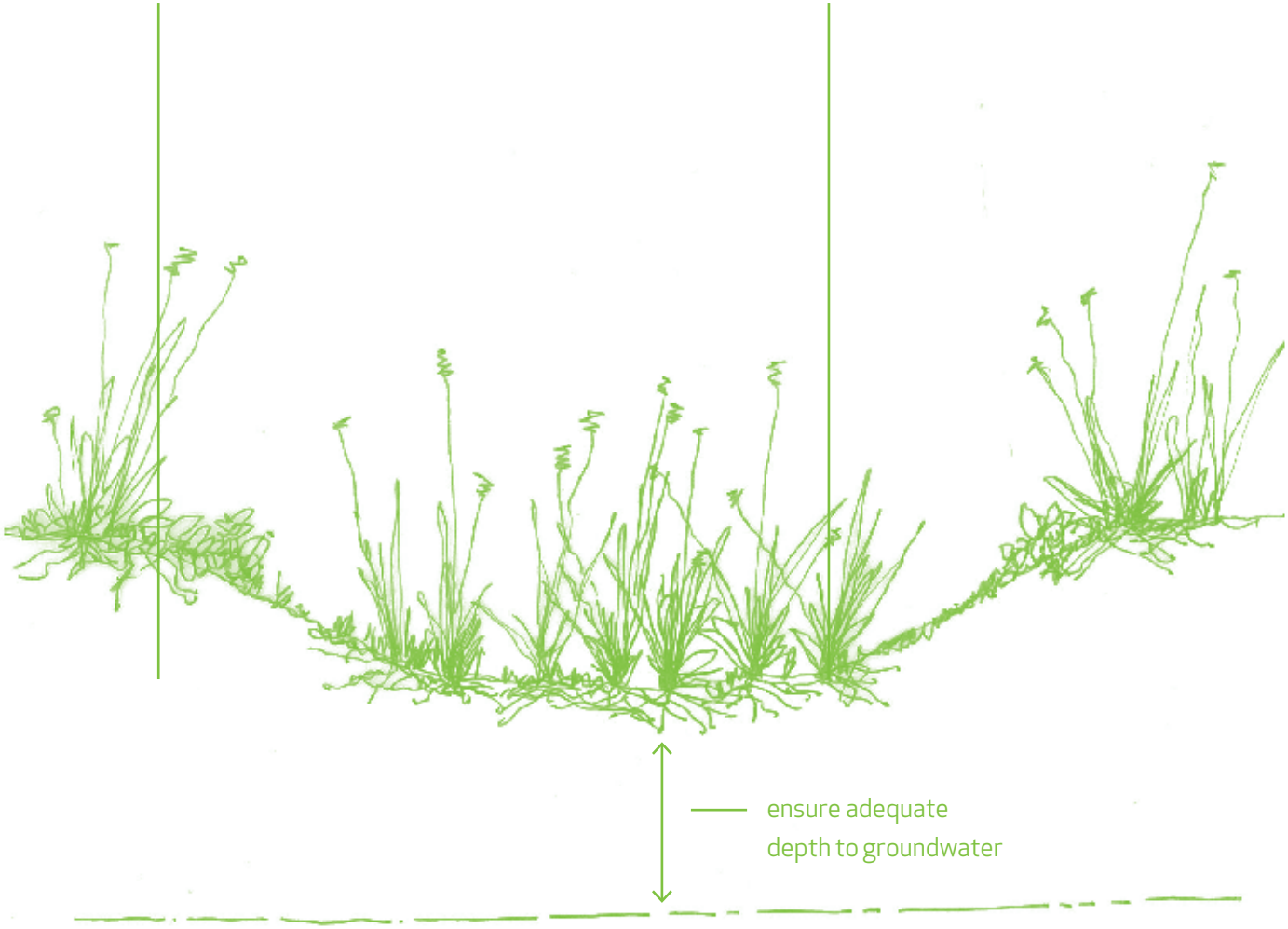


**Resource Efficient**



insitu sandy soil

endemic coastal vegetation



Unless regulated, the development and hardening of catchments can have detrimental impacts on local streams and creeks. It is important to try and avoid these impacts before repair work becomes necessary.

Flow management can be achieved by increasing permeable areas, promoting infiltration, stormwater harvesting and stormwater detention.





# Flow Management

# Lotscale Infiltration

**application:** residential lots

**advantage:**

- avoids hydrological impacts
- promote infiltration

**note:** consult geotech for infiltration near footings

**refer:** green roof design guidelines <http://www.growinggreenguide.org/>

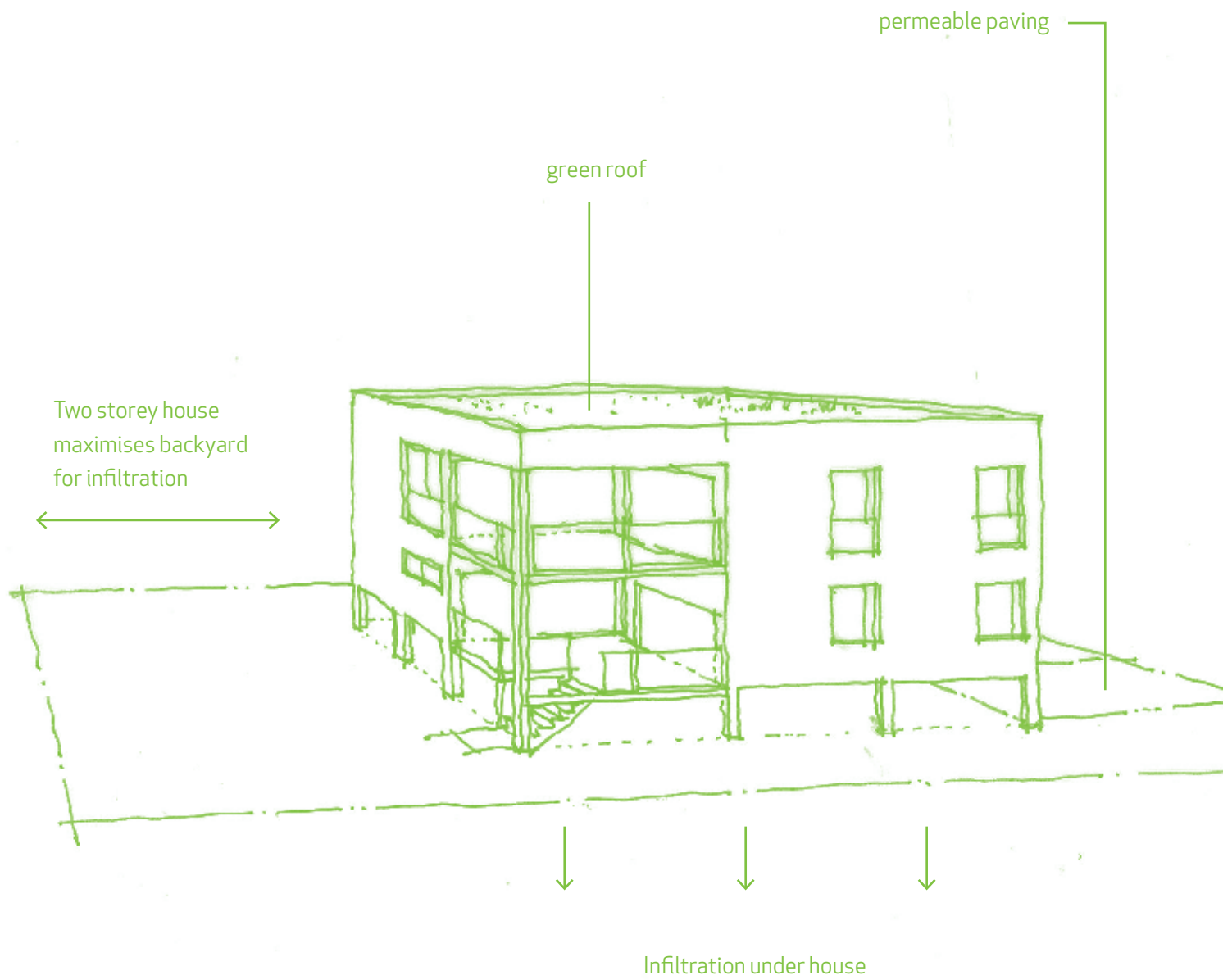
**idea (sourced or via):** Alan Hoban – Bligh Tanner



Flow Management



Infiltration



# Infiltration Terrace

**application:** sites with sufficient space

**advantage:**

- flow management
- infiltration

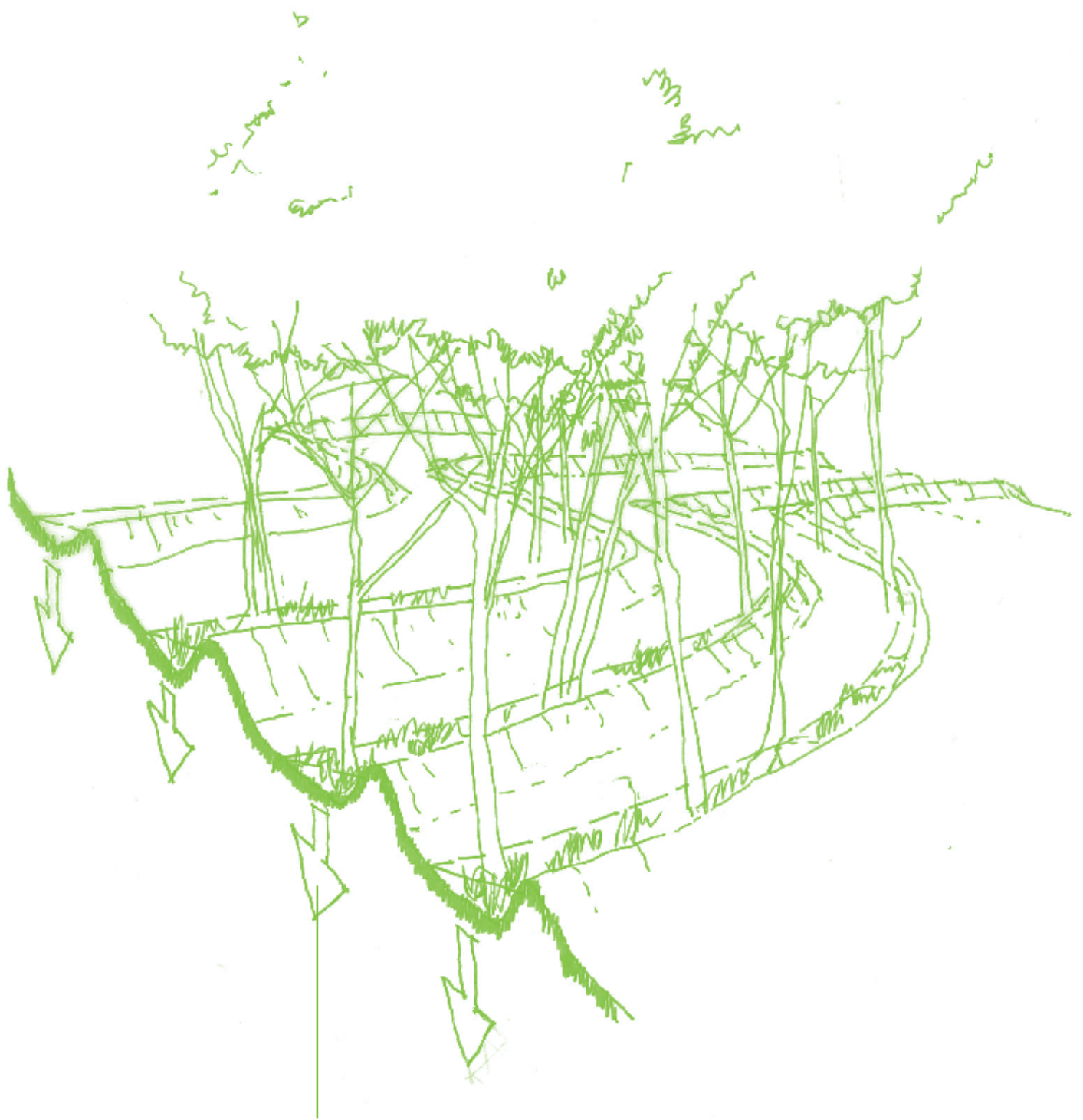
**note:** consider groundwater depth / adjacencies / insitu soil type  
**idea (sourced or via):** Peter Breen - AECOM



**Flow Management**



**Infiltration**



Infiltration replenishes  
groundwater

# Basin Outlet Control

**application:** bioretention systems with detention

**advantage:**

- hydrological benefit
- help achieve waterway stability objective
- single outlet pit

**note:** requires hydraulic design / note safety (depth) considerations



**Flow Management**



**Resource Efficient**

additional  
flood storage

extended  
detention

orifice for further  
flow attenuation



Pollution threatens the health of our local waterways. An important function of any WSUD device is to capture and treat pollutants and improve water quality.





**Water Quality**

# Floating Wetlands

**application:** retrofit to urban lakes and ponds with poor water quality

**advantage:**

- water quality treatment

**note:** specific maintenance requirements / potential low DO conditions beneath mats if no flow

**idea (sourced or via):** SPEL environmental and Redlands IndigiScapes Centre



**Water Quality**



pollutants removed  
via root system

# Dedicated Carwash Parking Bay

**application:** multiunit developments

**advantage:**

- capture pollutants at source
- minimise potable water use

**note:** check groundwater proximity if using infiltration methods

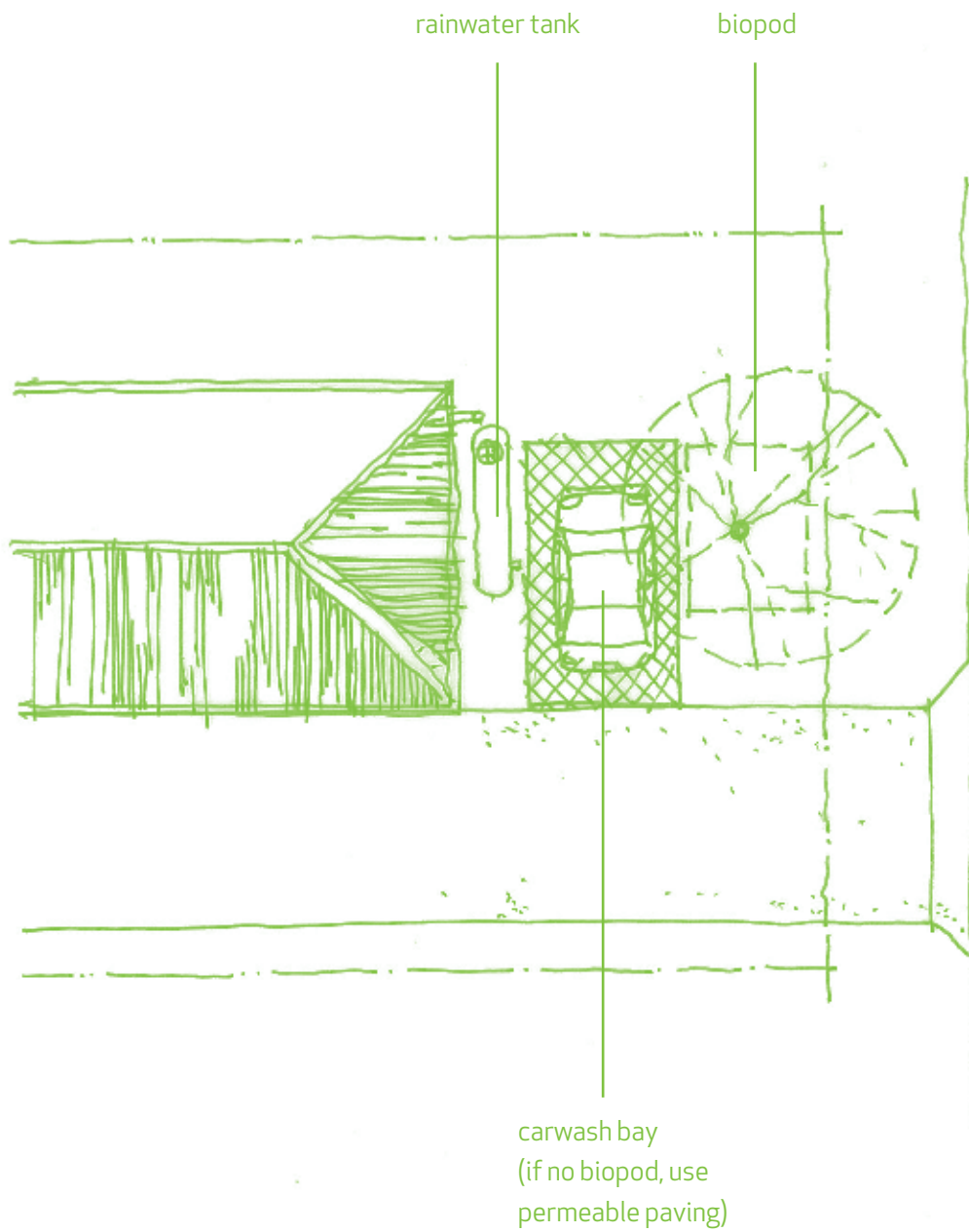
**idea (sourced or via):** Dylan Cain – CCE & Australian Carwash Association



**Water Quality**



**Stormwater Reuse**



# Side Cast Weir

**application:** retrofit of WSUD into developed catchments

**advantage:**

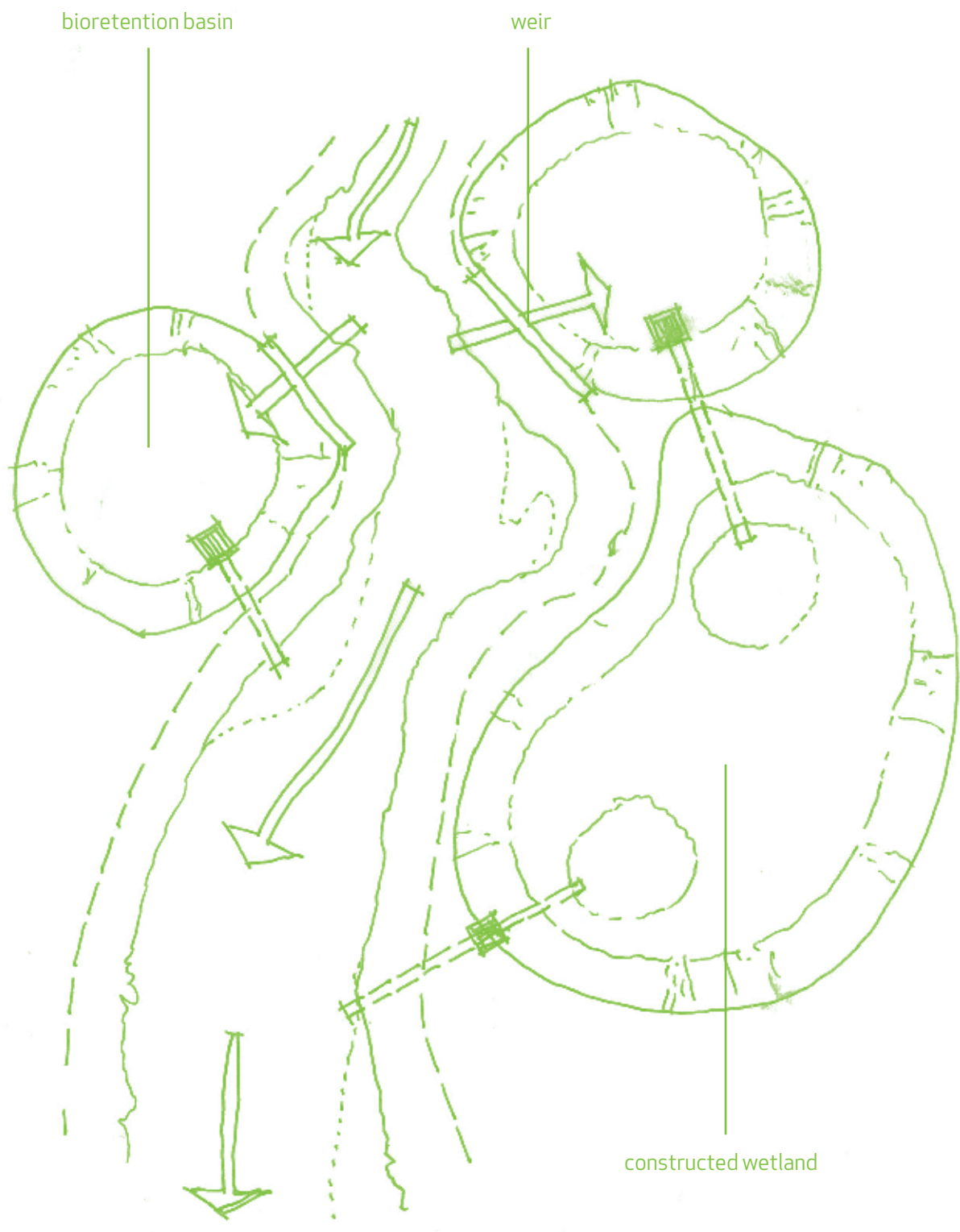
- improve water quality in creek and adjacent stream
- offline systems reduce the likelihood of high velocities within treatment systems

**note:** consider flooding issues / sediment loading and blinding issues

**idea (sourced or via):** Peter Breen and AECOM



**Water Quality**



It is important when designing stormwater treatment systems that we not to lose sight of the fundamental goal of habitat preservation. Habitat needs can be accommodated by:

- Conserving existing creeks
- Providing sufficient riparian buffer widths
- Assessing fauna needs
- Sourcing local plant stock
- Managing the interface between urban and riparian zones





**Habitat**

# Habitat Logs

**application:** bioretention basins and constructed wetlands

**advantage:**

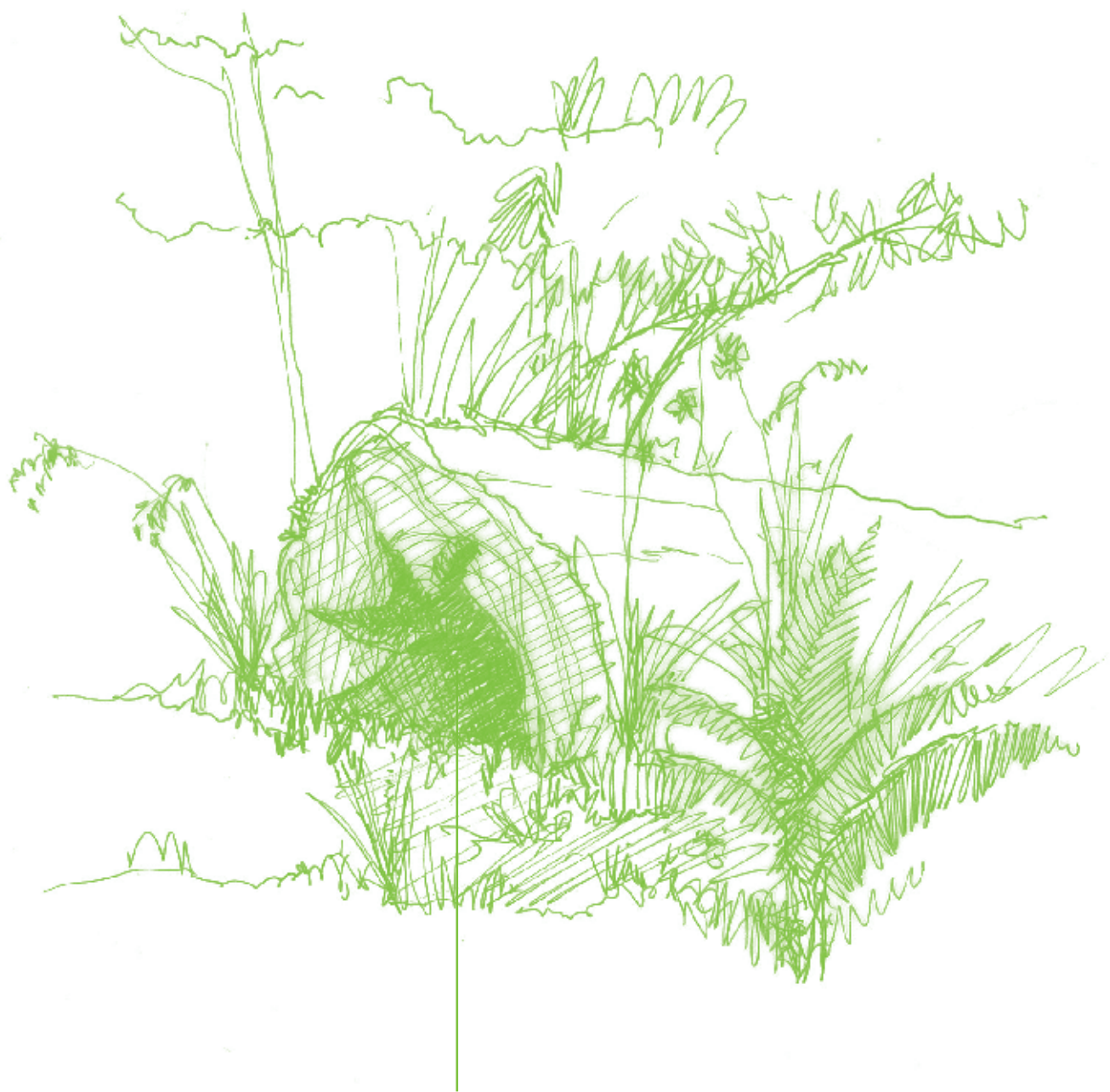
- provides habitat
- make use of any trees cleared for development

**note:** local fauna requirements

**idea (sourced or via):** Dean Challenor & Christoph Pester - EDAW



**Habitat**



hollows for fauna

# Flow Spreader

**application:** basins outlets next to riparian zones

**advantage:**

- sheet flow to riparian zone
- promotes infiltration
- supplies water to more vegetation
- more treatment of stormwater

**note:** scour protection requirements



**Habitat**

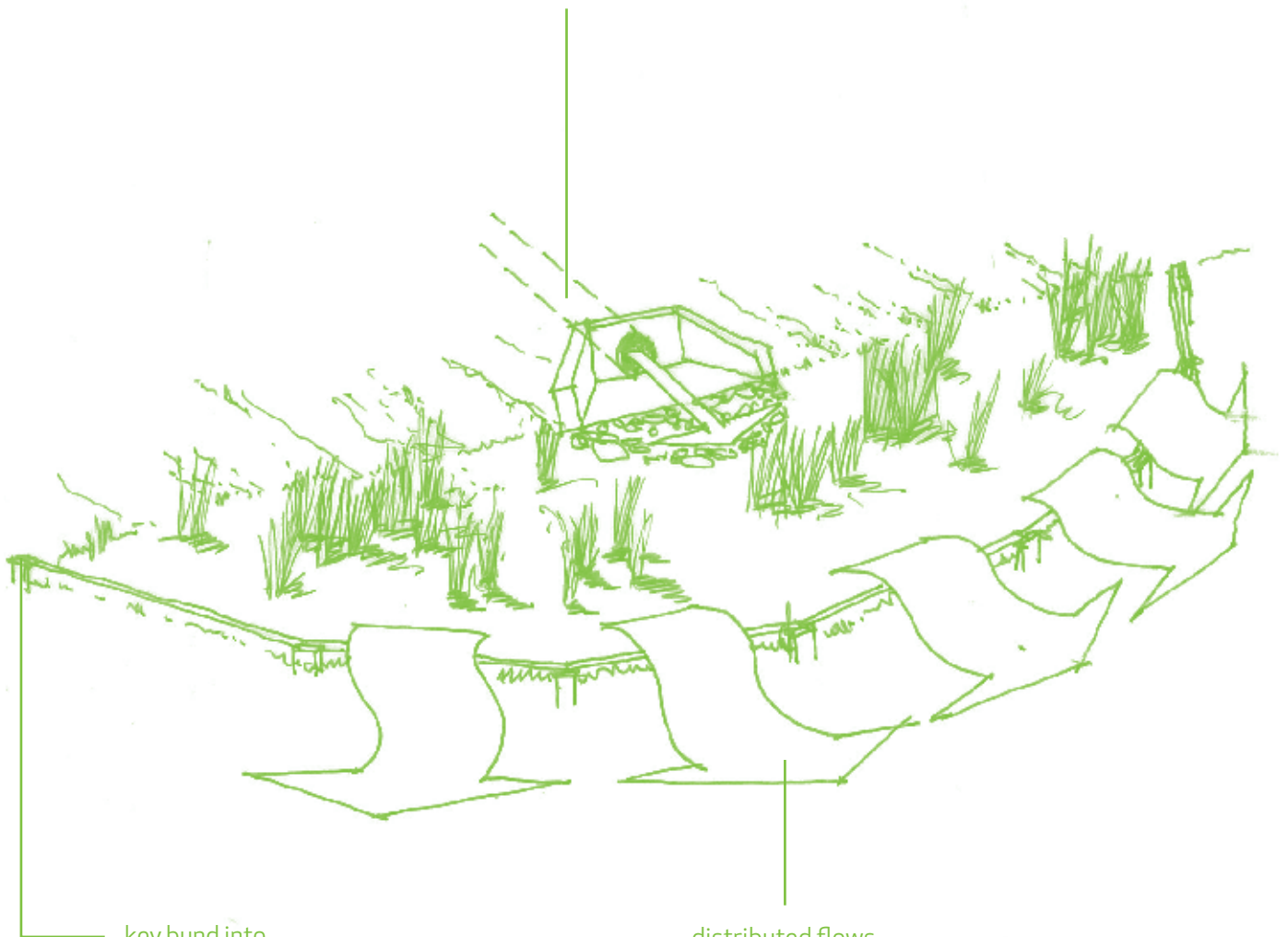


**Infiltration**



**Water Quality**

stormwater pipe



key bund into  
embankment

distributed flows

# Fish Friendly Outlet

**application:** large scale constructed wetlands adjacent to riparian zones

**advantage:**

- habitat
- simple construction

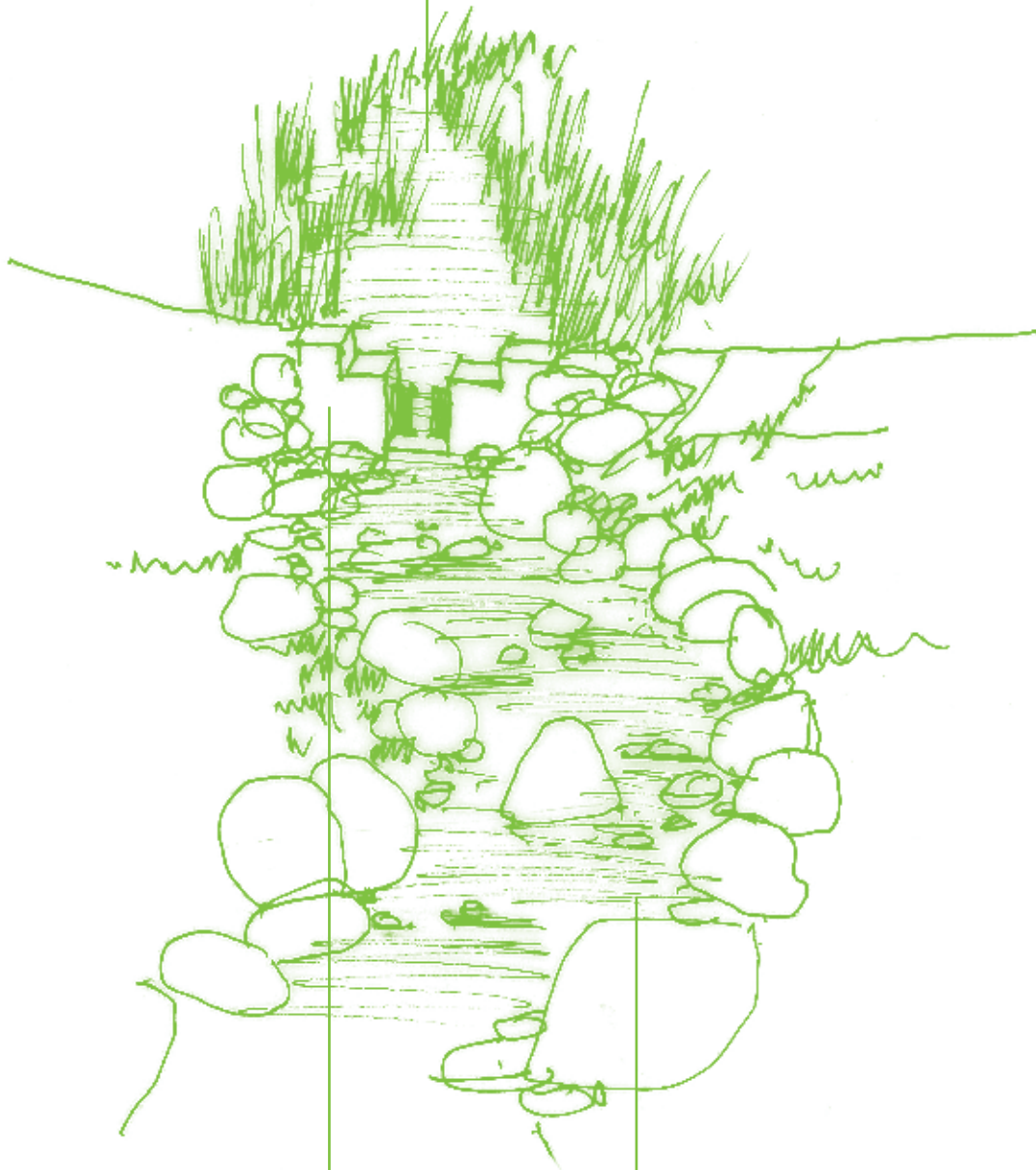
**note:** exotic fish species may disturb base sediments within wetlands

**idea (sourced or via):** Matt Moore - Reef Catchments



Habitat

wetland



weir with vertical slot  
maximum drop 80mm

rock ladder with  
refuge pools

The general community can be valuable allies for environment causes. WSUD should improve community understanding of the water cycle and promote stewardship.





**Community Interest**

# Feature Biopod

**application:** prominent sites with limited available space

**advantage:**

- point of interest
- small footprint
- capture rainwater
- water treatment

**note:** additional irrigation may be required to sustain plants



Community Interest



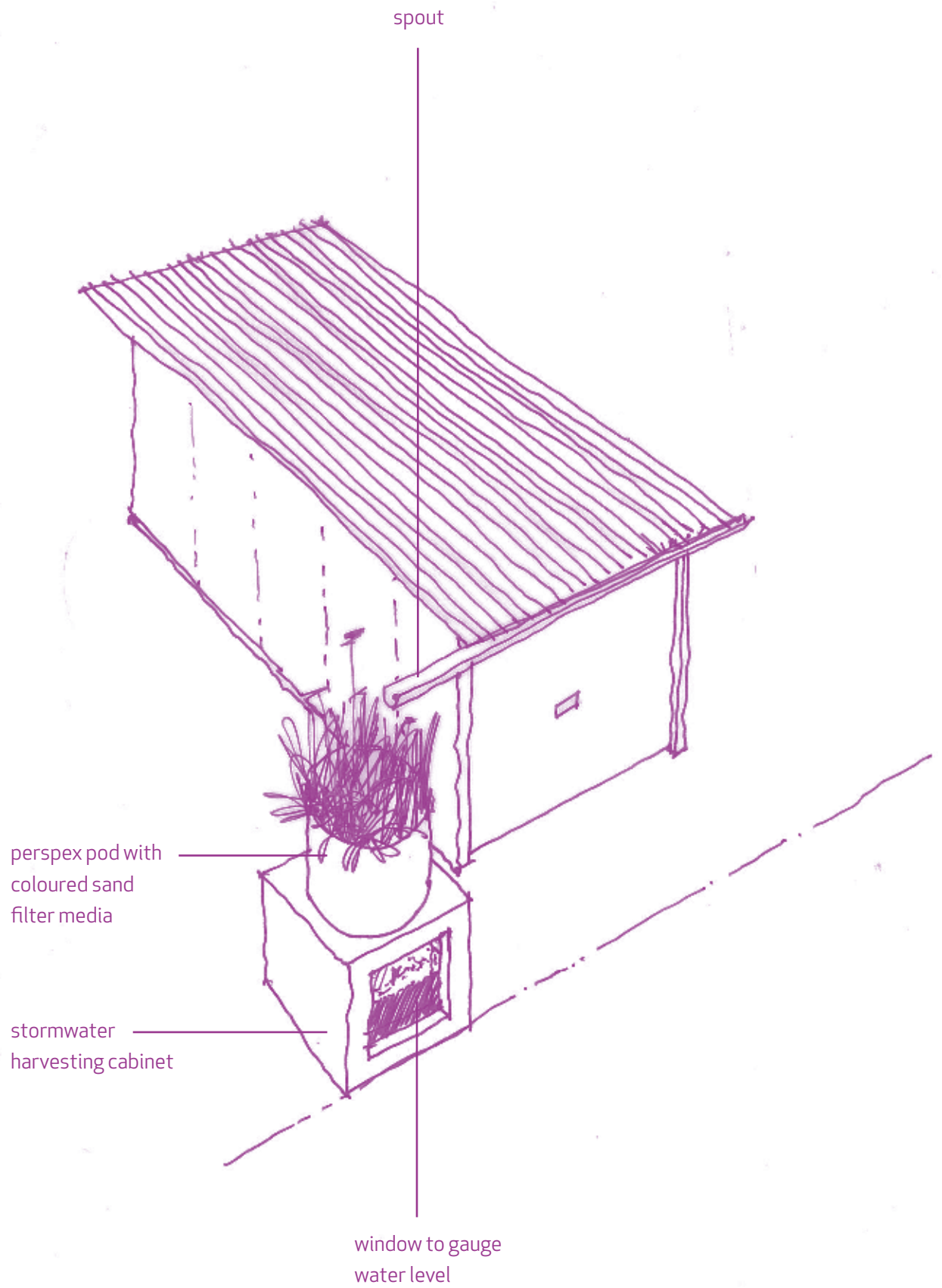
Space Efficient



Stormwater Reuse



Water Quality



# Art Feature Pit Grate

**application:** prominent overflow pits

**advantage:**

- connect public to marine conservation
- aesthetics

**note:** integration of hydraulics / maintenance access

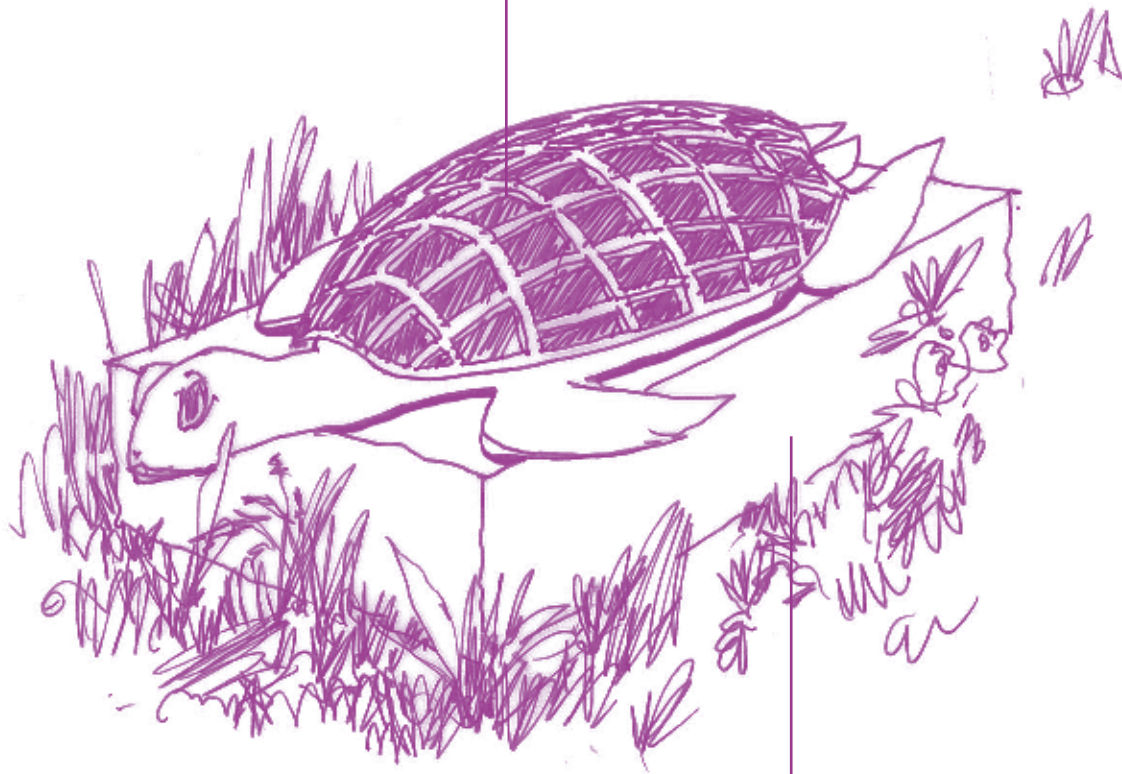


Community Interest



Sense of Place

open grate



overflow pit

# Grate Detailing

**application:** shallow streetscape bioretention systems with grate/drains

**advantage:**

- create community interest
- aesthetics
- low profile drain

**note:** trafficability considerations



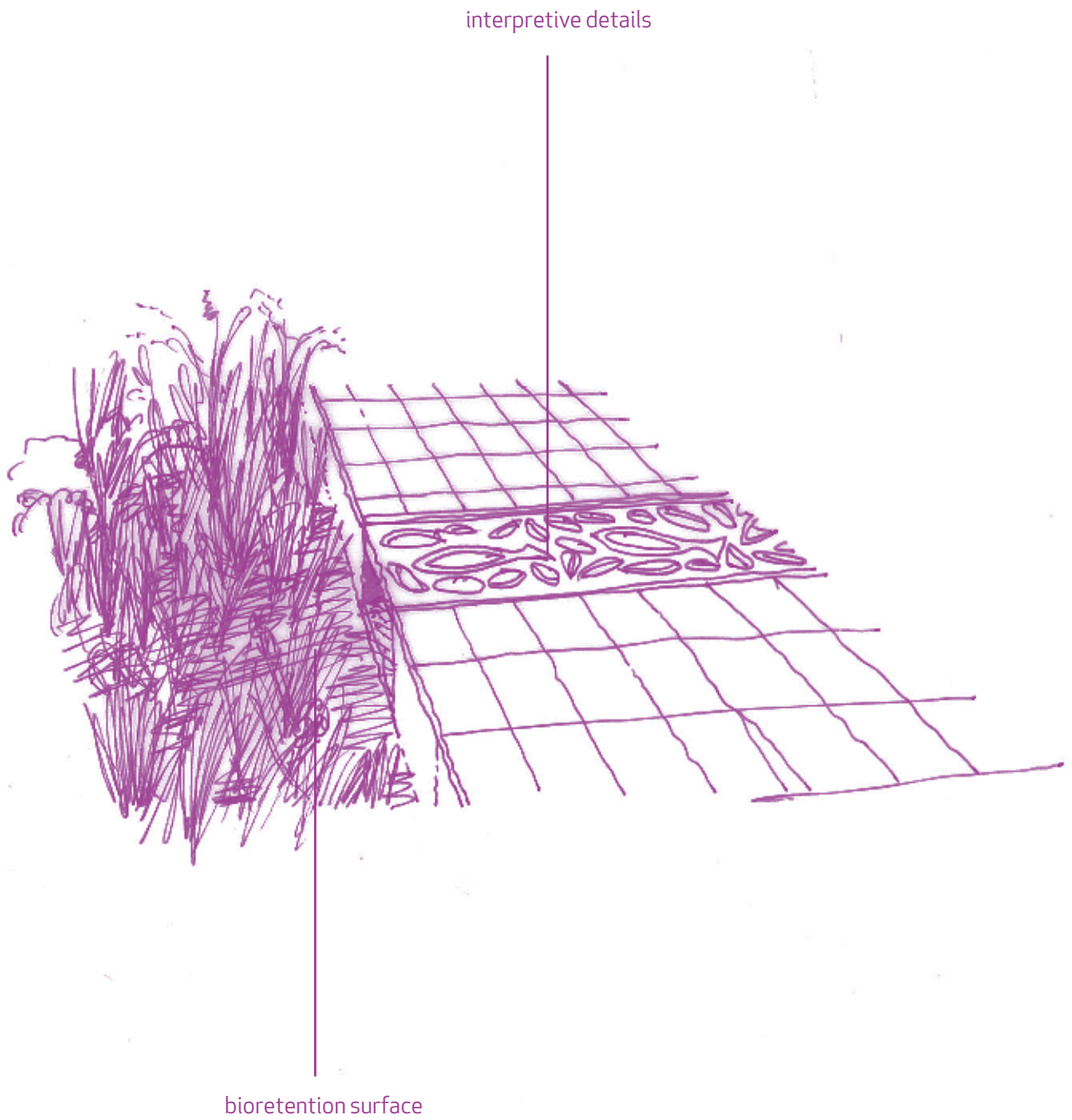
Community Interest



Sense of Place



Space Efficient



interpretive details

bioretention surface

# Eco Shower

**application:** beachside showers / eco resorts

**advantage:**

- create community interest
- feature
- at source treatment

idea (sourced or via): Jun Yasumoto - inhabitat.com



Community Interest



Sense of Place



Water Quality





hardy endemic coastal vegetation

Concrete pits, headwalls, scour pads and retaining walls should seamlessly blend into the landscape or be used to create striking features.



# Visual Impact



# Circular Pit

**application:** urban bioretention systems

**advantage:**

- improved aesthetics
- comparable cost

**note:** maintenance access requirements

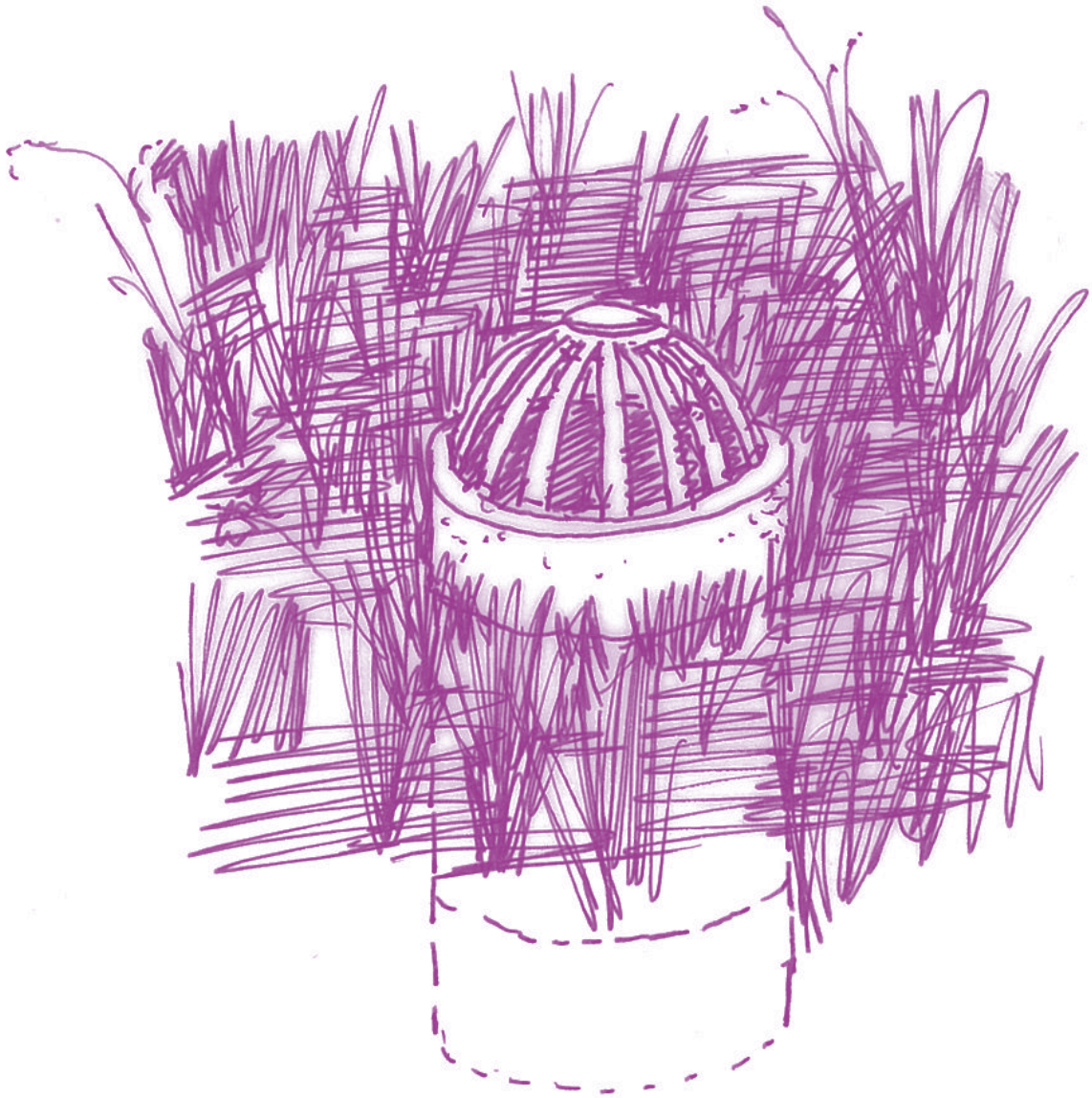
**idea (sourced or via):** Shaun Leinster – DesignFlow



**Visual Impact**



**Resource Efficient**



# Perimeter Step

**application:** urban bioretention systems with dropoff

**advantage:**

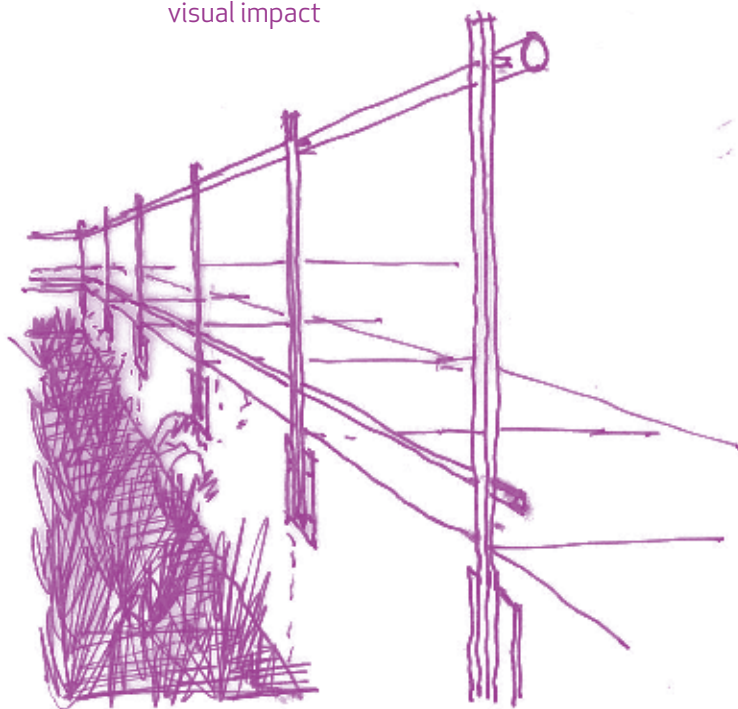
- reduced visual impact

**note:** risk assessment requirements



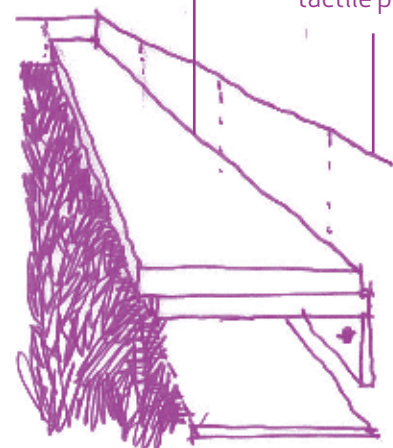
**Visual Impact**

fence has negative  
visual impact



reduced visual impact

fixed to wall



tactile paving

utilise filtermedia  
under step

# Energy Dissipation Sculpture

**application:** basins with high velocity flows

**advantage:**

- reduced visual impact
- energy dissipation
- scour protection
- point of interest

**note:** safety / maintenance / structural considerations



Visual Impact

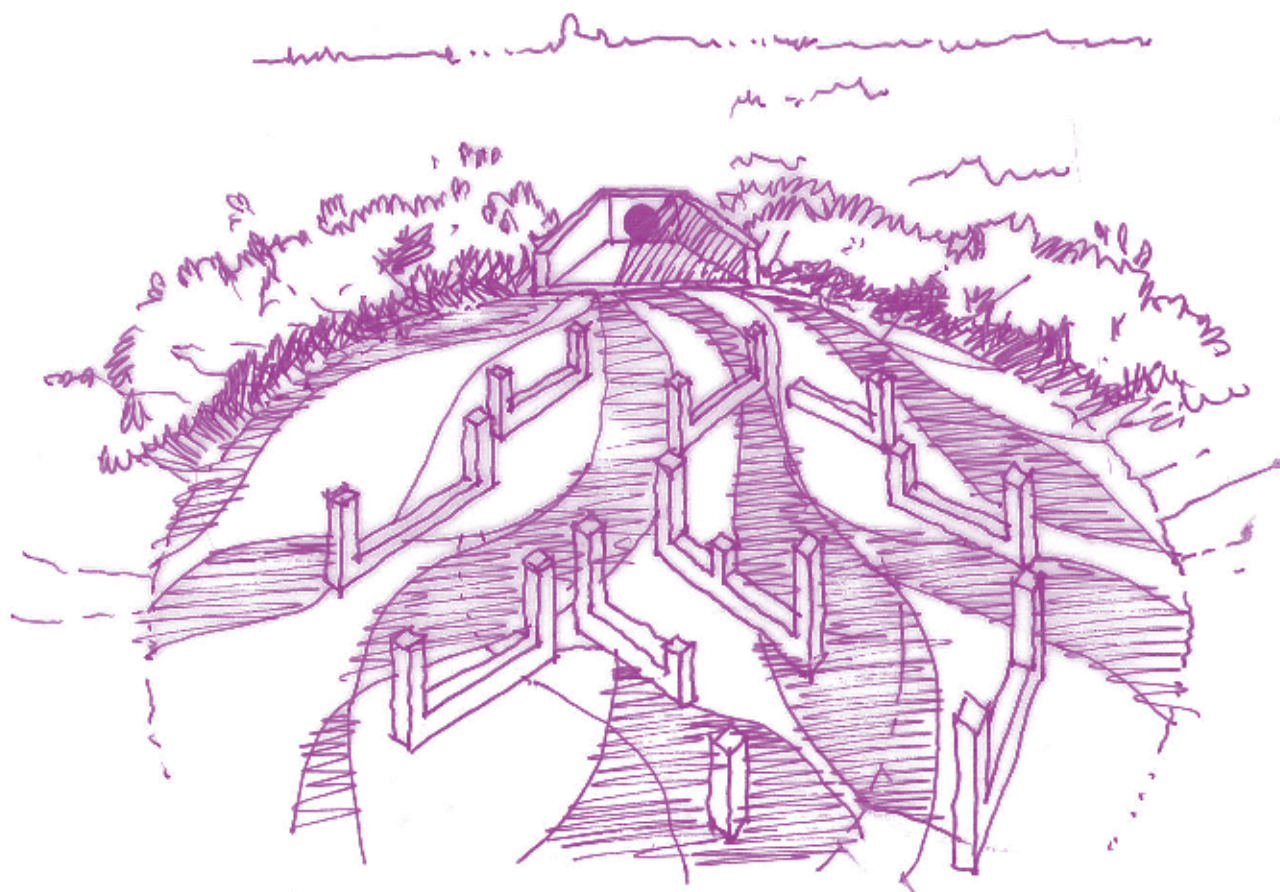


Efficient Maintenance



Community Interest





Designs should aim to create unique localities that reference local character and enhance a sense of place.

One way this can be achieved is by providing opportunities for the general community to observe flowing water.



## **Sense of Place**

# Downpipe Garden

**application:** on-lot bioretention systems

**advantage:**

- ownership by resident
- small footprint
- low cost
- at source water treatment

**note:** consult geotech for infiltration next to footings

(or try a surcharge outlet away from house - idea: Sally Boer – E2 Designlab)



**Sense of Place**



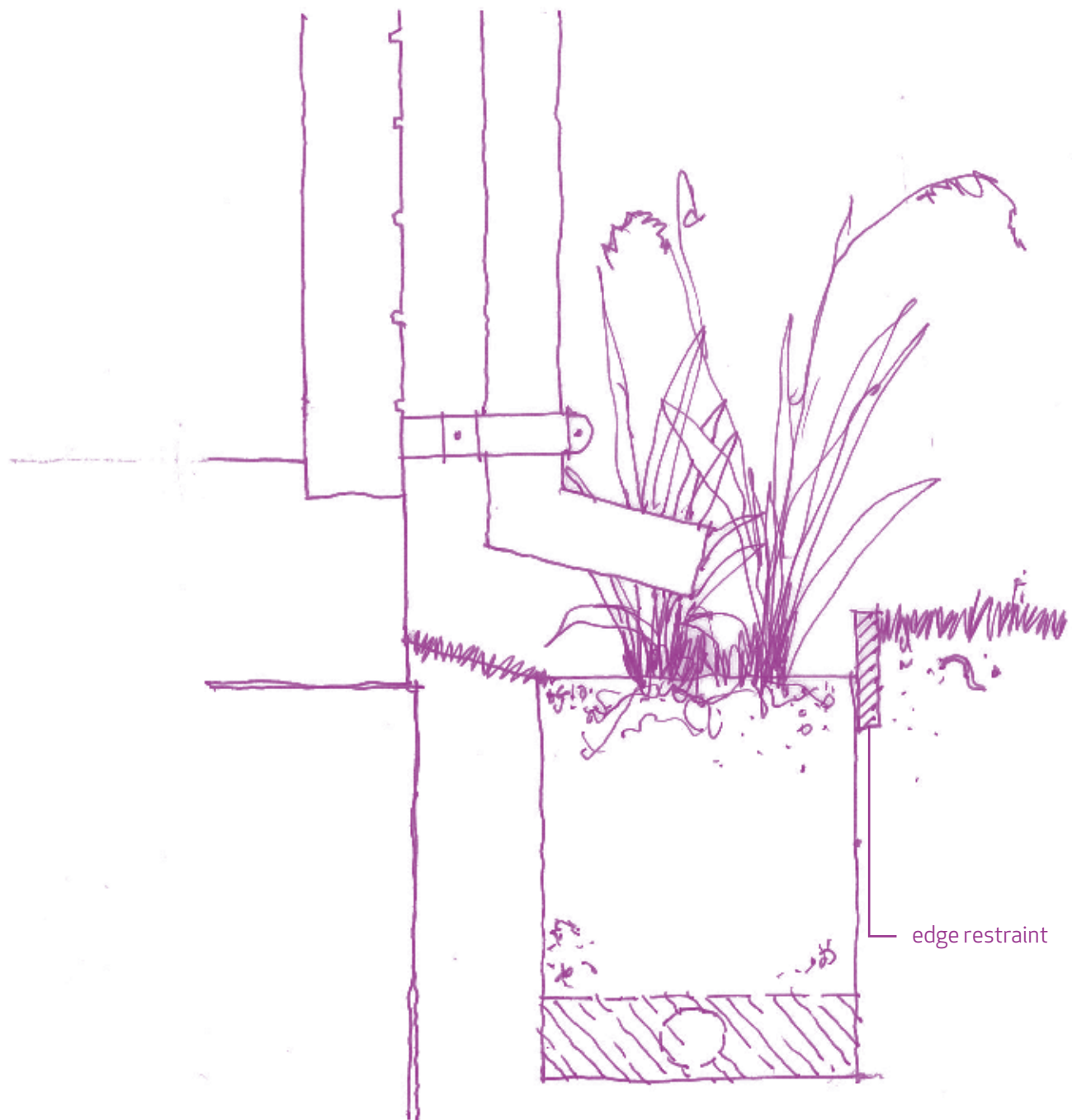
**Space Efficient**



**Resource Efficient**



**Water Quality**



# Internal Biopod

**application:** office space / hotel lobby

**advantage:**

- sense of place
- connection to outside rainfall
- no external footprint
- stormwater treatment

**note:** integration of hydraulics



Sense of Place



Community Interest



Space Efficient



Water Quality



# Cascade Outlet

**application:** roofwater treatment systems

**advantage:**

- water feature
- improve dissolved oxygen
- community interest when raining

**note:** consider signage / public interaction with stormwater and associated safety issues



Sense of Place

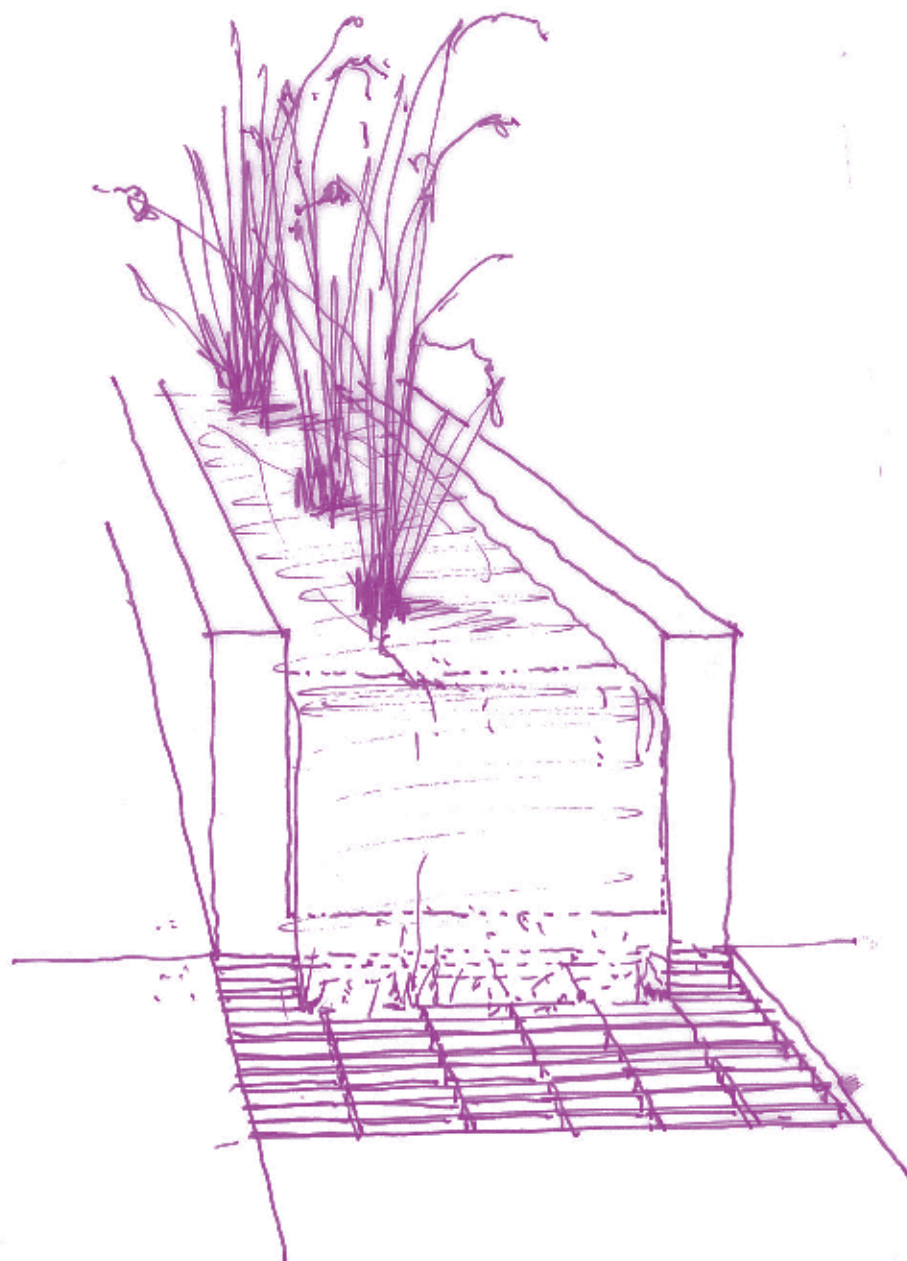


Habitat



Community Interest





# Urban Waterfall

**application:** outlets with difficult grade issues

**advantage:**

- water feature
- aesthetics
- improved dissolved oxygen
- prevents erosion

**note:** safety / structural stability issues



**Sense of Place**



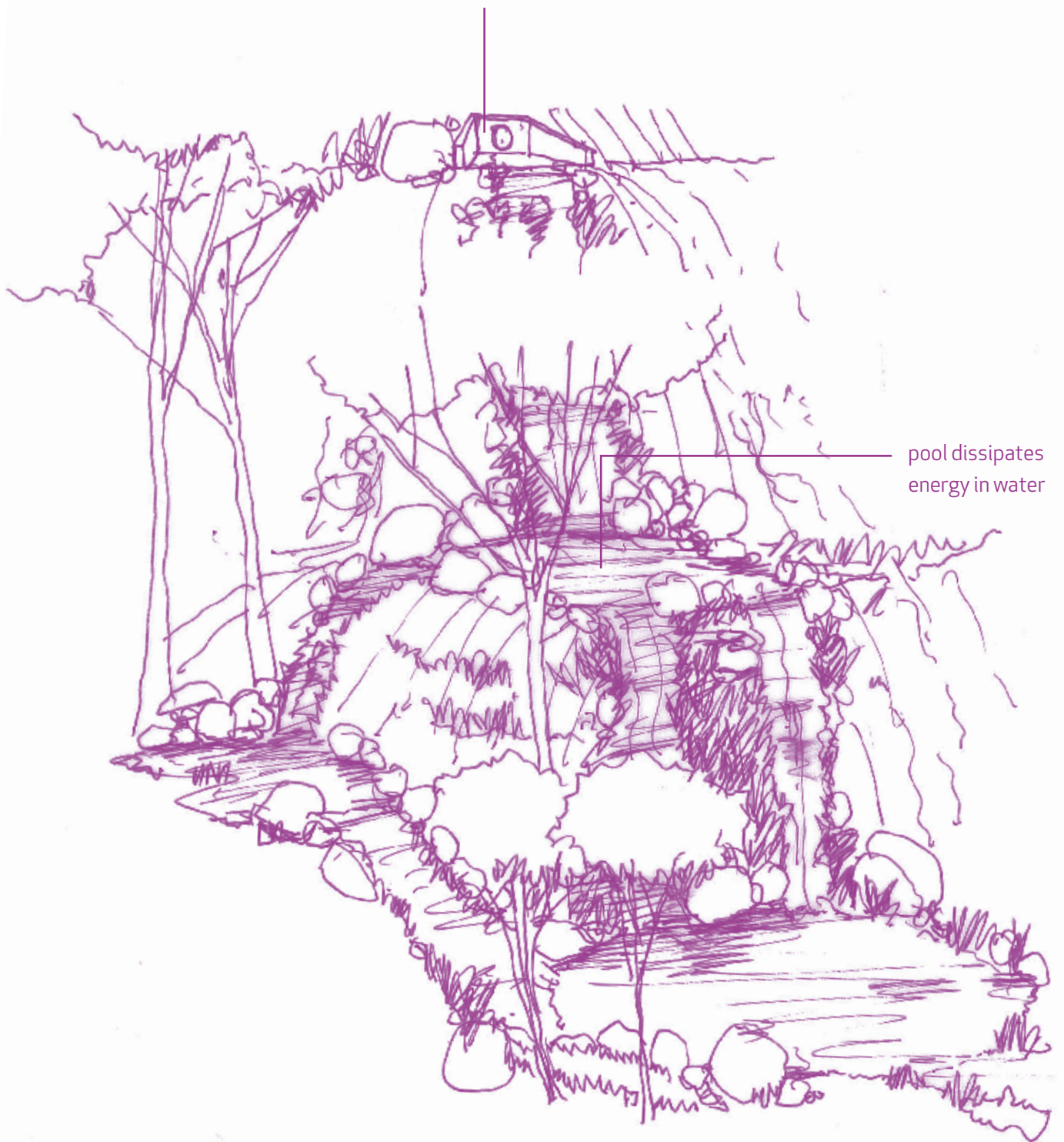
**Visual Impact**



**Habitat**

stormwater outlet

pool dissipates  
energy in water



With the density of developments ever increasing, there are strong drivers for enhancing the local environmental, social and cultural amenity.

This can be achieved by introducing elements that beautify and soften the urban landscape.



## **Landscape Amenity**

# Vertical Garden

**application:** sites with limited available space

**advantage:**

- soften urban landscape
- small footprint
- point of interest
- passive cooling benefits

**note:** additional irrigation may be required



Landscape Amenity



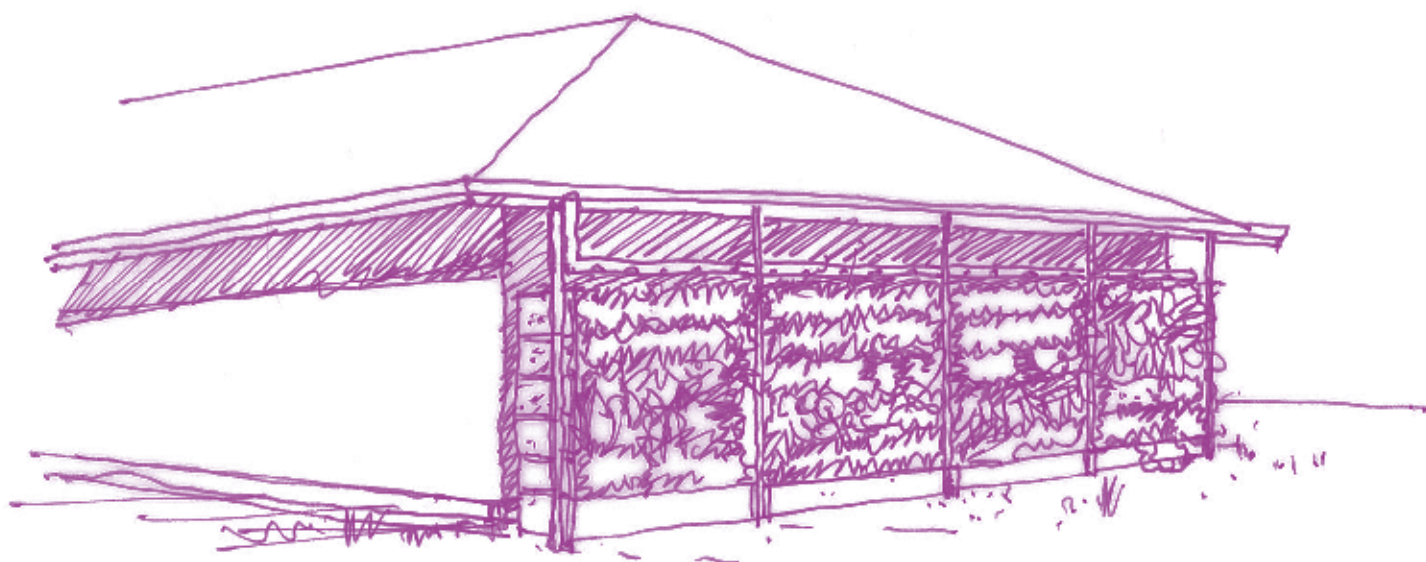
Space Efficient



Community Interest



Microclimate



# Terrace Planter

**application:** steep sites with terraced retaining walls

**advantage:**

- soften urban landscape
- optimal use of space between walls
- feature wall
- stormwater treatment

**note:** maintenance / structural and drainage requirements of retaining wall



**Landscape Amenity**



**Space Efficient**

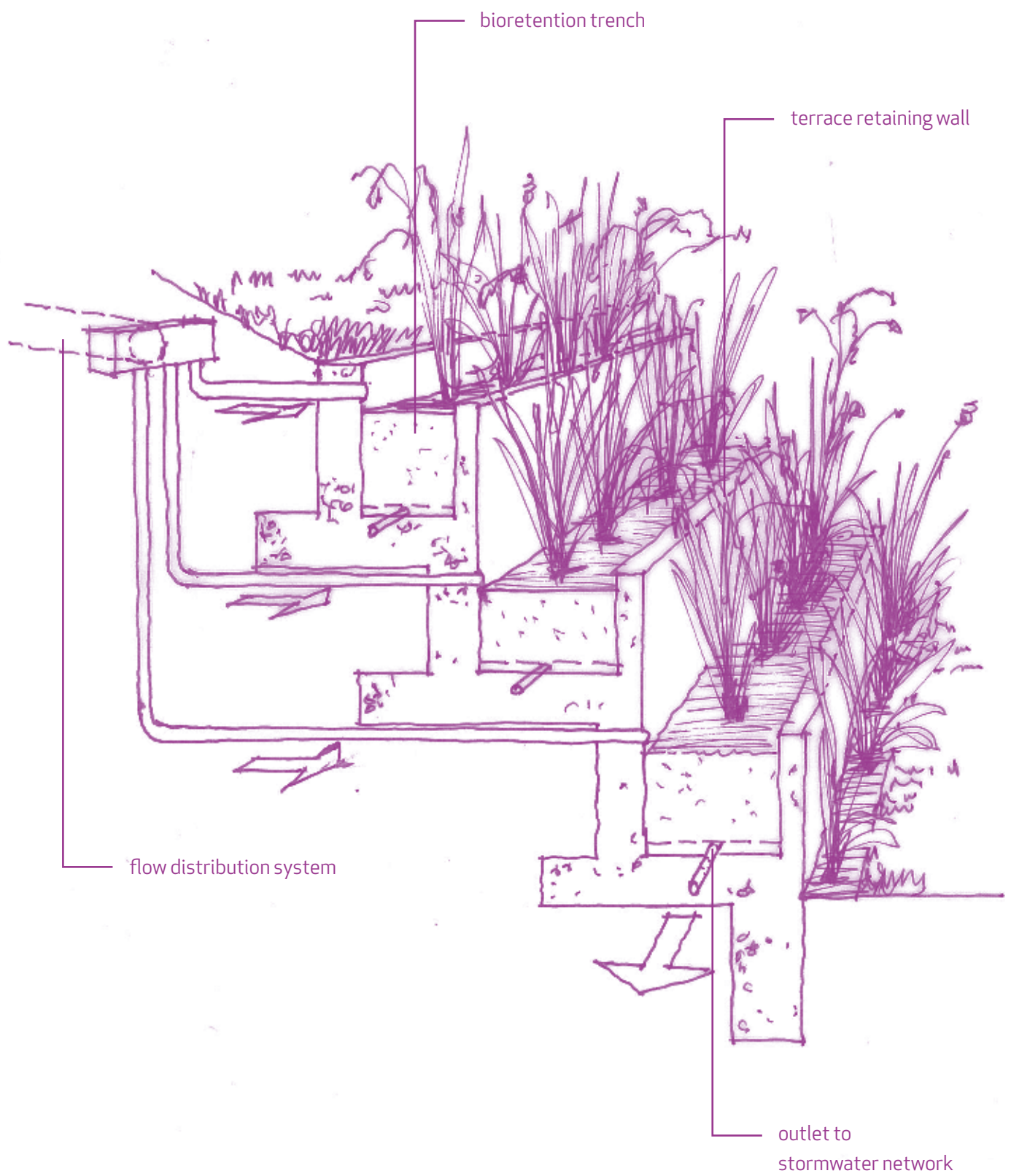


**Sense of Place**



**Water Quality**





Water and shade can be used in combination to mitigate the effects of the urban heat island and create cooler more liveable environments.



# Microclimate



# Microclimate Design

**application:** bioretention systems

**advantage:**

- improved plant establishment
- reduced weed growth and maintenance

**note:** CPTED issues

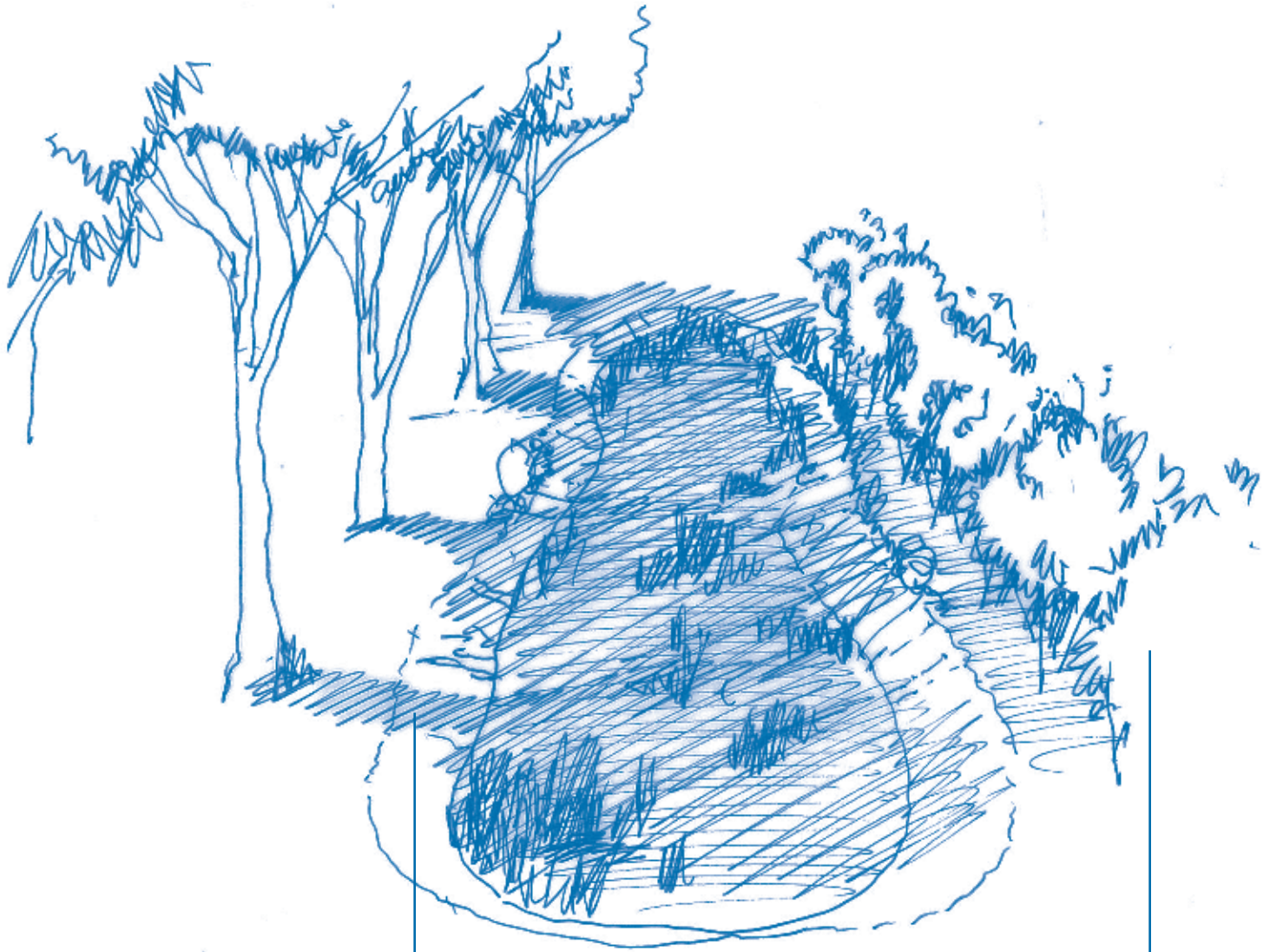
**idea (sourced or via):** Andrew Cook - AECOM



**Microclimate**



**Efficient Maintenance**



shadows cool  
surface of basin

shrubs protect from  
prevailing winds

# Tree Island

**application:** large bioretention basins with insufficient depth for trees

**advantage:**

- aesthetics
- improve plant establishment
- reduced weed growth and maintenance

**note:** tree suitability

**idea (sourced or via):** Ben Walker – ICC



**Microclimate**

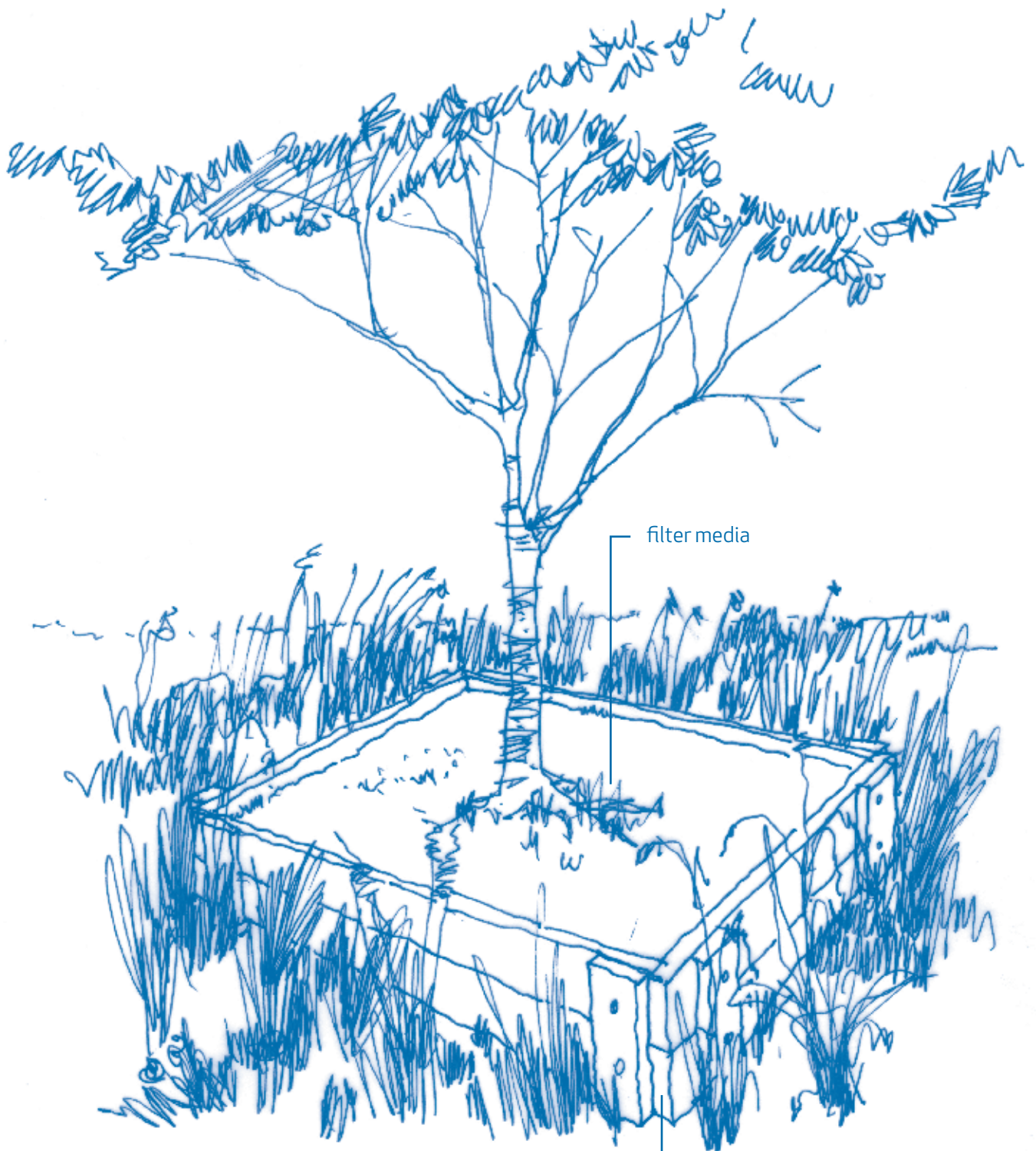


**Visual Impact**



**Efficient Maintenance**





filter media

sleeper retaining wall

# Urban Cool Pool

**application:** urban plazas

**advantage:**

- reduce temperatures in local area
- community feature

**note:** water to be fit for purpose / safety considerations

**idea (sourced or via):** Peter Skinner, UQ & Masdar Project, AECOM

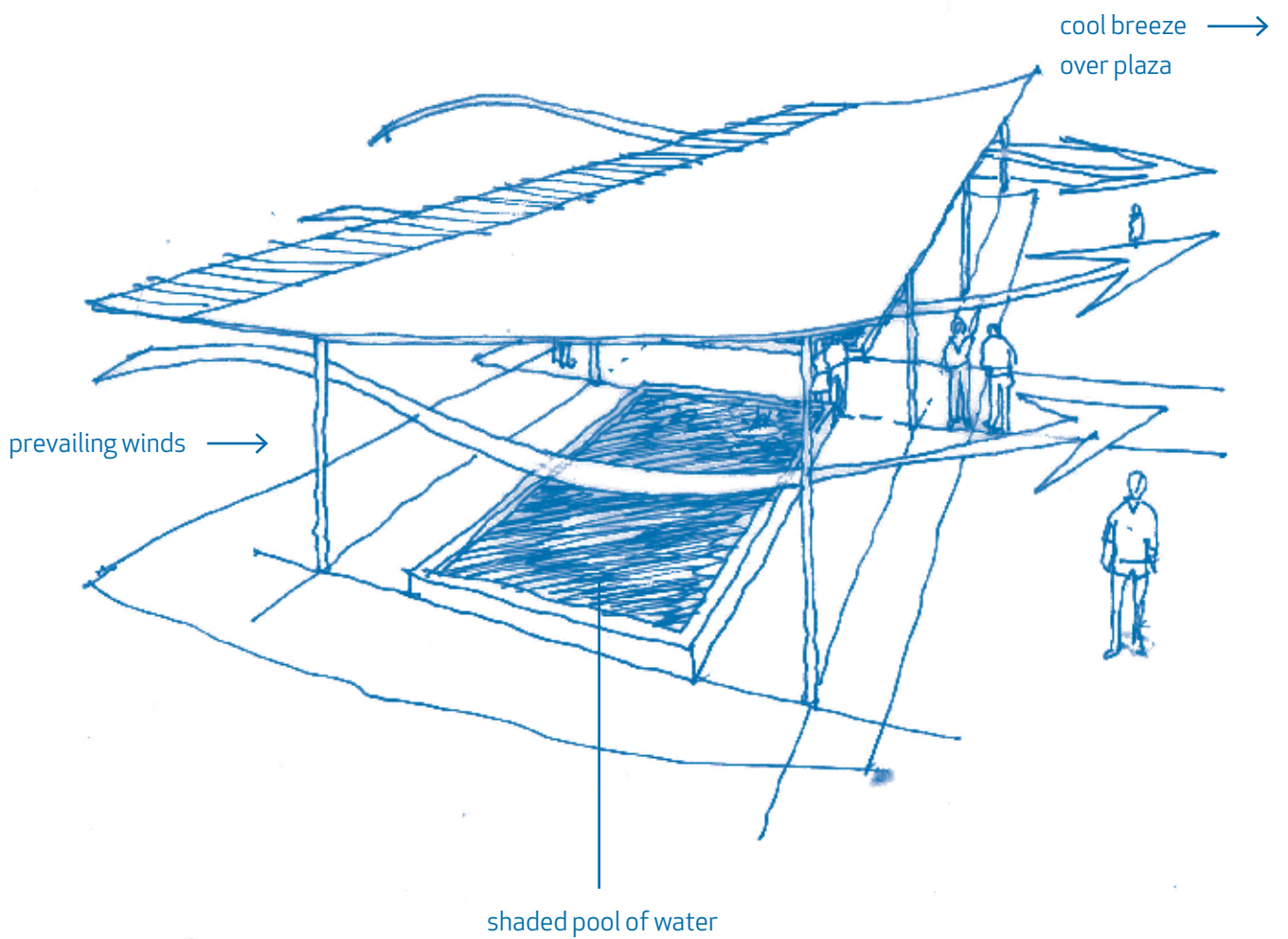


**Microclimate**



**Sense of Place**





Extended droughts can greatly diminish the available water supply for communities. In order to build resilience, smart development makes best use of its water resources via fit for purpose stormwater reuse schemes.



## **Stormwater Reuse**

# Stormwater Harvest

**application:** bioretention systems adjacent parks

**advantage:**

- alternative water supply
- hydrological benefit
- improved landscape outcomes
- additional treatment

**note:** water to be fit for purpose



**Stormwater Reuse**



**Flow Management**



**Landscape Amenity**



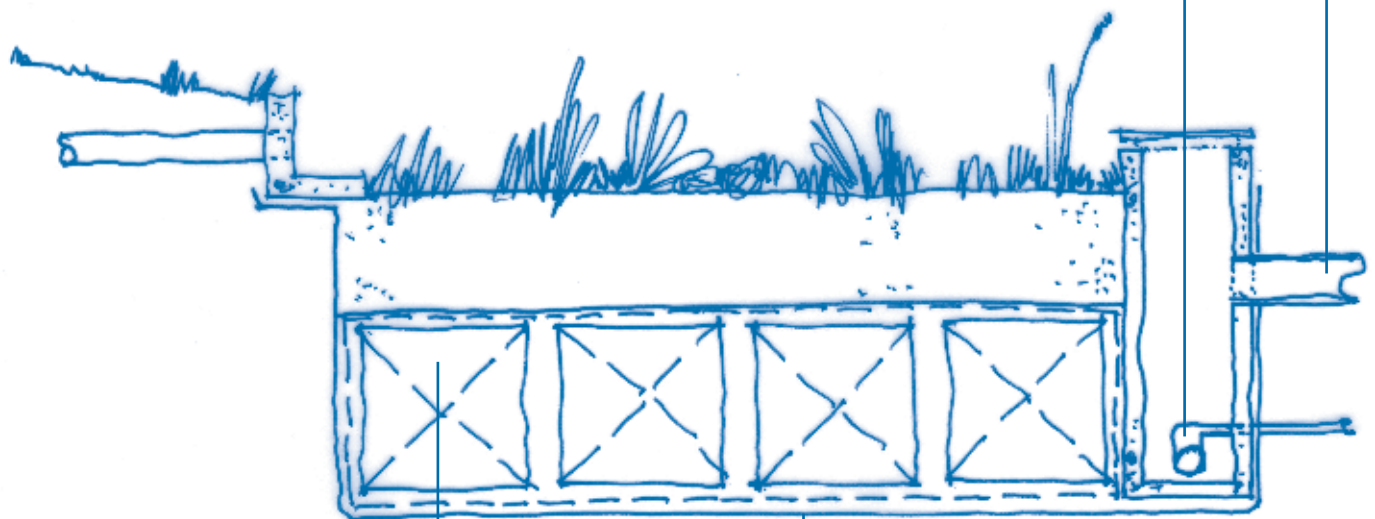
**Water Quality**

overflow to stormwater network

pump to irrigation parks

impermeable liner

stormwater harvesting cells



# Infiltration Branch

**application:** downstream of bioretention basins

**advantage:**

- utilise treated stormwater
- promote infiltration
- improved tree growth
- hydrological benefit
- additional treatment

**note:** groundwater conditions / water needs for tree species / tree suitability



**Stormwater Reuse**



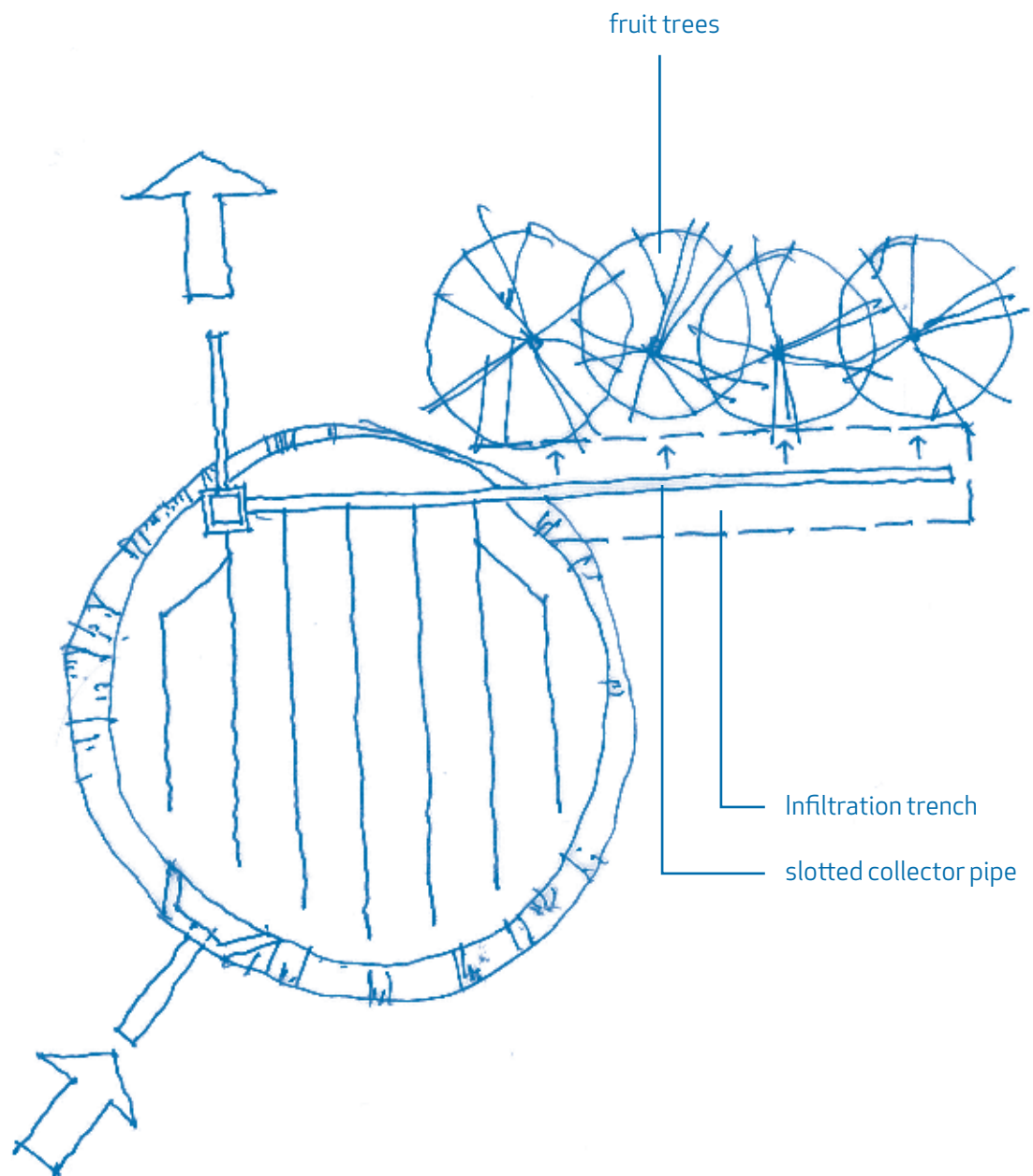
**Infiltration**



**Landscape Amenity**



**Water Quality**



# Stormwater Mining

**application:** opportunistic / stormwater lines with capacity issues

**advantage:**

- harvest stormwater for reuse
- hydrological benefit
- promote infiltration
- reduce pressure on stormwater network
- additional treatment

**note:** groundwater conditions, water to be fit for purpose



Stormwater Reuse



Flow Management



Infiltration

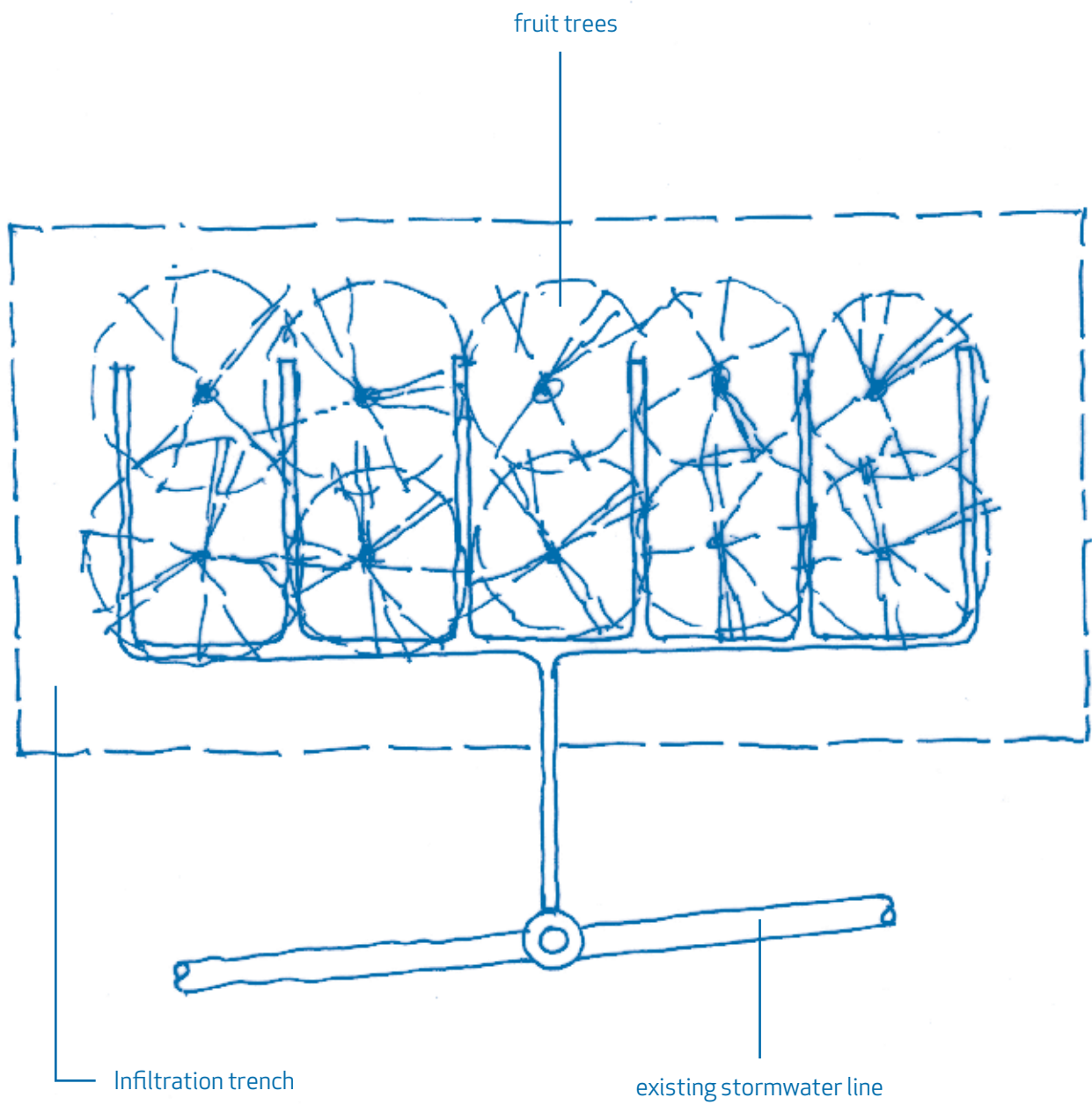


Resource Efficient



Water Quality





Any infrastructure placed within community reach should consider public safety.



**Safety**

# Pod Lighting

**application:** urban basins with dropoff / lighting requirements

**advantage:**

- safety
- water ripples cast onto wall
- night time aesthetics

**note:** use submersible electrics if below water level



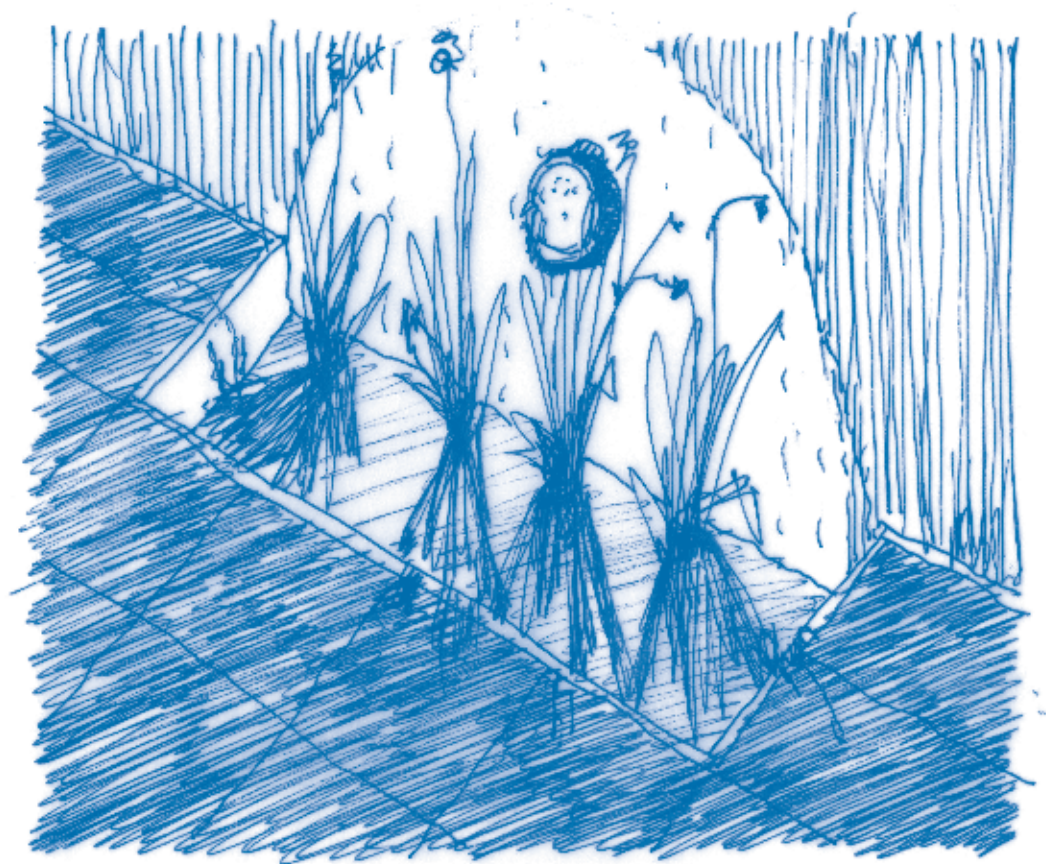
Safety



Sense of Place



Visual Impact



# Letterbox Pit / Seat

**application:** urban bioretention systems

**advantage:**

- seat acts as barrier to drop off
- pit hidden from view
- pit can function as seat

**note:** maintenance requirements

**idea (sourced or via):** Tarek Barklay - AECOM



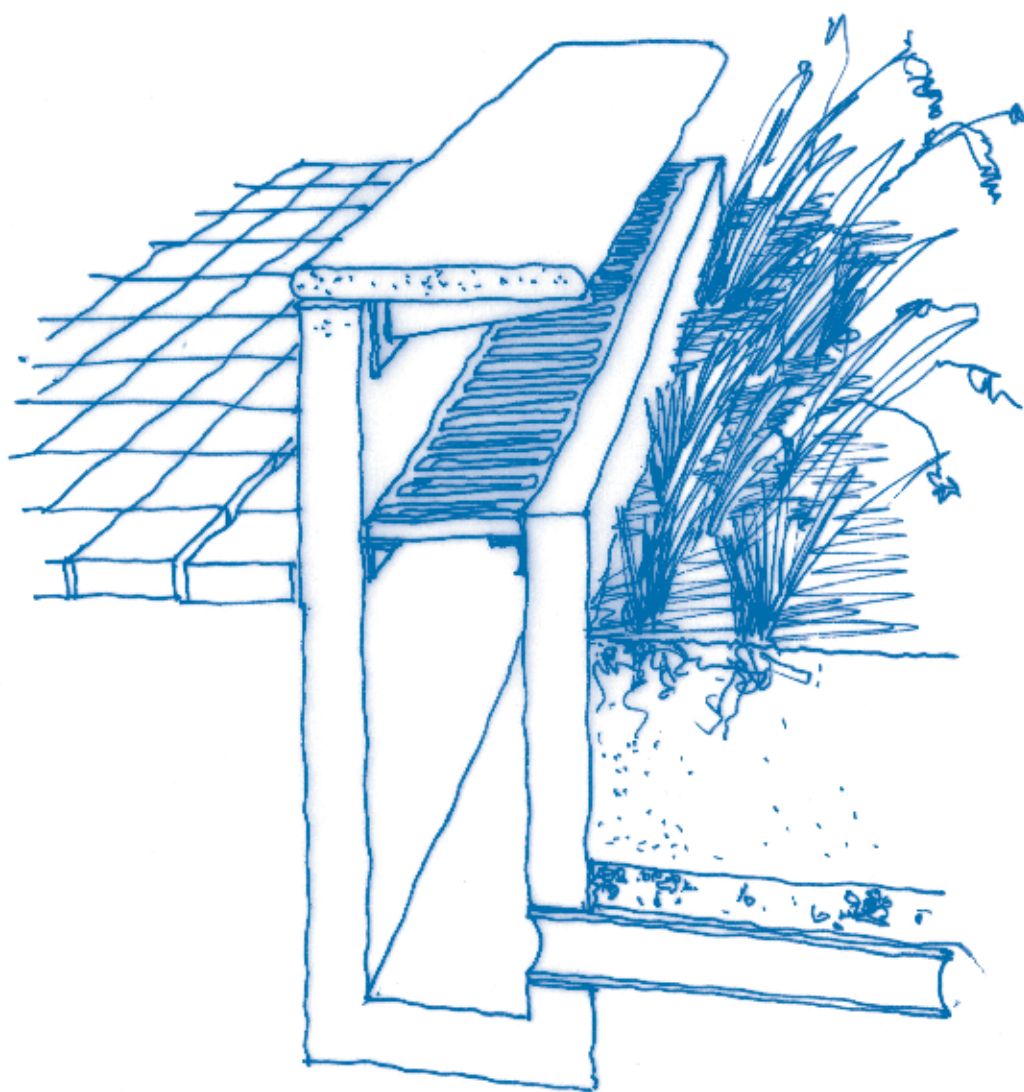
**Safety**



**Visual Impact**



**Passive Recreation**



# Carpark Bioretention Swale

**application:** carpark bioretention systems

**advantage:**

- trafficable surface eliminates drop off
- minimise footprint

**note:** structural loading requirements / sunlight penetration for deep systems

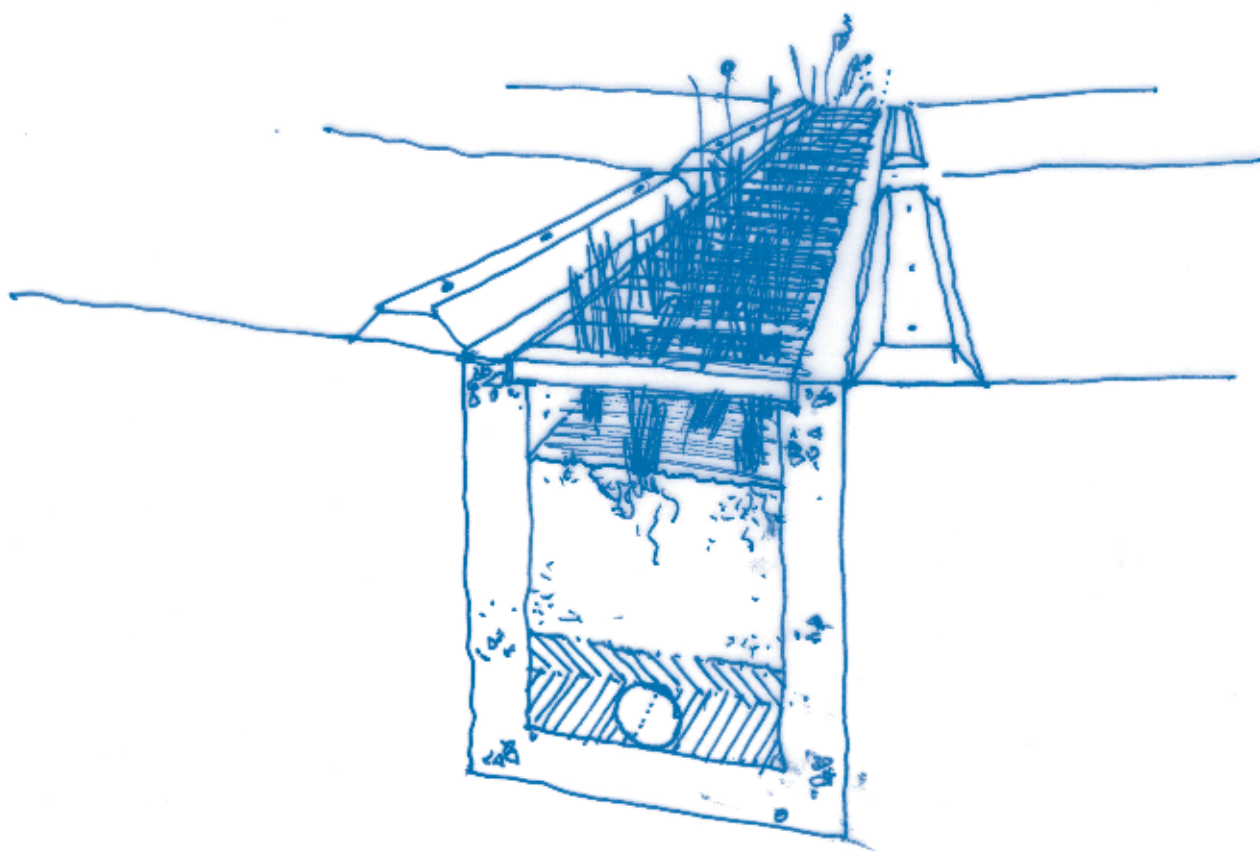


**Safety**



**Space Efficient**





Design outcomes can contribute to healthy living aspirations within communities by encouraging recreation, contemplation and general well-being.



## **Passive Recreation**

# View Deck

**application:** wetlands

**advantage:**

- passive recreation
- sense of place

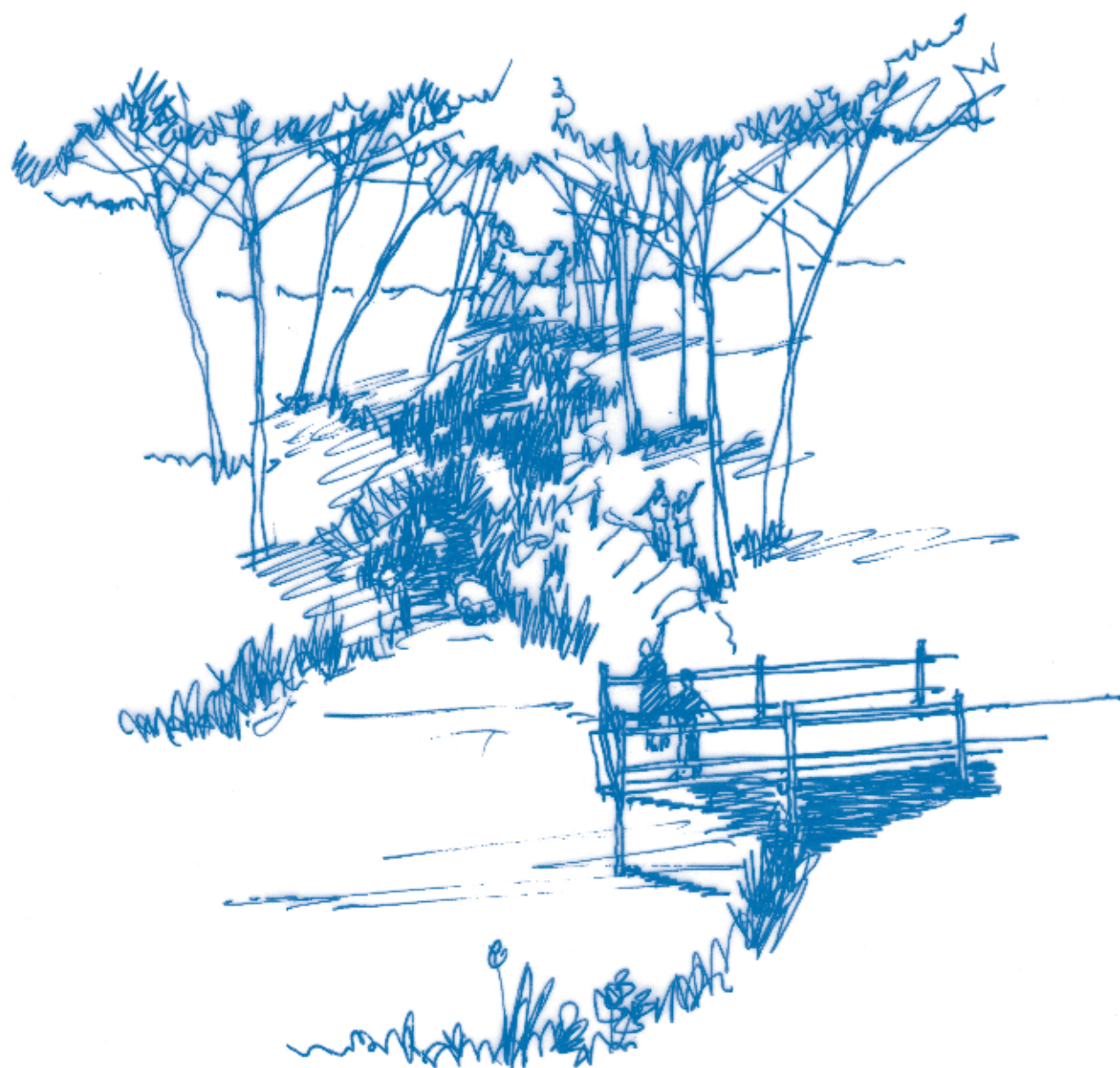
**note:** safety considerations



**Passive Recreation**



**Sense of Place**



# Ornamental Pond Filtration System

**application:** ornamental ponds

**advantage:**

- passive recreation
- point of interest
- help maintain pond water quality

**note:** safety considerations



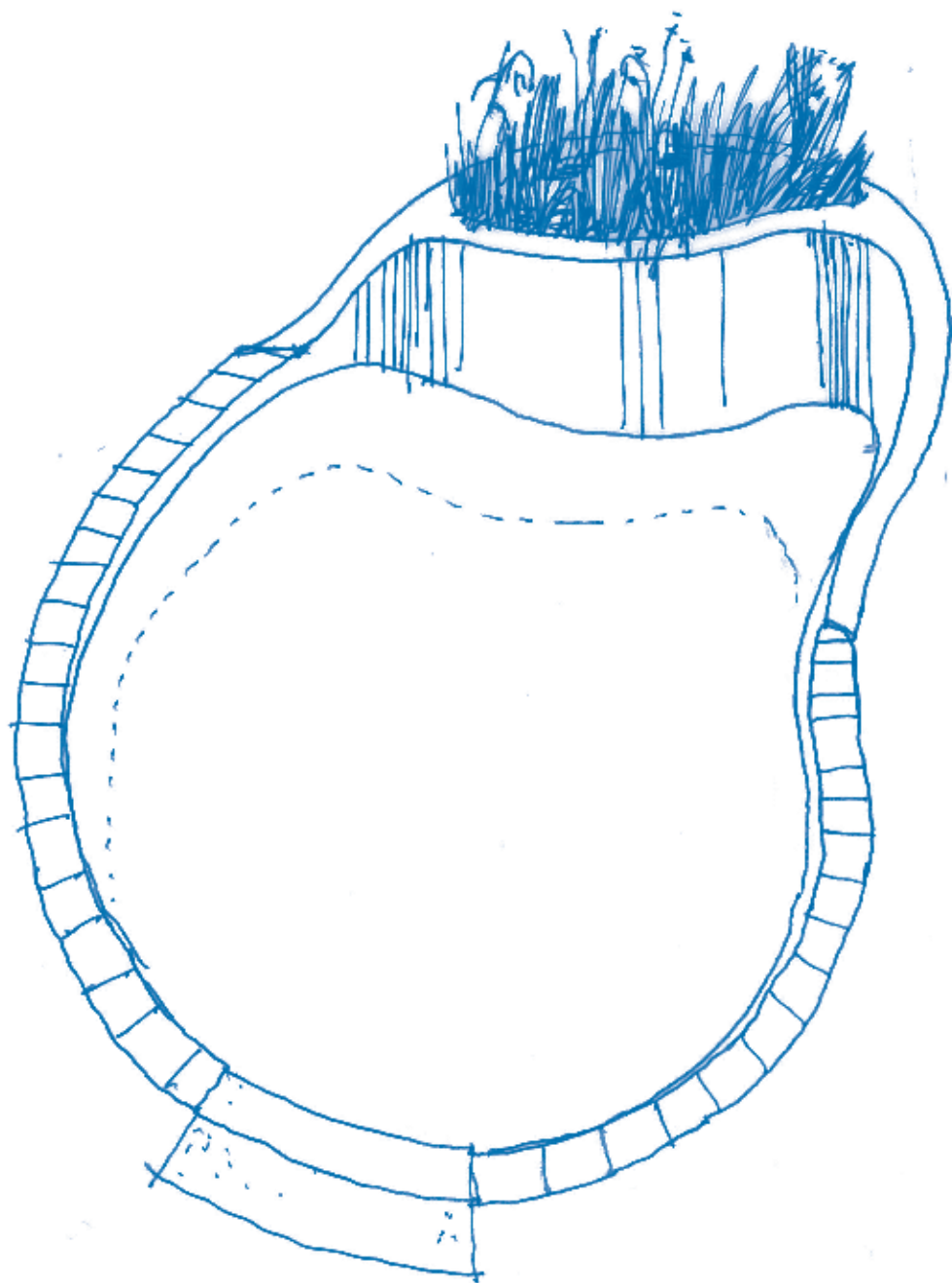
**Passive Recreation**



**Community Interest**



**Material Sustainability**



With funding often in short supply, it is beneficial to create resource efficient WSUD systems that maximise outcomes while considering the upfront and ongoing life-cycle costs.





**Resource Efficiency**

**F**

# Small Sediment Forebay

**application:** streetscape bioretention systems

**advantage:**

- low cost
- easy maintenance / no ponding / scour protection

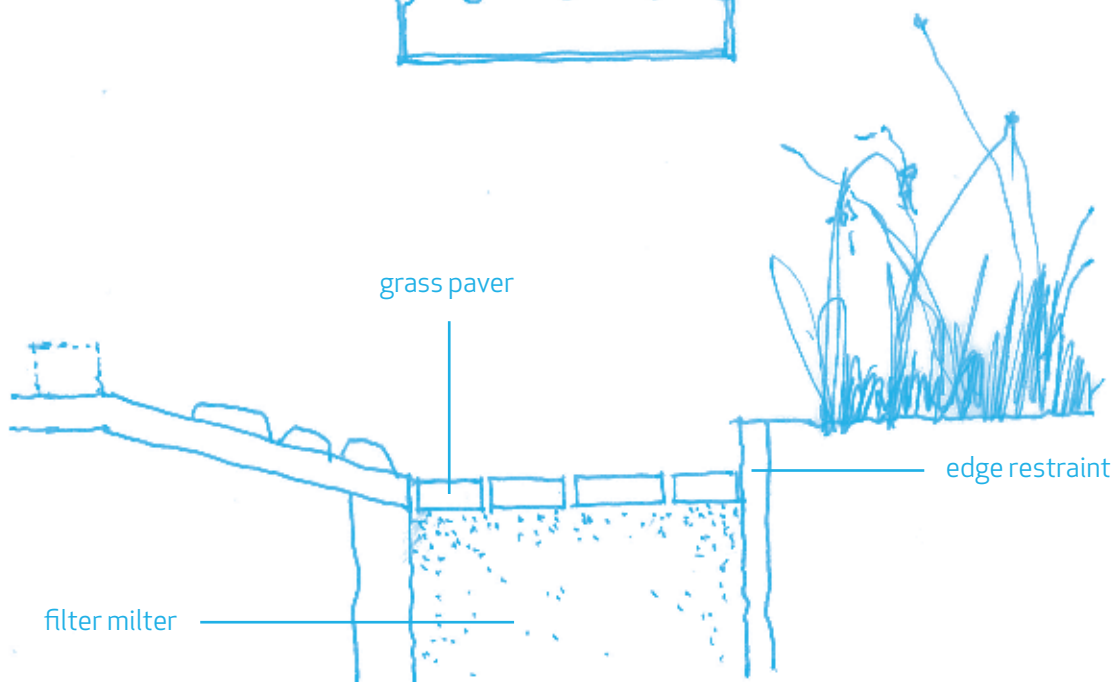
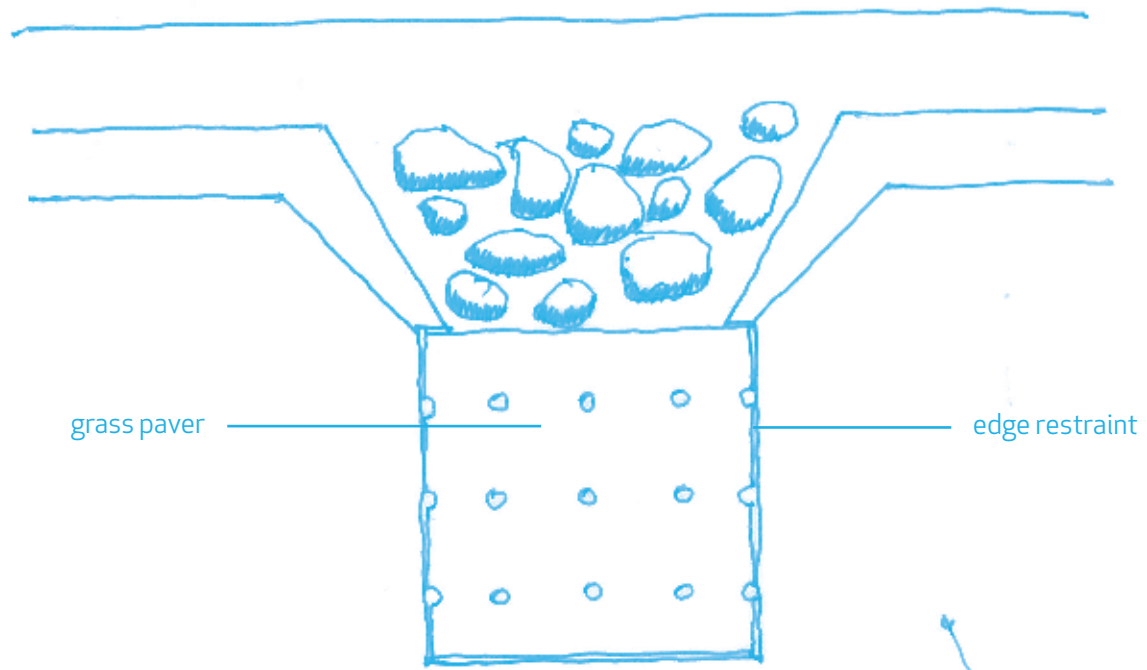
**idea (sourced or via):** Christoph Pester & Courtney Henderson AECOM



**Resource Efficient**



**Efficient Maintenance**



# Medium Sediment Forebay

**application:** bioretention basin

**advantage:**

- low cost
- easy maintenance / no ponding / scour protection

**note:** allow for impacts on hydraulics / beams can be removed at later date

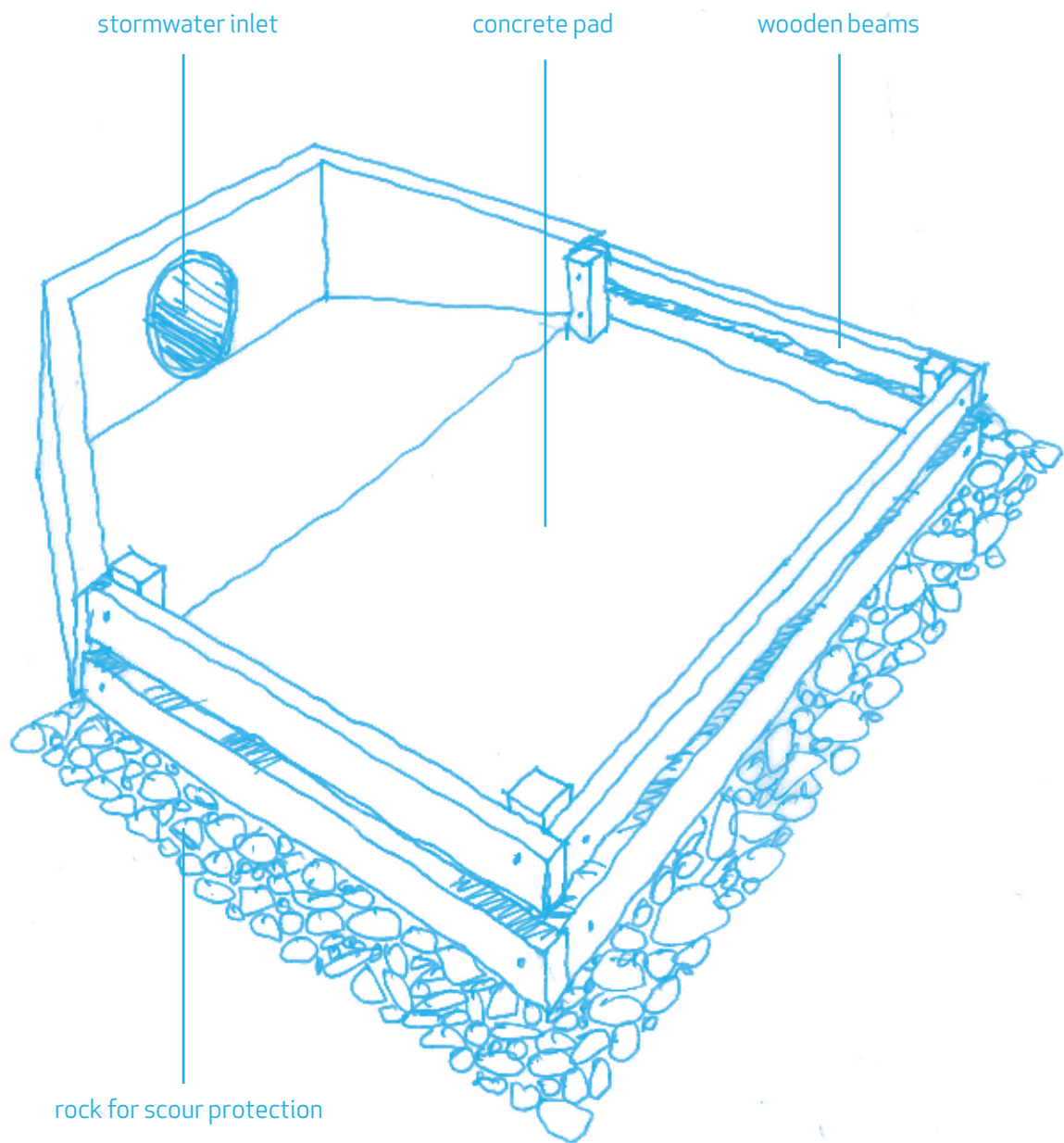
**idea (sourced or via):** Gary Deans Constructions - Freshwater Estate



**Resource Efficient**



**Efficient Maintenance**



# Low Impact Access Track

**application:** basin access tracks

**advantage:**

- low cost
- aesthetics
- minimises materials

**note:** batter slope requirements

**idea (sourced or via):** Andrew Cook - AECOM



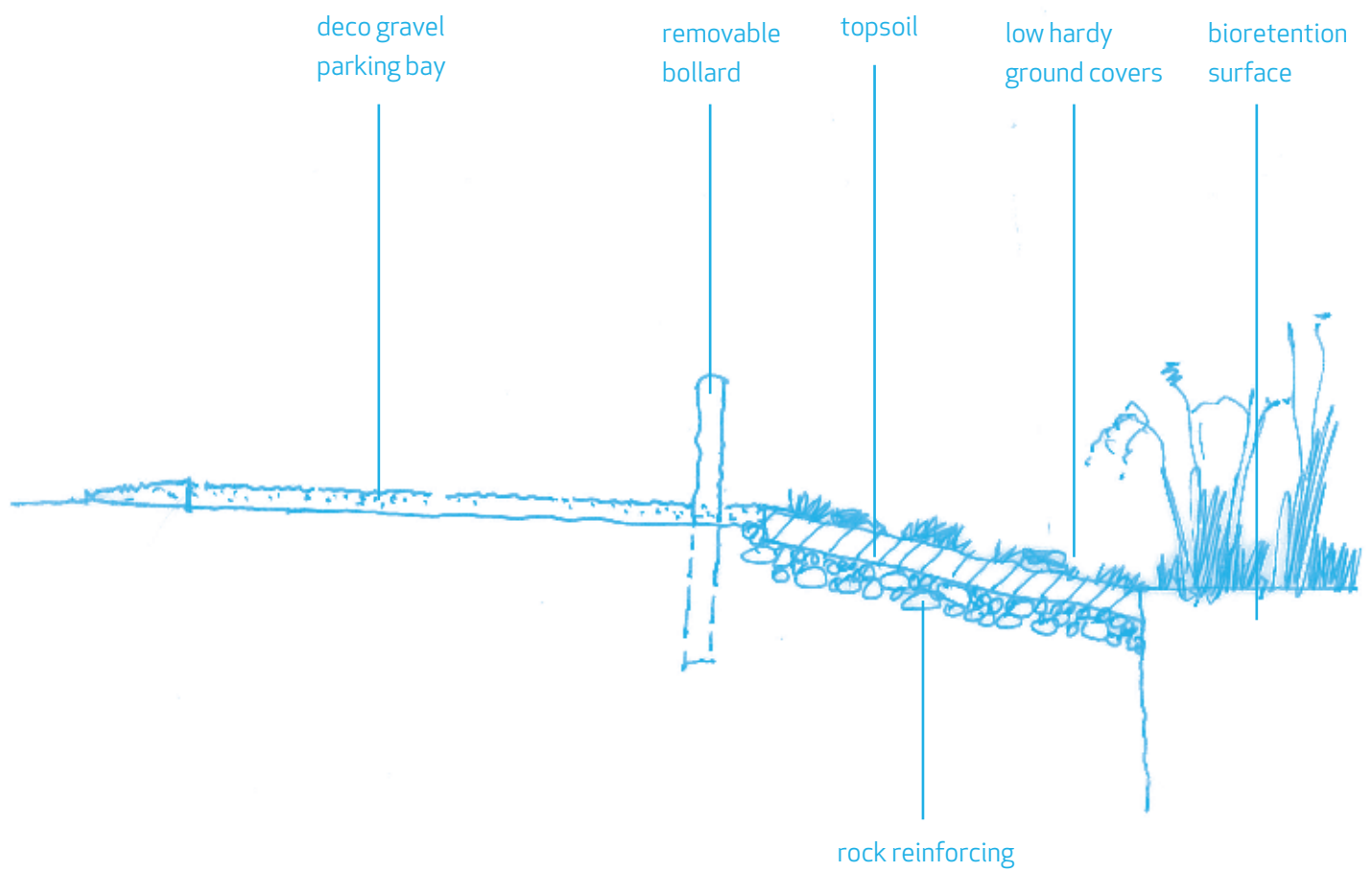
**Resource Efficient**



**Visual Impact**



**Material Sustainability**



# Pitless Bioretention

**application:** bioretention systems next to riparian zones

**advantage:**

- cost saving for pits
- multiple distributed stormwater outlets
- engage riparian zone

**note:** surface protection at outlets and overflow weir



**Resource Efficient**

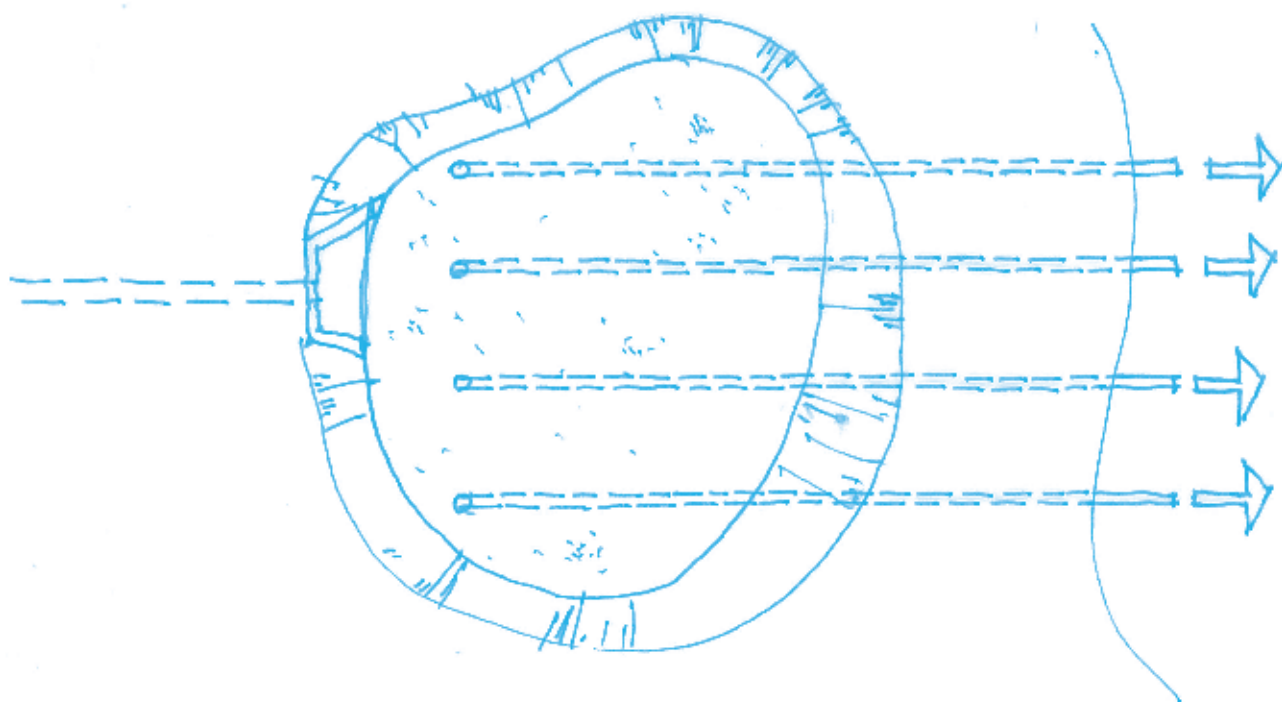
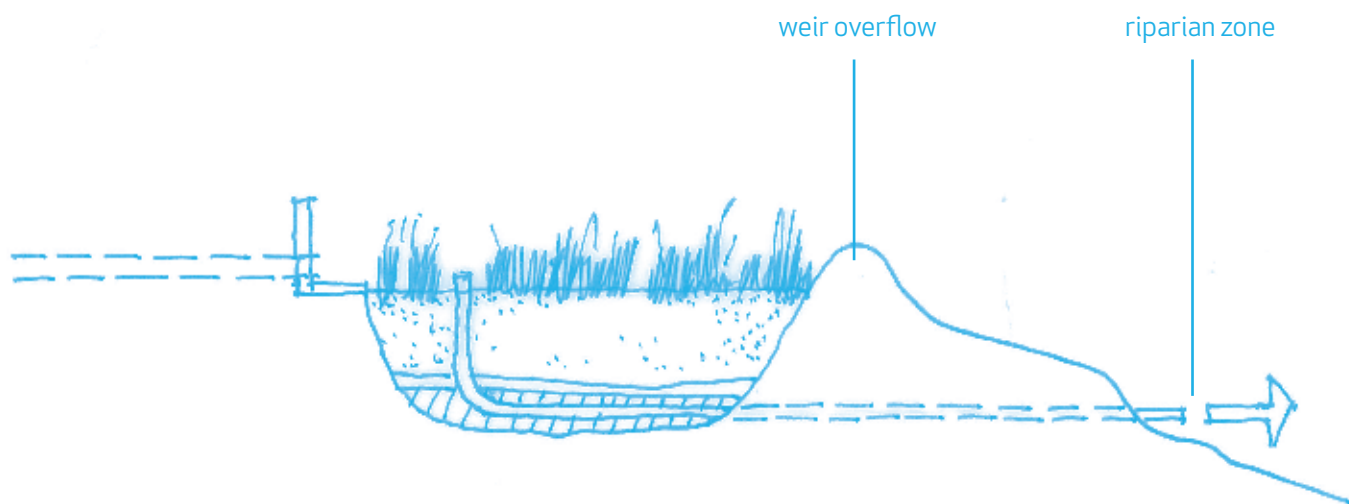


**Flow Management**



**Habitat**





During the planning and concept design phases, system designs should recognise the relative price of land and provide the appropriate level of space efficiency.



**Space Efficiency**

# Balcony Planter

**application:** multi storey units

**advantage:**

- minimise footprint
- treatment of roofwater
- aesthetics

**note:** structural support as required / filter media specification can be adapted to ensure adequate landscape outcome



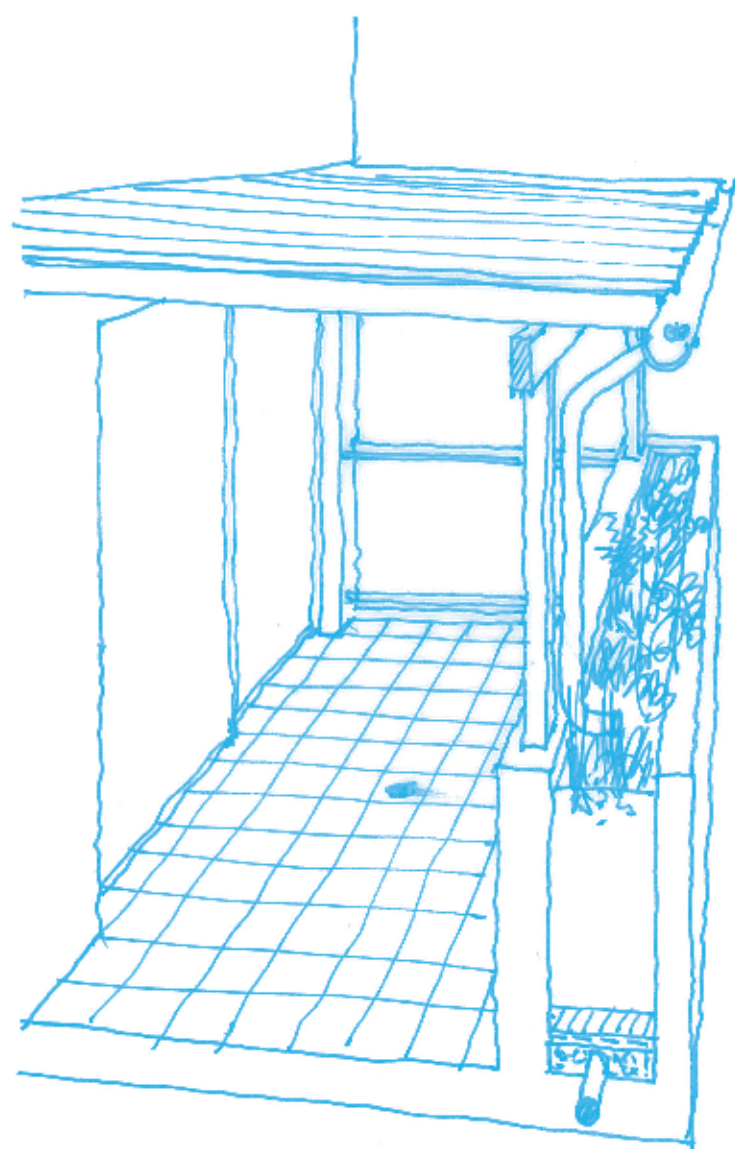
**Space Efficient**



**Water Quality**



**Sense of Place**



# Raised Planter Box

**application:** urban areas with outlet depth issues

**advantage:**

- can be free draining
- landscape feature
- roofwater treatment

**note:** include small soakage pit to empty surcharge pipe after storm / consult geotech for infiltration



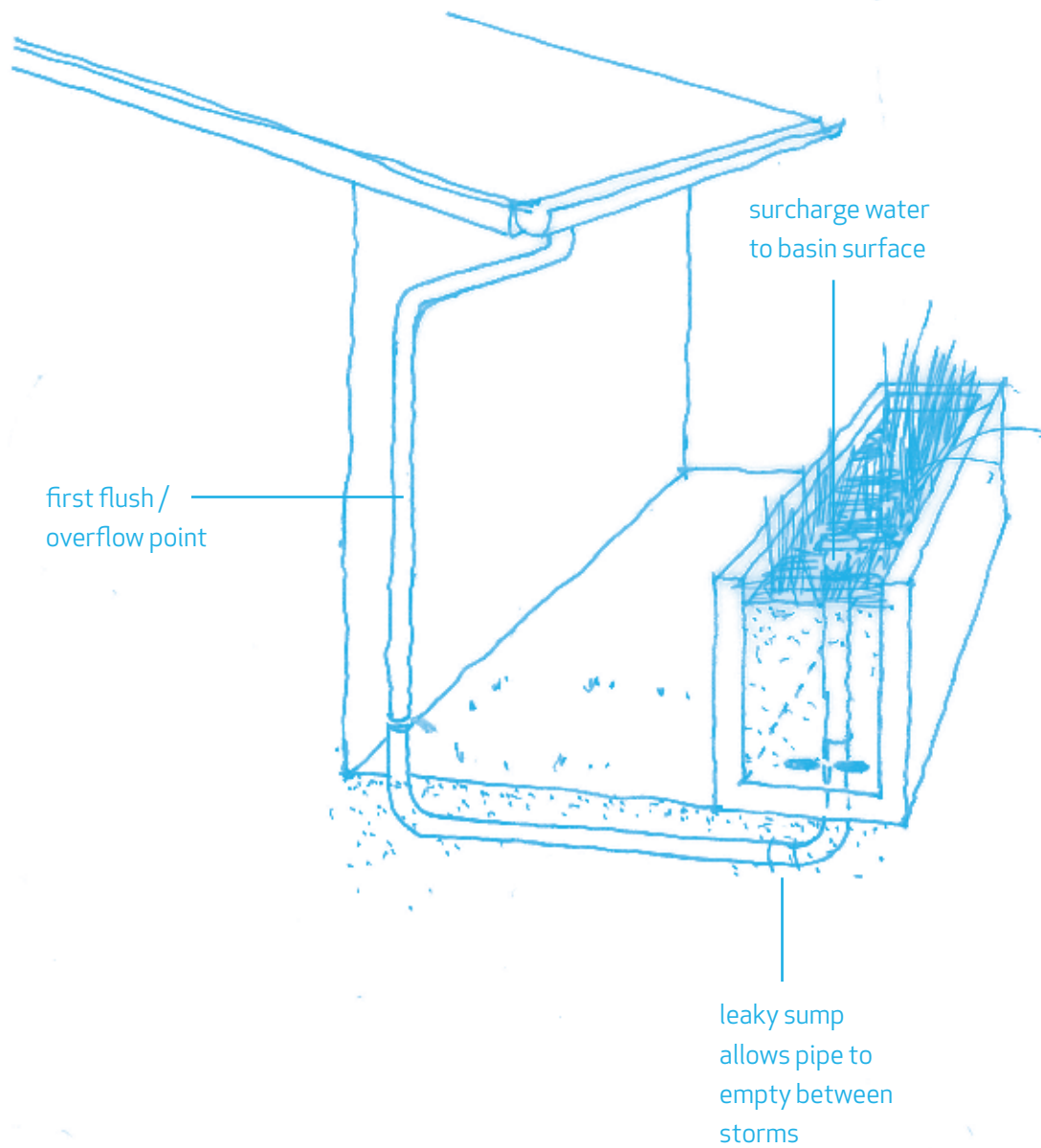
Space Efficient



Sense of Place



Water Quality



# Constrained Drainage Layer

**application:** bioretention systems with a constrained drainage layer

**advantage:**

- utilise available space
- maximise surface area
- minimise materials

**note:** consult geotechnical engineer for infiltration systems next to footings / piered footings may reduce intrusions

**idea (sourced or via):** Hoyland Street bioretention basin



**Space Efficient**

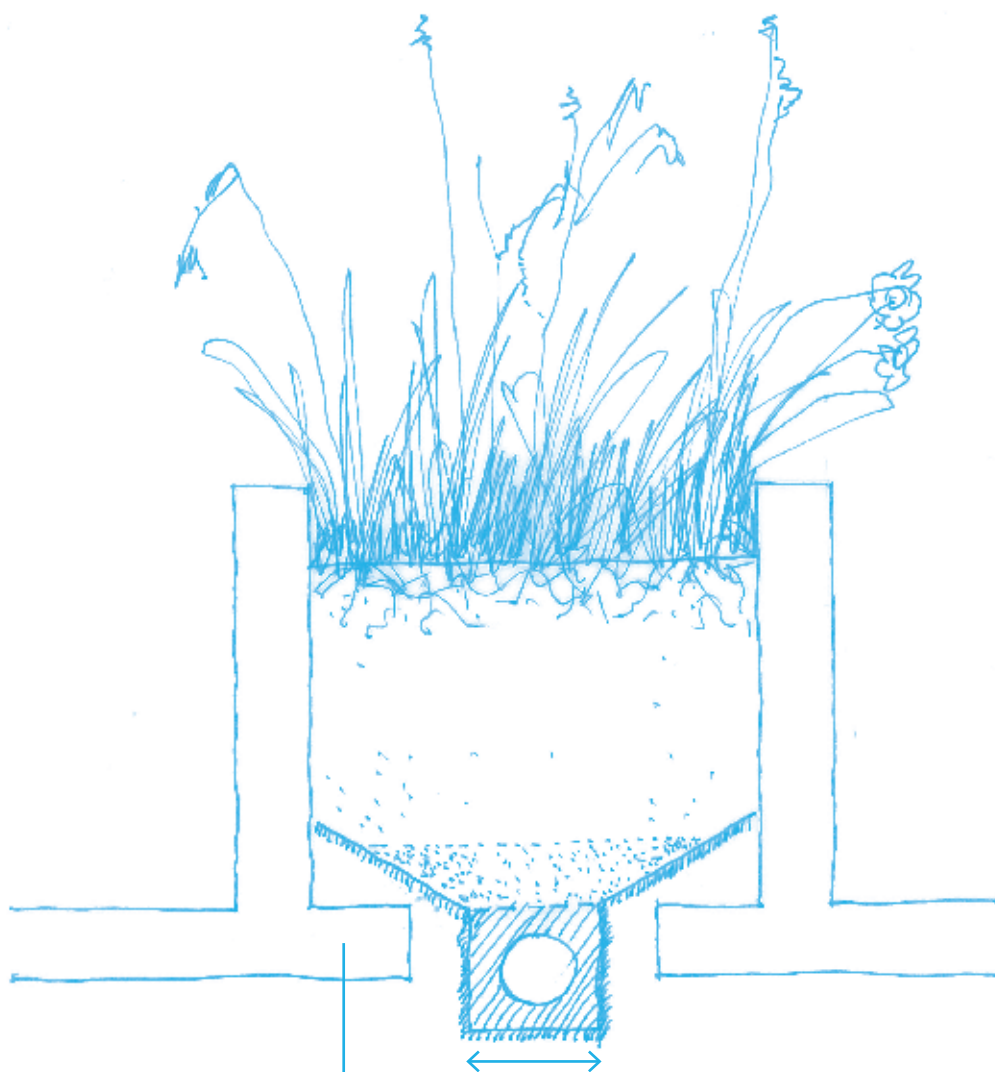


**Resource Efficient**



**Material Sustainability**





intrusion into  
drainage layer

reduced width

# Pool to Pond Conversion

**application:** infill residential subdivisions

**advantage:**

- make use of existing pool
- minimise materials
- water treatment
- aesthetics

**note:** consider integration of hydraulics / public interaction and associated safety issues

**idea (sourced or via):** Ku-ring-gai Council - Pool to Pond



**Space Efficient**



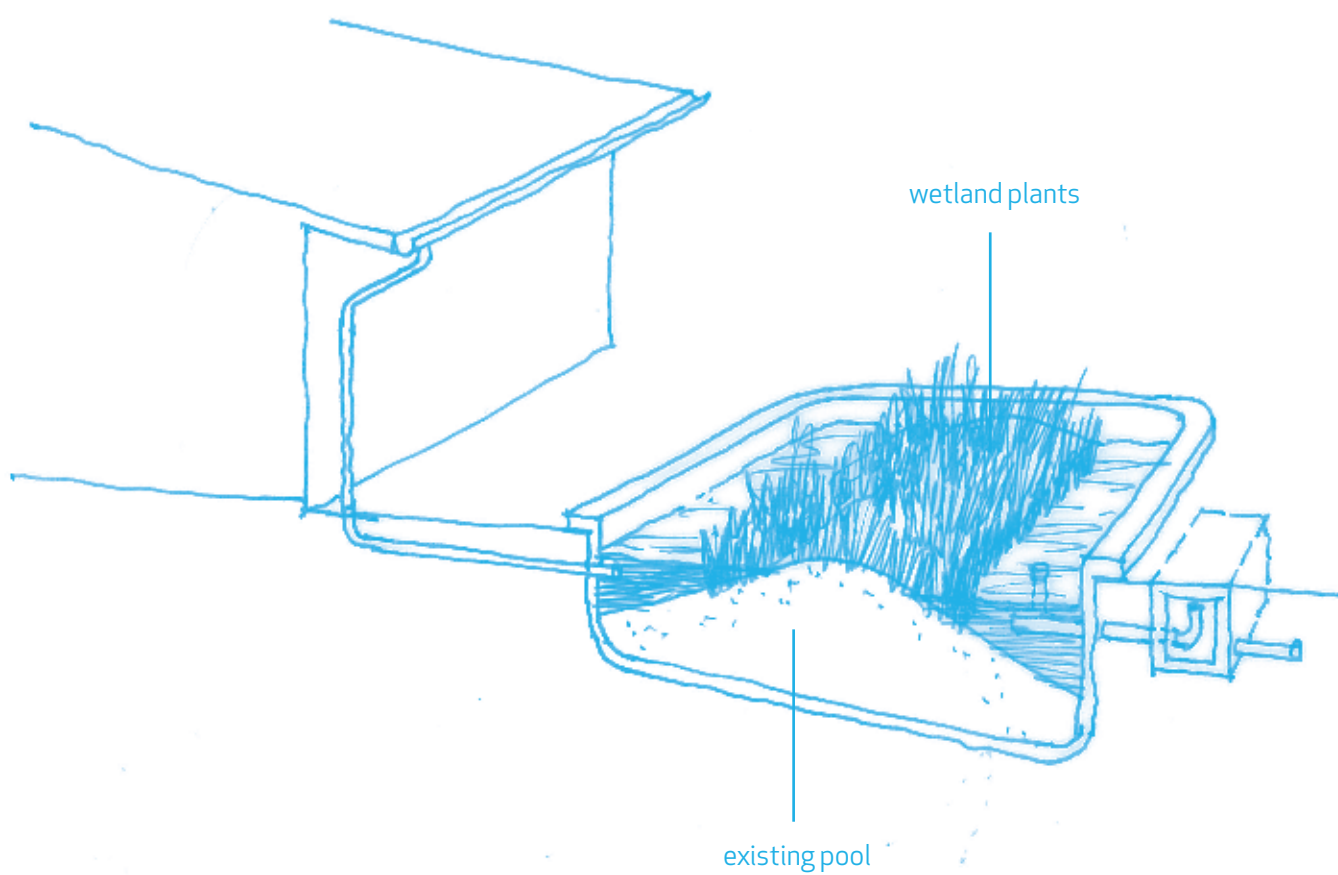
**Resource Efficient**



**Water Quality**



**Sense of Place**



As with most functioning landscapes, WSUD systems require ongoing maintenance for them to be kept in a functional and attractive state. Designs can reduce ongoing maintenance requirements for asset owners by ensuring good initial plant establishment and coverage.

One way this can be achieved is by carefully managing flow distribution and ponding within systems.



## **Efficient Maintenance**

# Wet Zone / Dry Zone Planting

**application:** bioretention systems with intermittent flows causing algae at inlet

**advantage:**

- prevent algae takeover and plant loss
- no change to basin design

**note:** plants to be fit for purpose

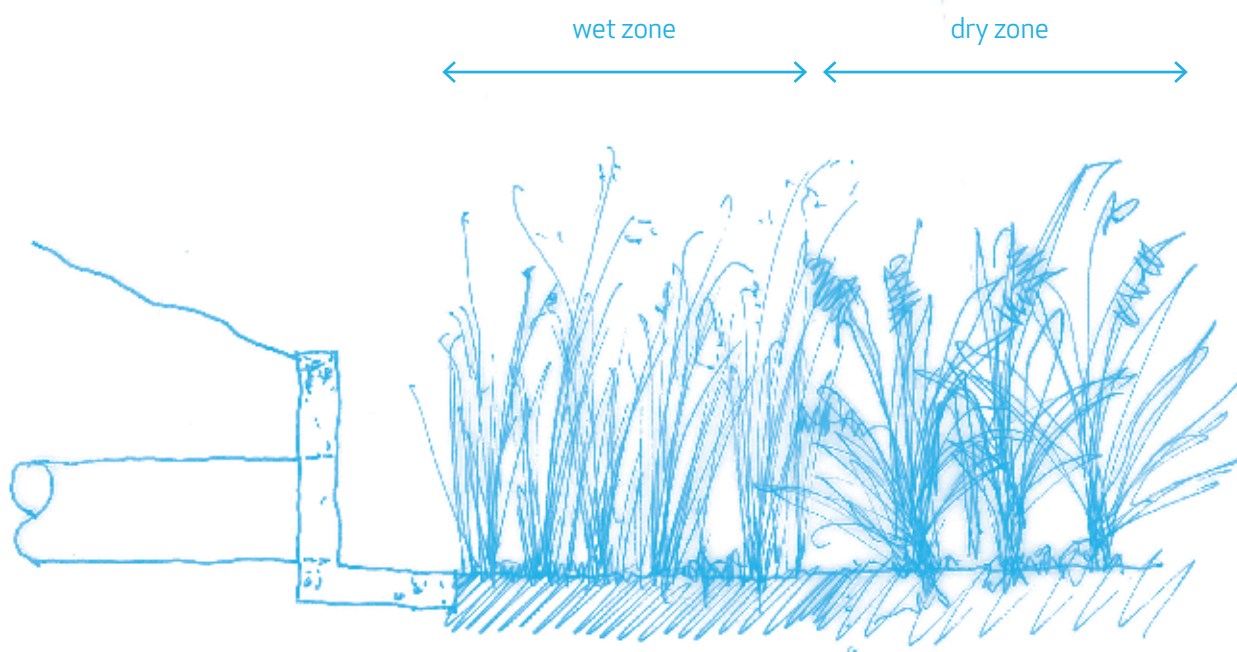
**idea (sourced or via):** Wiebke Witte - AECOM



**Efficient Maintenance**



**Resource Efficient**



melaleuca  
quinenervia  
juncus usitatus  
gahnia seiberiana

ficinia nodosa  
lomandra hysterix  
themeda triandra

# Trickle Flows

**application:** basins with trickle flows causing algae at inlet

**advantage:**

- prevent algae growth and plant loss

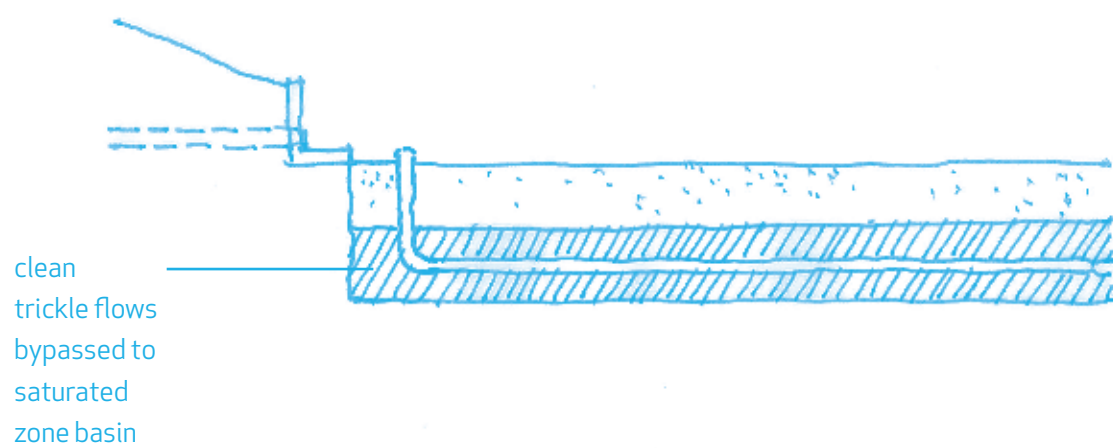
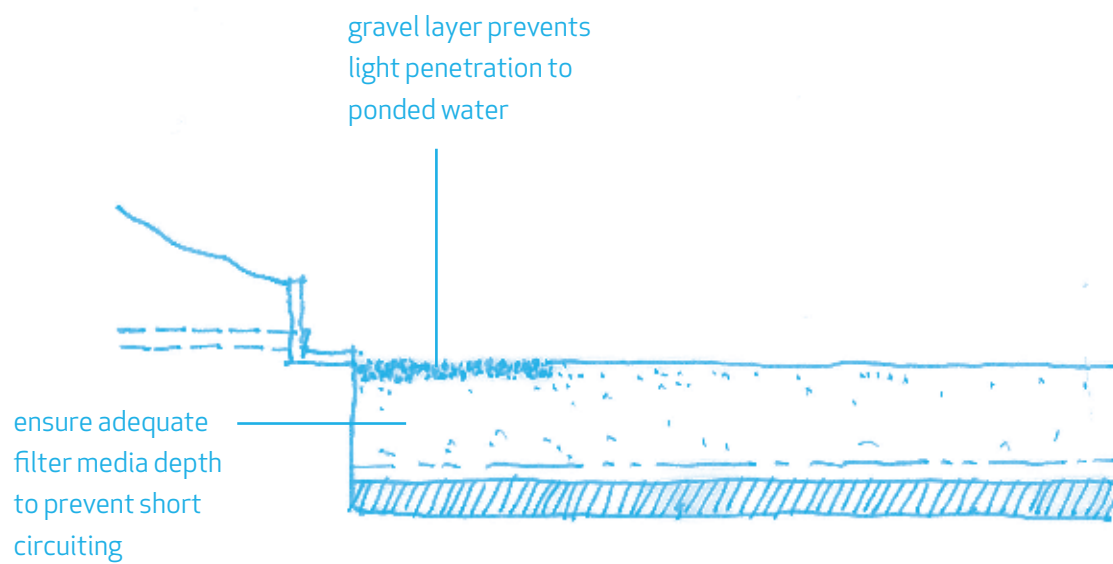
**note:** trickle flows depend on catchment behaviours and can change over time

**idea (sourced or via):** Courtney Henderson & Sally Boer AECOM



**Efficient Maintenance**





# Pilot Channel

**application:** large basins with flow distribution issues or moisture gradients

**advantage:**

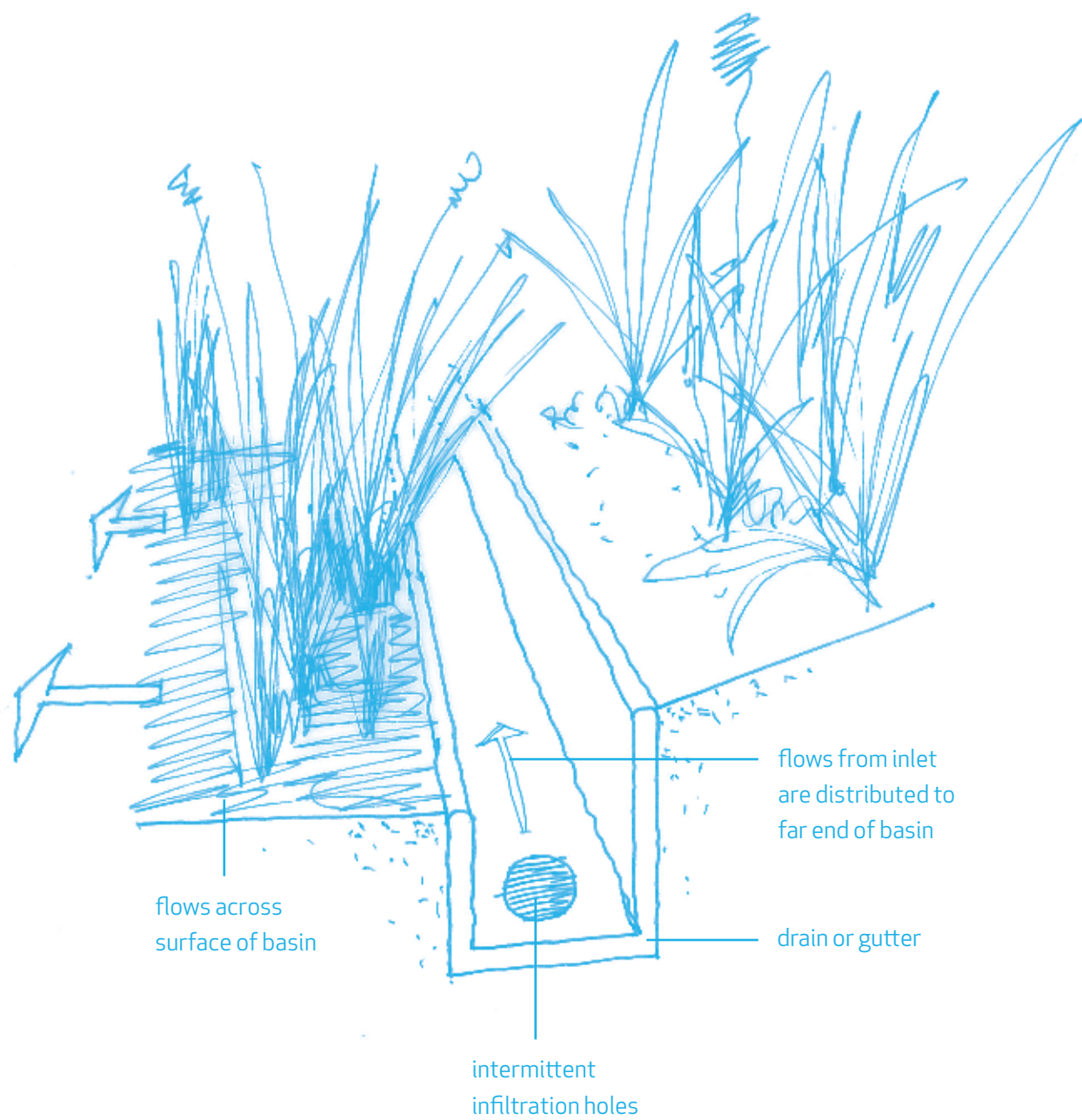
- even distribution of flow
- improve plant health at far end of basin

**note:** sediment buildup issues

**idea (sourced or via):** Peter Breen - AECOM



**Efficient Maintenance**



# Temporary Uprstand

**application:** establishing plants in bioretention systems

**advantage:**

- provides temporary watertable for establishing plants
- faster plant establishment

**note:** potential to leach nutrients if left for long period

**idea (sourced or via):** Shaun Leinster - DesignFlow

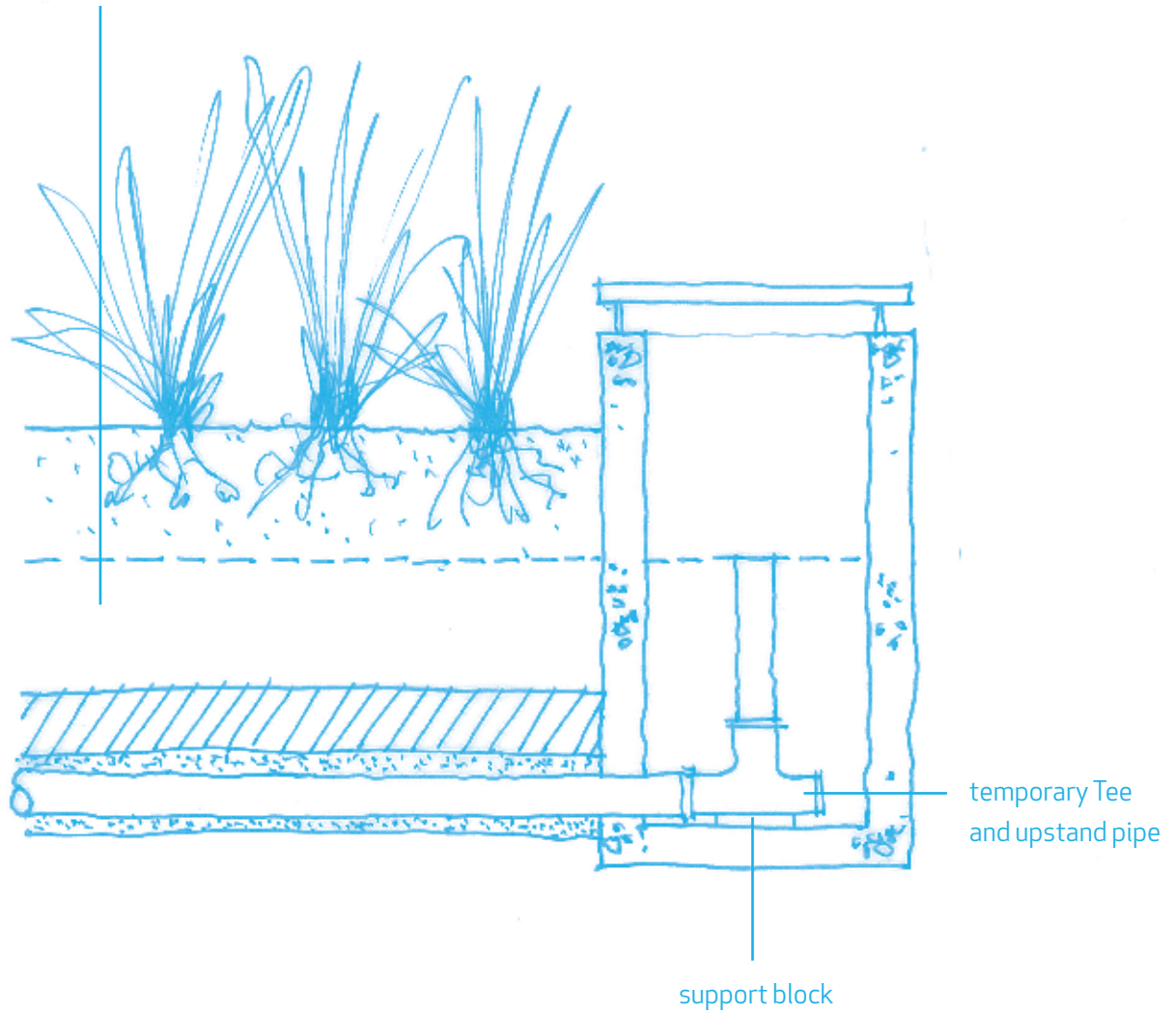


**Efficient Maintenance**



**Visual Impact**

temporary  
water source for  
establishing plants



# Surface Clogging

**application:** bioretention systems with surface blinding

**advantage:**

- low cost rectification

**note:** consider use of of grasses, sedges, shrubs and trees / hand removal of weeds  
can further break up filter media surface / additional works may be required if  
clogging layer is thick

**idea (sourced or via):** Jack Mullaly – Logan City Council

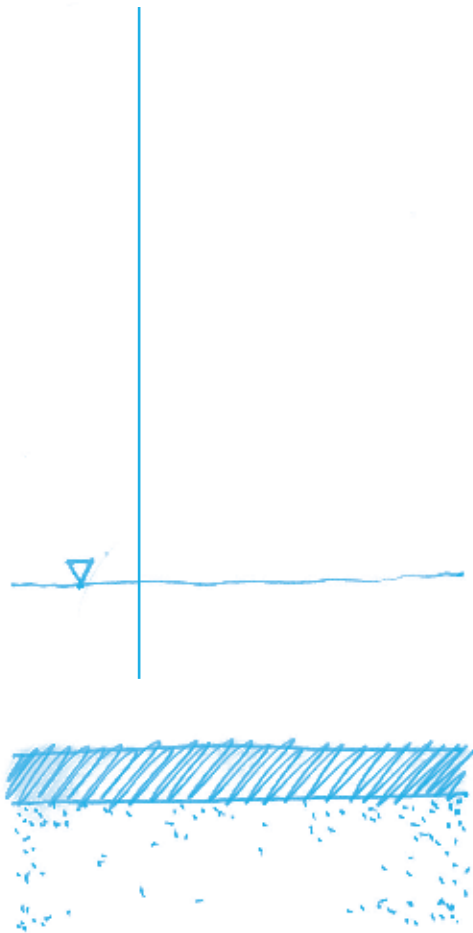


**Efficient Maintenance**

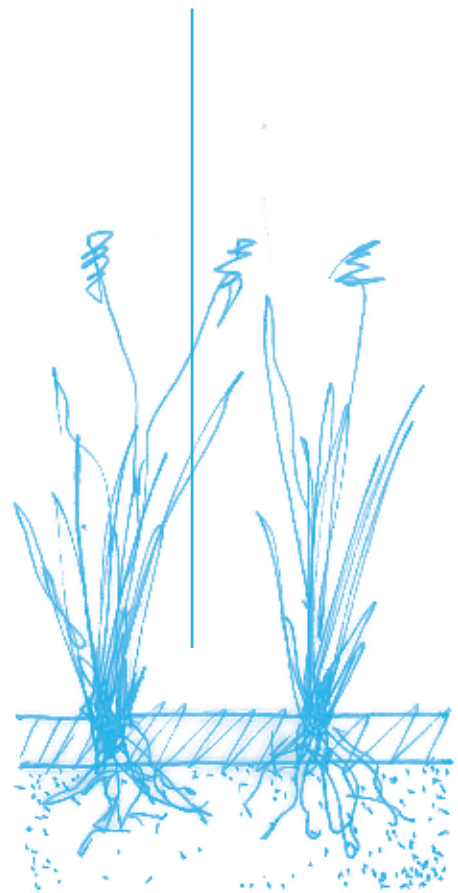


**Resource Efficient**

surface clogging  
causing water to be  
permanently ponded -  
plants drowned



densely replant with  
aquatic and riparian  
plants to breakup  
surface clogging and  
lower water level



# Surface Ponding

**application:** bioretention systems with surface blinding

**advantage:**

- low cost rectification
- maintain plant health

**note:** water quality impacts of short circuiting

**idea (sourced or via):** Jack Mullaly – Logan City Council



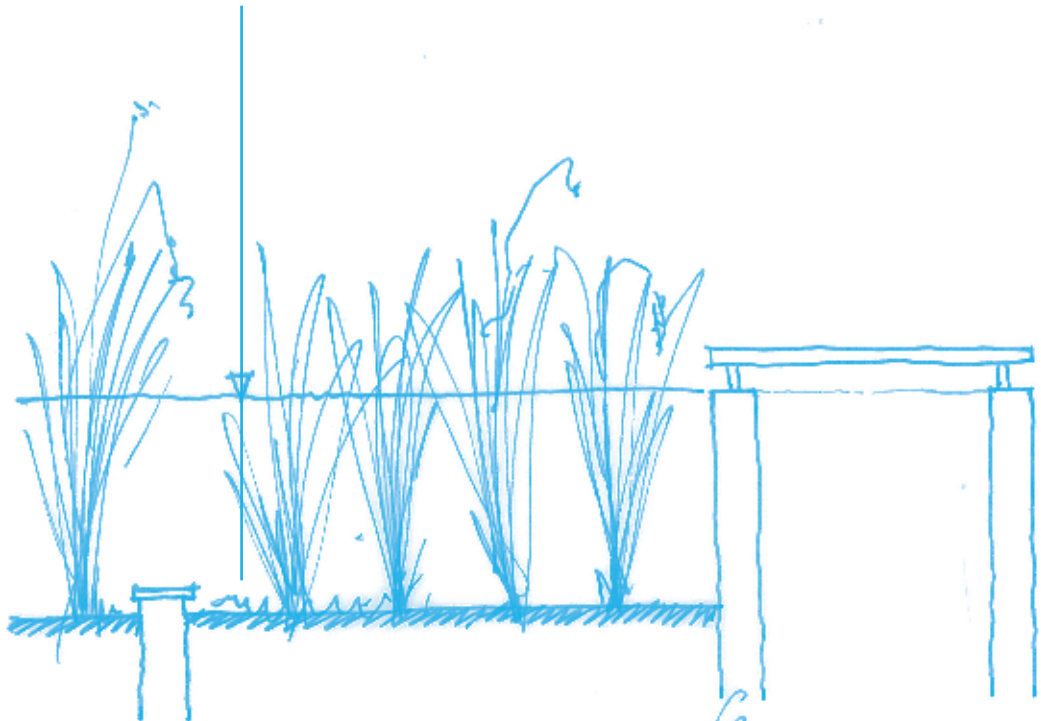
**Efficient Maintenance**



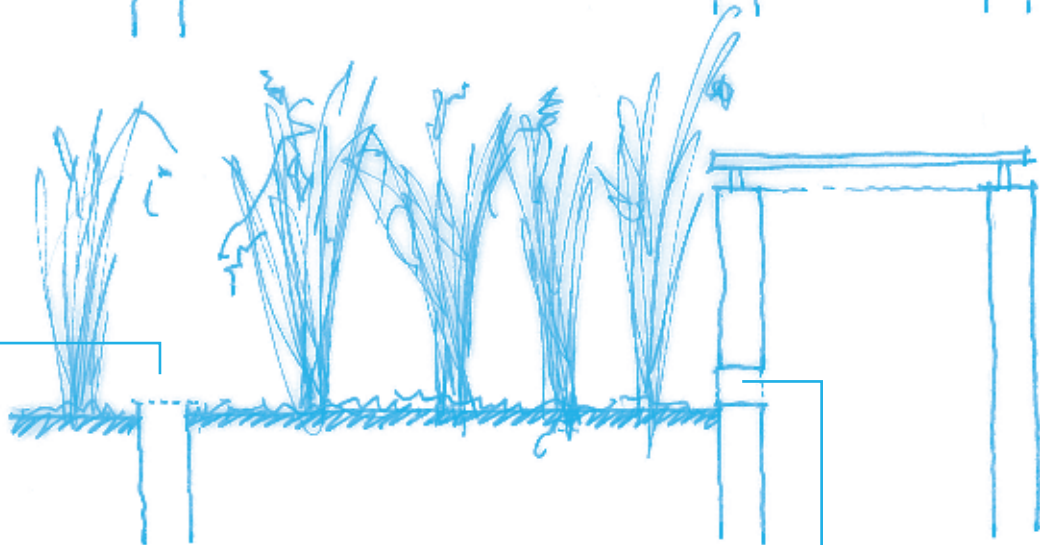
**Resource Efficient**



surface clogging  
causing water to be  
permanently ponded



endcap  
removed  
to flushout  
point



OR core drilled  
in pit wall

# Subsurface Ponding

**application:** bioretention systems with ponding

**advantage:**

- low cost rectification

**note:** short circuiting

**idea (sourced or via):** Jack Mullaly

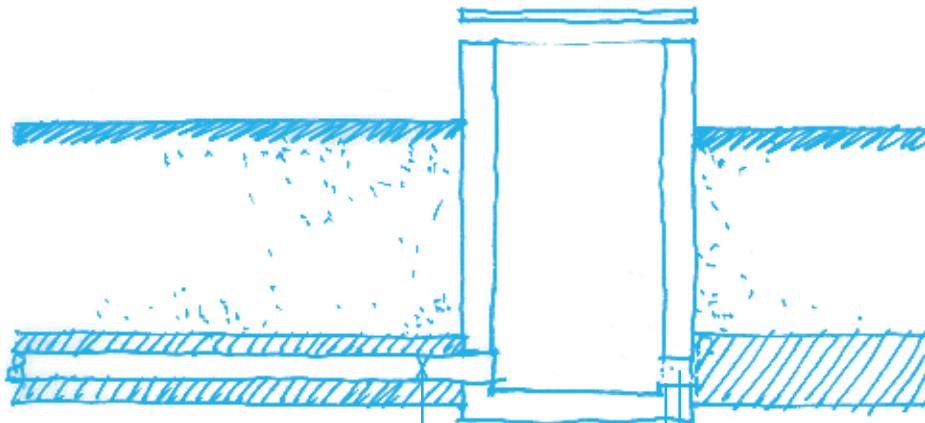
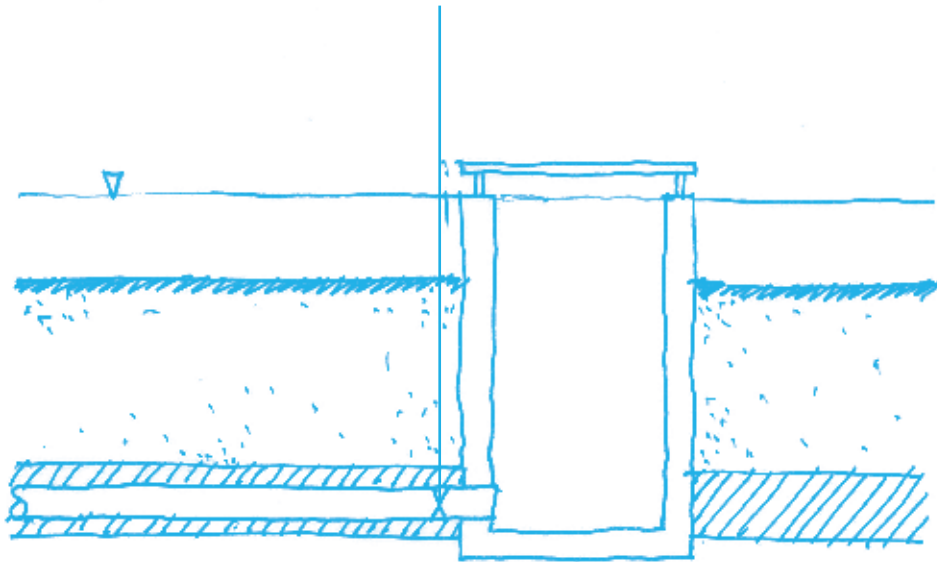


**Efficient Maintenance**



**Resource Efficient**

pipe blockage  
causing water to be  
permanently ponded



pipe blockage

wire mesh

drill hole in pit wall

In our efforts to move towards long-term sustainability, our choice of materials needs to consider environmental impact, renewability and energy inputs.



# **Material Sustainability**

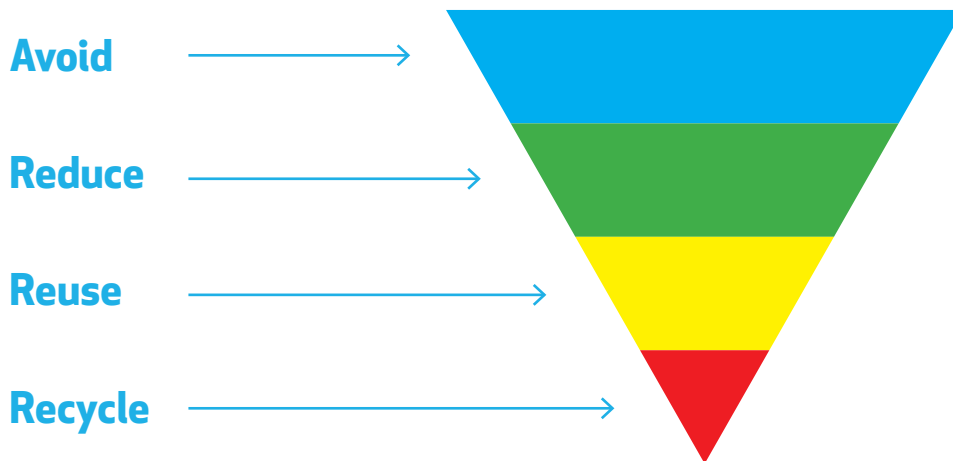
# Material Sustainability

Materials selection is often a balance of competing benefits and disadvantages as well as consideration of costs and functionality. Sustainable design should seek to protect receiving ecosystems while reducing regional water demands for irrigation. The sourcing of locally available filter media and plant species is also of importance to reduce transportation and support local provenance species.



**Material Sustainability**

Broad principles for sustainable selection of materials are outlined below:



**Low impact**

- low energy / carbon
- local source
- extraction damage minimised
- non-renewables avoided

**Durability** – appropriate length of lifecycle

**Reasonable costs**, functionality and maintenance requirements

Item	Sustainable Options
Earthworks	<p>Reduce – modify cell size, shape and orientation to minimise earthworks volume (e.g. align long axis of basin parallel with contours)</p> <p>Reduce import / export - balance earthworks on site to avoid extra cut and fill</p> <p>Low impact – limit area of disturbance</p> <p>Low impact – avoid exposure of PASS, AASS and sodic soils</p>
Drainage aggregate	<p>Low impact – avoid extraction from rivers or creeks</p> <p>Durability – non degrading</p> <p>Substitution – use washed recycled concrete</p>
Filter media	<p>Local sourcing</p> <p>Low impact extraction</p> <p>Durability – non degrading</p>
Transition layer	<p>Avoid – through careful selection of drainage and filtermedia satisfying the bridging criteria</p> <p>Local sourcing</p> <p>Low impact extraction</p> <p>Substitution – use an appropriate recycled crushed glass product</p>
Underdrainage pipes	<p>Avoid – can an infiltration basin be used?</p> <p>Reuse – offcuts, abandoned pipes</p> <p>Recycle – use recycled plastic</p>
Inlet / outlet pipes	<p>Reduce – encourage upstream infiltration (where appropriate) to reduce pipe size</p> <p>Reduce – optimise hydraulics to reduce pipe size, use at-source bioretention on flat sites</p> <p>Low carbon – low embodied energy for plastic pipes</p> <p>Low carbon – use fly ash cement for RCP</p>
Topsoil for batters	<p>Reuse – Save and reuse topsoil layer from site</p> <p>Local sourcing – if insitu soil not suitable</p> <p>Low impact – free of weeds / fireants</p>



Item	Sustainable Options
Liner	Avoid – can this be eliminated from the design Substitute – can insitu clay be used instead of plastic
Concrete Weirs	Reduce – optimise hydraulics to reduce weir length Substitute – can rock protection be used instead Substitute – low carbon fly ash cement
Concrete Pits	Reduce – optimise hydraulics to reduce pit size Substitute – low carbon fly ash cement
Headwalls	Substitute – can rock armouring be used instead? Substitute – low carbon fly ash cement or recycled plastic
Sediment forebay	Avoid or reduce – through careful design Substitute – low carbon fly ash cement
Access Tracks	Reduce – through careful design Substitute – use reinforced turf / garden (gravel base + topsoil + low groundcover)
Retaining Walls	Avoid – through careful design Substitute – use boulder walls, low impact extraction, local sourcing Substitute – use low carbon fly ash cement
Rock Protection	Avoid – can velocities be reduced to avoid need? Low impact – Avoid extraction from rivers or creeks Avoid material that could pollute or change the pH of the water (e.g. AMD)
Plants	Local provenance – grown from local seed by local growers Organic – grown without pesticides and artificial fertilizers Durability – use hardy plants to limit dieoff and replanting Multiuse – carbon sequestration, productive landscapes, biodiverse, fauna friendly
Irrigation Water	Avoid – timing of establishment period with seasonal rain Avoid – use drought tolerant plant species Substitute - use suitable alternative water source Low impact – minimise release of pollutants to environment

# Filter Media Layering

**application:** alternatives to standard profile

**advantage:**

- less resource consumption
- reduce filter media costs

## Alternative Profile 1

**note:** use only if hydraulic conductivity (HC) unaffected & plants can completely establish (root depth may be shortened)

**idea (sourced or via):** Southern Pacific Sands

## Alternative Profile 2

**note:** use only if bridging criteria is satisfied

**idea (sourced or via):** River Sands

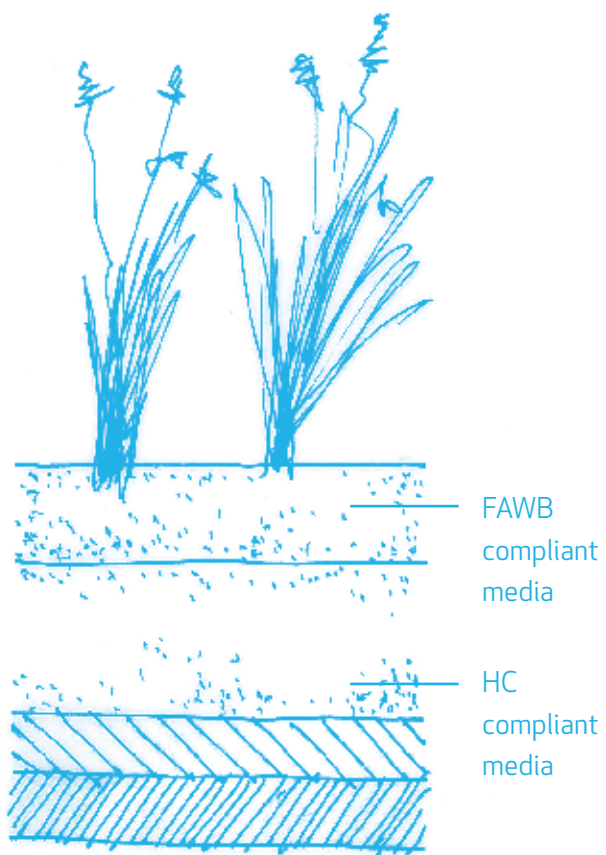


**Material Sustainability**

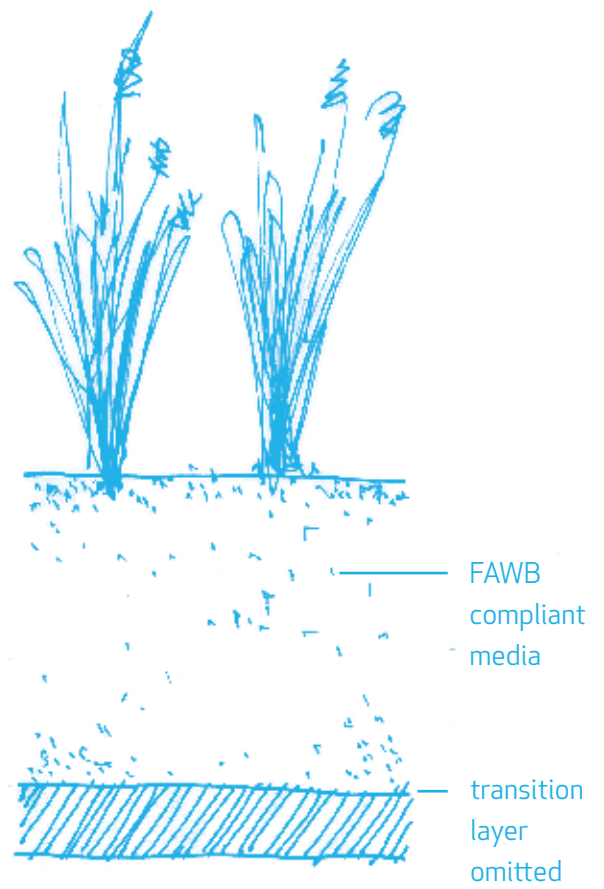


**Resource Efficient**

ALTERNATIVE PROFILE 1



ALTERNATIVE PROFILE 2



# Filter Media Additives

**application:** to enhance filter media properties

**advantage:**

- improved plant establishment

**idea (sourced or via):** Sally Boer - E2Designlab and Simon Leake - SESL



**Material Sustainability**

**Low nutrient organic matter:**

- Composted garden waste
- Composted pine bark
- Coconut coir
- Composted wood chip fines
- Sugar cane bagasse
- Composted saw dust

**Mineral additives:**

- Diatomaceous earth
- Zeolites
- Scoria
- Perlite
- Power station ash
- Crushed brick and tile

**Other additives to support plant establishment:**

- Water retention polymers (water holding crystals)  
(1-2% by weight)
- Slow release fertiliser (10g/plant)
- Silica, calcined clay and cellulose based water holding agents.

# How Does Your System Rate?

Discover the new Living Waterways scoring system at [www.waterbydesign.com.au](http://www.waterbydesign.com.au)

Submit your own ideas at [info@waterbydesign.com.au](mailto:info@waterbydesign.com.au)

