



**Presentation to Australian Native Plants Society
12th August 2004**

**Development of a Canberra
Water Sensitive Residential Garden:
Work in progress**

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Background to the garden: Transitions

- **In late 2000, the need to replace 30 year old fences**
- **A growing sustainability awareness, heightened by the severe 2000 – 2004 drought**
- **As 3rd/4th generation new Australians, a desire to give expression to our ‘Ozism’ in ways relating to the local landscape, flora & fauna**
- **Presentation on the basis of ‘work in progress’**
- **Nothing remarkable about an Australian native plants garden, or rainwater or grey water systems. Perhaps what is of interest here is the integrated approach to the redevelopment of our garden**

**Clearing of
overgrown Ivy &
shrubs,
preparatory to
rebuilding the
boundary fence**

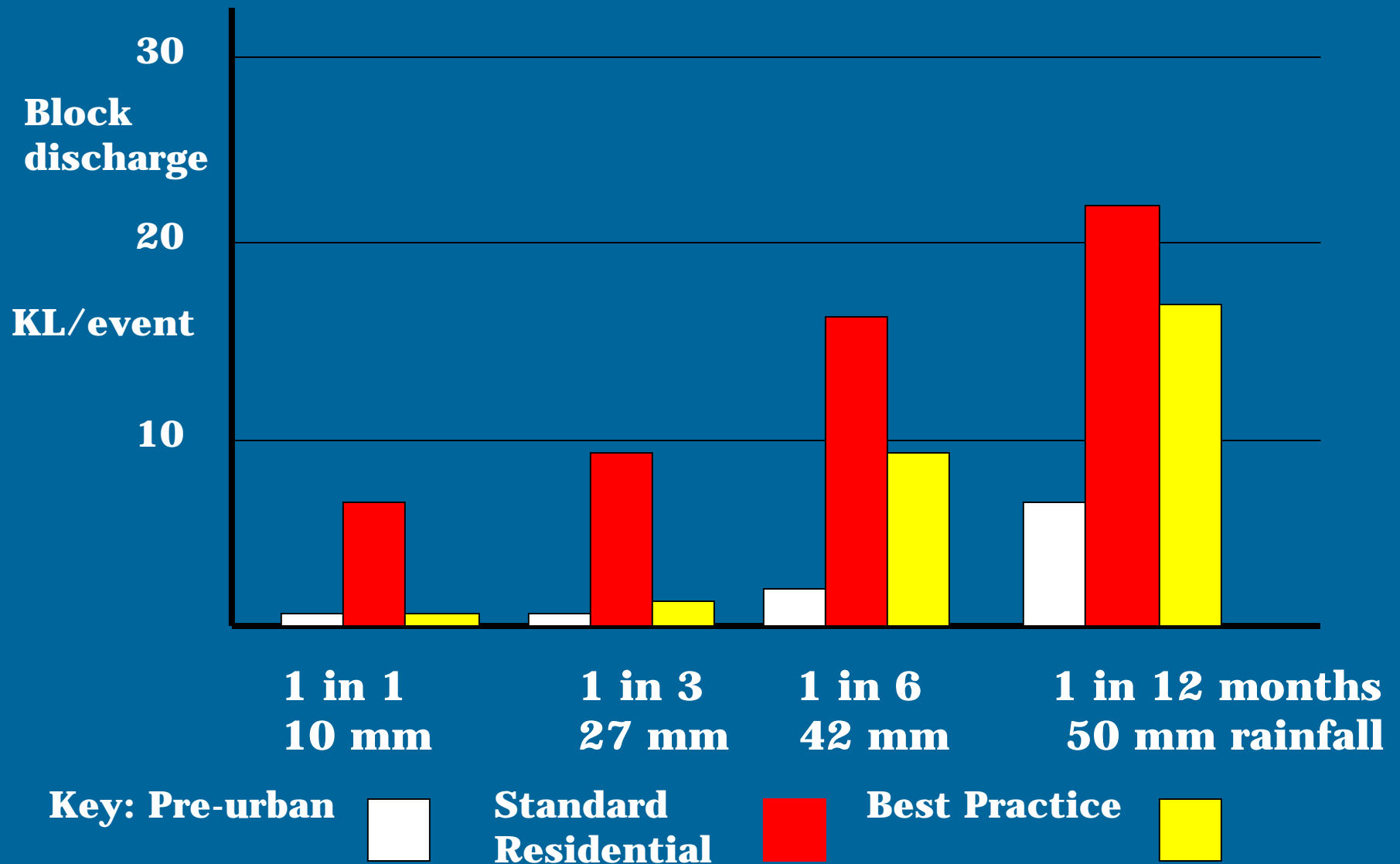


Issues: Impacts of urban development on waterways

- **Depletion of flows in water supply streams, resulting in the loss of ecosystems & biodiversity**
- **A 5 fold increase in stormwater discharge volume & 10 fold increase in peak rate of discharge, resulting in loss of habitat and biodiversity in downstream waterways**
- **A 7 fold increase in sediment & nutrient exports, smothering benthic biota, reducing water clarity, depleting oxygen & stimulating nuisance algal growth**
- **Urban drainage development (concrete pipes & channels), resulting in the loss of local waterways & ecosystems**
- **The generation of large volumes of wastewater, with treated effluent discharge modifying receiving water flow characteristics, resulting in loss of bio-diversity of downstream waterways**

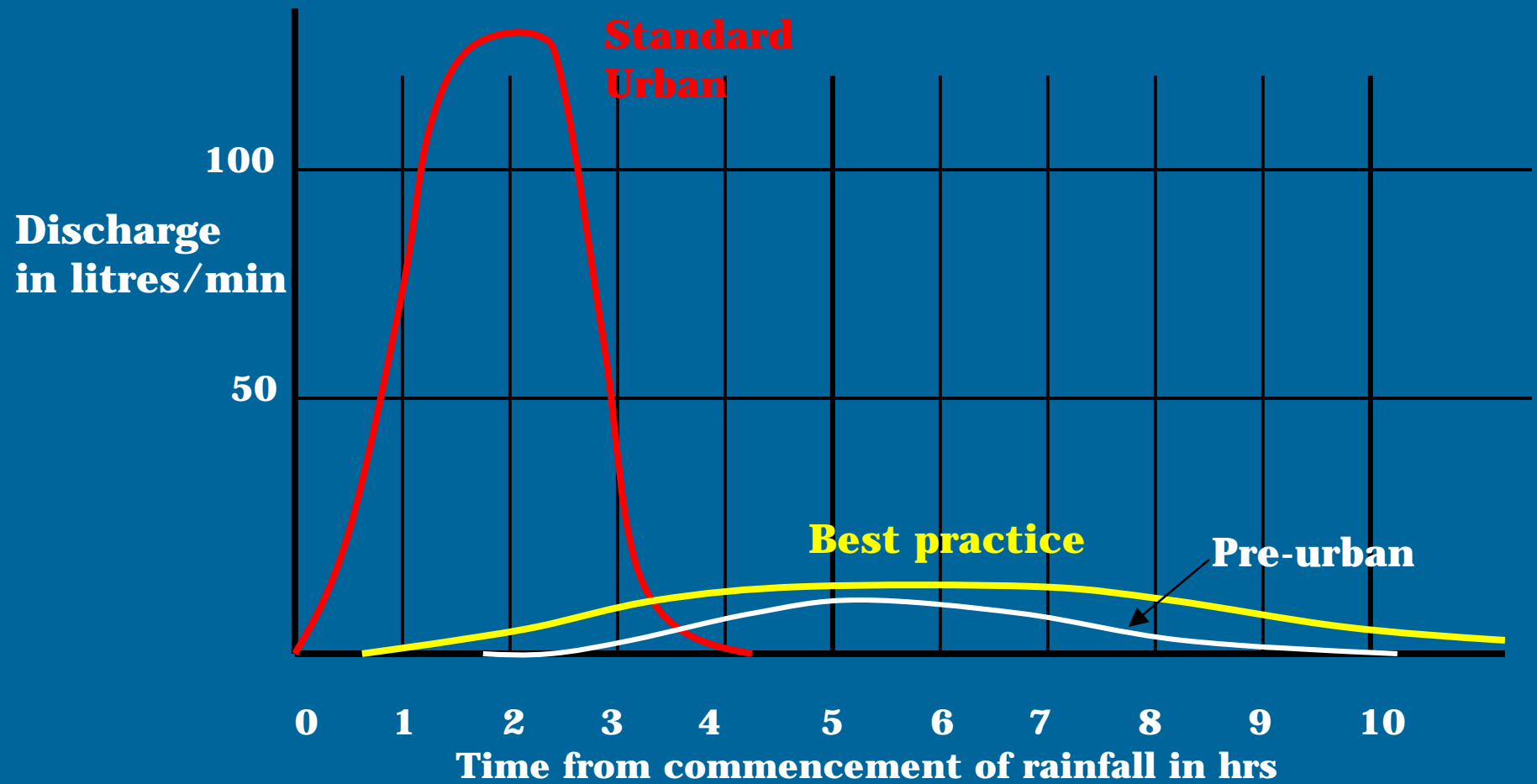
RESIDENTIAL BLOCK STORMWATER DISCHARGE

Assessment of performance for the ACT



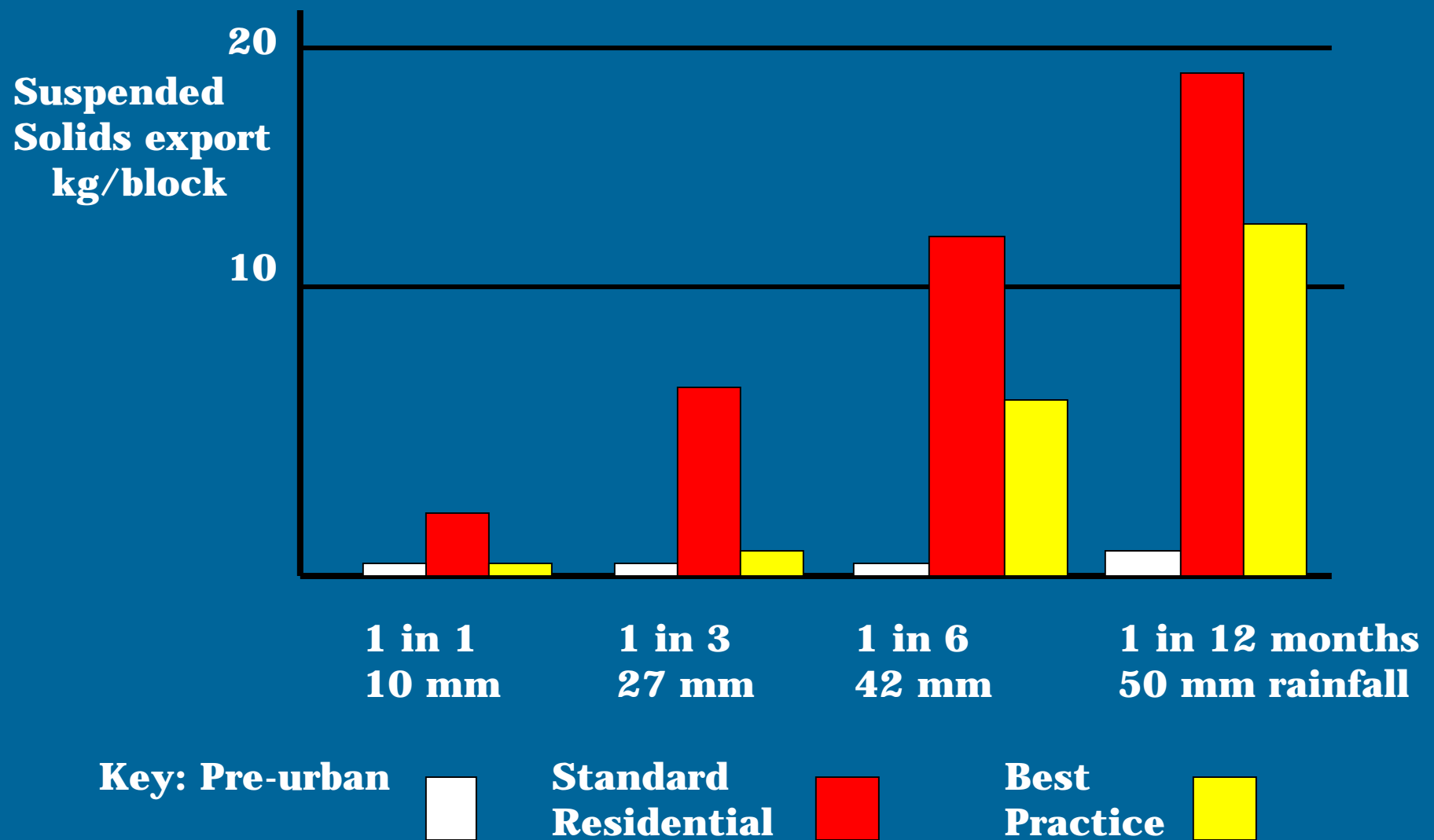
RATE OF DISCHARGE FROM RESIDENTIAL BLOCK

(Assessment for 1 in 3 months ACT storm event - 27 mm over 2 hrs)



RESIDENTIAL BLOCK POLLUTANT EXPORTS

Assessment of performance for ACT



Management responses

- **In the past, separate development of water supply, drainage & sewerage, and the application of structural measures such as concrete pipes & drains, gross pollutant traps, pollution control ponds & retardation basins**
- **These responses have yielded a loss in urban amenity, poor use of water resources, high cost infrastructure & detriment to local and regional waterways. The limited opportunities to build new water supply dams highlights the need to use existing resources more efficiently**
- **There is currently a shift to management of 'water in the landscape' at source, as the basis for reducing the quantity and improving the quality of stormwater discharge, for better utilising the water resource & for enhancing urban amenity**

Water Sensitive Urban Design principles:

- **Maintenance or restoration of the 'soil-water' storage processes**
- **Maintenance or restoration of the landscape water detention capacity**
- **Capture opportunities for harvesting rainwater runoff and greywater from in-house water use**
- **Reduce the demand for in-house & garden water**
- **Re-integrating design of landscape, water supply, stormwater, wastewater & groundwater streams**

Water Sensitive Urban Design elements:

Infiltration:

- **Pervious areas – vegetation, gravel surfaces**
- **Porous paving – porous pavers, open jointed pavers, gravel pavements**
- **Grassed or gravel lined swales & infiltration trenches**

Runoff detention:

- **Break the direct stormwater pipe connection**
- **Grassed or gravel lined swales, infiltration trenches**
- **Extended detention ponds, rainwater tanks**

Rainwater & greywater retention (harvesting):

- **Rainwater tanks & use in-house & garden**
- **Greywater tanks, treatment & use in-house & garden**

Reduction in water use:

- **Select landscape forms & plants reducing watering requirement**
- **Mulching to reduce evaporation losses**
- **Efficient irrigation systems**
- **Water saving measures in the house**

Swale arrangements



Swale in association with landscape rockery



Grassed swale in street verge*



Gravel lined swales on our block. Timber edges installed to limit mulch input by Blackbirds

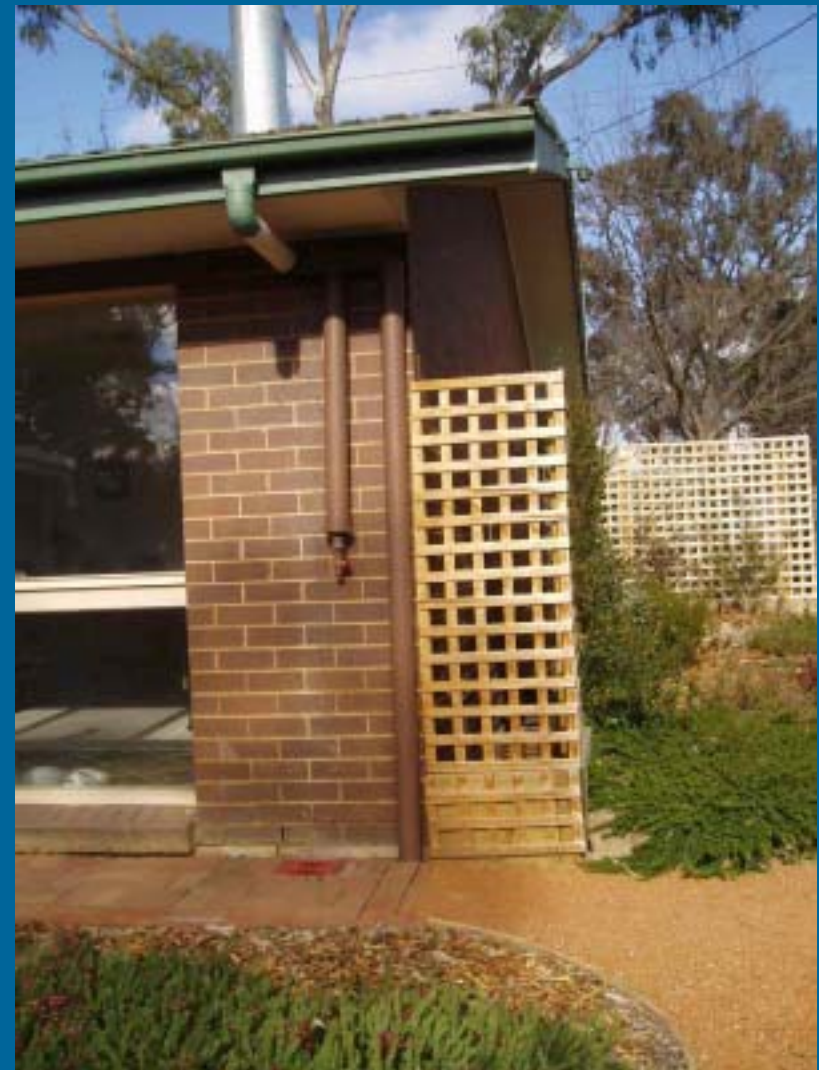


Rainwater harvesting

Rainwater tank (4500 litre), gauge
& overflow to swale



Down pipe connection detail,
including first flush unit,
'inverted siphon' arrangement to
limit length of pipe 'festooned'
across external walls



**Spout discharge arrangements,
cascading to wetland (left*) or
(our block) to collector pot &
infiltration trench (right)**



**Greywater tanks (300 litres),
with simple inlet strainer &
pump for reticulation**





**Gravel swales &
infiltration basins,
Churchill House Canberra**

**Permeable pavers
marketed by Hydrocon**



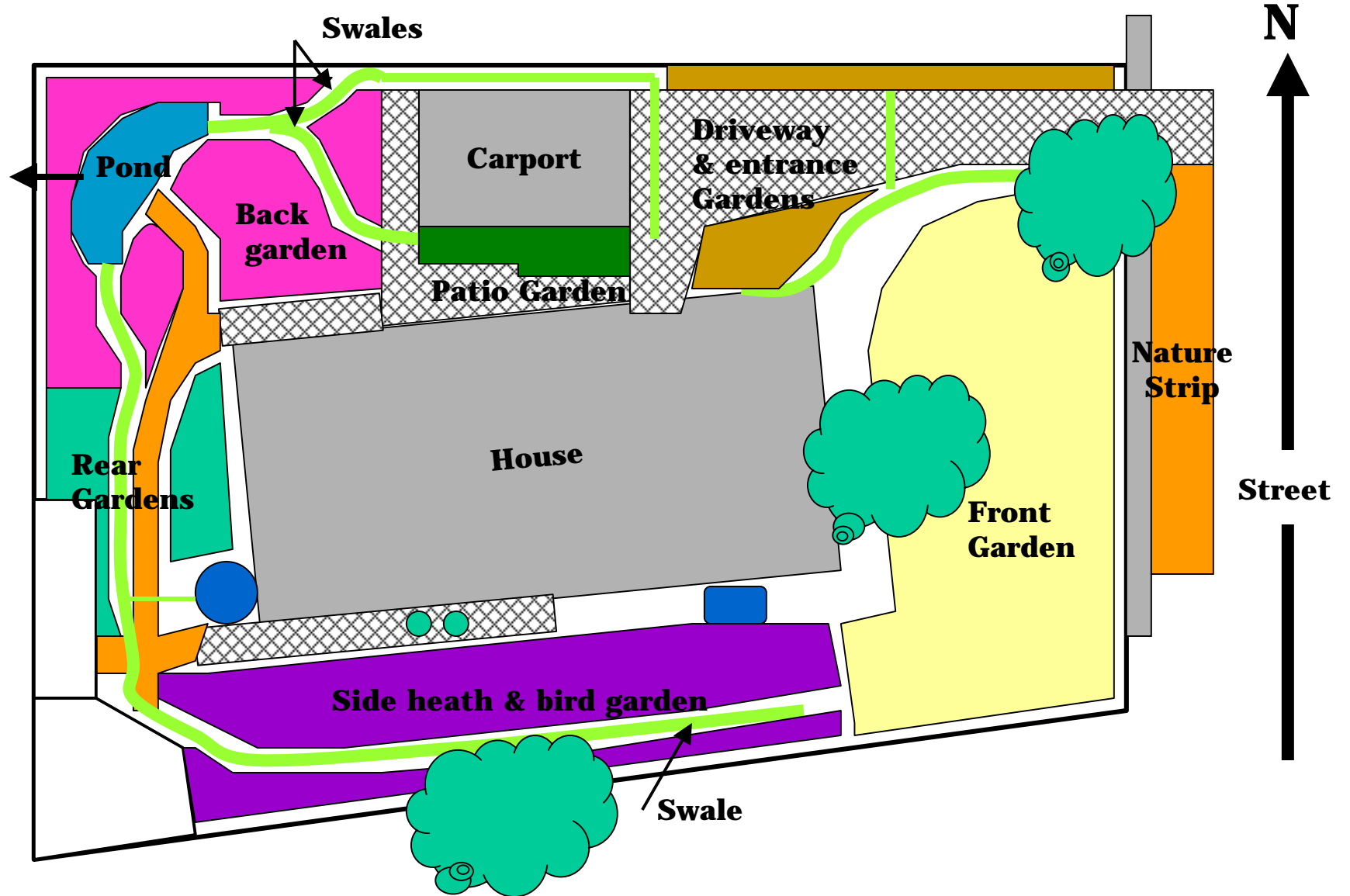
Block landscape & water management objectives guiding the redevelopment of our block landscape:

- **Sustainability**
- **Aesthetic, contemplative & recreational values**
- **Comfort (summer shade & breeze, winter sun)**
- **Provision of micro-habitats sustaining plants, birds,
aquatic biota**
- **Reliable & low maintenance water systems**
- **Balance between cost, environmental & amenity
benefits**

Key Block orientation, slope & garden features:

- **Eastern frontage, fall (5%) to the North West**
- **Block area 880 m², house & carport 250 m², paving 120 m², garden 530m² (impervious 42%, pervious 58%)**
- **Slab on ground house (strong house–garden connection) orientated East-West on block**
- **A 16 m² extended detention pond located in north western corner, adjacent to the boundary stormwater tie**
- **4500 litre & 500 litre rainwater tanks collecting runoff from 150 m² of house roof (plan to extend to 200 m²)**
- **Two 150 litre greywater tanks & screen. Currently, laundry outlet only connected to greywater tanks.**
- **Pump, delivering rainwater & greywater via 25 mm PVC pipes to turbo-key drippers & micro-sprays (rainwater only)**

Block arrangement



Front 'Red Gum/Yellow Box woodland' garden

Function:

- Address to Street – streetscape

Significant vegetation:

- 100 yr old Red Gum & Yellow Box trees
- 25 yr Golden Ash
- Struggling grass
- Flock of 50 roosting Cockatoos December to June

Adopted design:

- Promote *E.blakelyi* & *E.melliodora* woodland
- Remove grass & promote understory of *Acacia*, *Callistemon*, *Melaleuca*, *Themeda*, *Stipa*
- Token corner of grass surrounding Golden Ash
- Remove grass on nature strip and replace with compacted weathered granite
- Mulch of shredded *Eucalyptus* pruning material

Greywater reticulation for watering of selected shrubs.

Front Red Gum & Yellow Box woodland treatment



Driveway & Entrance gate gardens

Function:

- Vehicle entry to carport. Pedestrian entry to patio & house
- Significant runoff from paved area, discharging to stormwater

Significant vegetation:

- **Japanese Maple & Camellias** in entrance-gate garden

Adopted design:

- Remove Ivy from boundary fence and replace with **Westringia** (screen)
- Plant entrance-gate garden with **Camellias, Rosmarinus**

Remove concrete driveway & paths and replace with open jointed pavers

Install swales collecting driveway runoff, linking to garden bed infiltration & pond detention/treatment

Remove NW downpipe, with spout discharge tumbling to collector pot & infiltration trench

Weathered granite treatment of nature strip & open jointed pavers on driveway & swale



Patio flower garden

Function:

- Create an attractive patio activity area
- Extension of entry from entrance gate to front door
- Vista from family room & study

Significant vegetation:

- A very productive & ornamental lemon tree
- A very woody grapevine over the patio beams

Adopted design:

- Retention of ***Citrus Lisbon***
- Removal of grapevine & install a shade sail in summer
- Espaliered ***Camellias*** along wall of carport, ***Azaleas***, ***Helleborus***, ***Polyanthus***, ***Begonias*** & ***annuals***

Rainwater reticulation & micro-spray based watering system

Patio garden



Impatiens border



Back 'water & ground cover' garden

Function:

- Vista from sitting & family rooms & patio

Significant vegetation:

- Cottage garden of shrubs & climbers (Ivy) along fence
- Large open grassed area, and a 15 yr *E.maculosa*

Adopted design:

- Construct 16 m² pond in lower NW corner of garden. Remove *E.maculosa*. Pond plants *Schoenoplectus*, *Eleocharus*, *Juncus*, *Marsilea*, *Myrophyllum*, *Lythrum salicaria*
- Form 3 swales along major natural drainage lines, connecting to the pond. Swales effectively formed individual garden beds & drainage.
- Extensive use of ground covers across garden, to maintain vista of pond from Patio & house. Use of *Acacia*, *Grevilleas*, *Callistemon*, *Myoporum*, *Correas*, *Hardenbergia* groundcovers & shrubs

Limited greywater reticulation of this bed

Back pond & native ground cover garden



View from patio



View from patio



View across pond to rear 'shade' garden



Path & steps to pond



Pond outlet weir: Vee shaped to limit discharge (enhance detention) of runoff for smaller (< 1 in 3 yrs) storm events. (Outlet normally screened by rocks)

Rear shade & walkway garden

Function:

- Shading of western wall of house
- Access to clothes line & service area
- Vista from pond across Pegasus woodland to Brindabellas

Significant vegetation:

- A 30 yr Claret Ash, struggling grass area, shrubs & Ivy

Adopted design:

- Pruning of Claret Ash identified extensive borer damage, and need to remove tree. Replace with *E.leucoxylon*
- A meandering swale & weathered granite pathway, connecting the pond with the southern side of the house
- A rockery adjacent to rear wall of house, & planting with climbers on trellis, small shrubs & ground covers. *Sollya*, *Hardenbergia*, *Pandorea* climbers, *Myoporum* ground cover & *Callistemon*, *Grevillea*, *Crowea*, *Boronia*, *Banksia*, *Correa*, *Endogophora* shrubs

Greywater reticulation & drippers based watering system



Rear shade garden

View from side garden, looking towards the pond

View from entrance to rear shade garden, with rockery & 'shade' climbers on the left, and swale on the right



Side heath & bird garden

Function:

- Access from back door to clothes line & service area
- Vistas from house to Pegasus woodland & Brindabellas.

Significant vegetation:

- ***E.blakelyi*, Ash, Liquid Amber, *Banksia*, *Callistemon*, Liquid Amber, climbers (Ivy & Temora)** along the fence
- Open grass area between the border garden and house.

Adopted design:

- A swale, intercepting runoff from the reserve & overflow from the rainwater tanks, connecting to the rear pond swale.
- Use of small shrubs, to maintain vistas across the Pegasus woodland & Brindabellas. ***Callistemon*, *Banksia*, *Grevillea*, *Eriostemon*, *Westringia*, *Myoporum* & *Ceratopetalum*** shrubs & ground covers
- Planting with ***Erica* & *Epacris*** to form 'heath garden' section.

Greywater reticulation & drippers watering system for native shrubs. Rainwater reticulation & drippers for the heath garden.



Side heath & bird garden

Recently planted Heath in the foreground, with swale & stone wall forming raised garden bed along fence line

Banksia, Grevillea, Eriostemon, Myoporum, Westringia & Ceratopetalum shrubs forming the bird garden



Performance

Water saving

- **70% reduction in town mains water use**
- **60% overall reduction in total water use (including recycled greywater & rainwater)**

Stormwater discharge

- **80% reduction in runoff discharged to public stormwater system**
- **90% reduction in peak 1 in 1 yr storm discharge to stormwater system**

Economy

- **Annual saving in water rates \$200 to \$250.**
- **Annual amortization & operation cost \$210 (based on \$2600 purchase & installation cost for tanks, pump, pipes & valves, pond liner, rocks & mulch, and amortized at a 5% interest rate over 10 years)**



Impatiens



Grevilleas



Correa



**Mudede emerging from Pond for metamorphosis to adult
(Dragonfly) form**



Performance: Landscape values

- **Maintenance of 'green' landscape throughout the drought**
- **Great diversity of flowering plants**
- **Interest provided by pathway & swales meandering across the block, linking with the pond**
- **Pond sustaining growth of water plants, Dragonflies & Damselflies, back-swimmers, frogs. Free of mosquito nuisance.**
- **Enhanced bird activity associated with flowers & water (pond)**
- **Visual impact of tanks & rainwater pipes on house**

Maintenance

- **Free of lawn cutting**
- **Periodic cleaning of rainwater inlet screens (high organic loading on roof) required**
- **Drainage of exposed rainwater tank & pump pipes required during frost conditions**
- **Problem of Blackbirds filling gravel swales with mulch substantially reduced by timber edges**
- **Substantial reduction in use of hose for watering**
- **Manual operation of greywater & rainwater irrigation pump. Automation possible in future.**

Lessons learnt along the way

- **Difficulties of retro-fitting rainwater & greywater systems to a 'slab on the ground' house**
- **Need to minimise the visual impacts of pipe systems**
- **Maintenance & water use impacts of high litter load on roof (large trees) requiring careful design**
- **Accommodating drought, fire & frost hazards**
- **Care required in selecting & siting of plants**
- **Accommodating Blackbirds & Cockatoos as significant stakeholders**
- **Health issues – mosquitoes and use of rainwater & greywater**

Conclusion

I hope that the presentation has provided:

- **A better understanding of the relationship between residential blocks & water use and their impacts on waterways;**
- **Ways in which we can ameliorate these impacts;**
- **The benefits of an integrated ‘water in the landscape’ based approach to the design and management of house, garden and water systems;**
- **Some of the challenges in retro-fitting an existing house & garden with water sensitive gardens & water management systems;**
- **Some emerging ideas on an Australian residential landscape which is more sympathetic to our local environment.**

***Acknowledgements**

**Photo of grass swale (slide 11) at Lynfield Estate,
Melbourne, by John Neal, ACT Planning.**