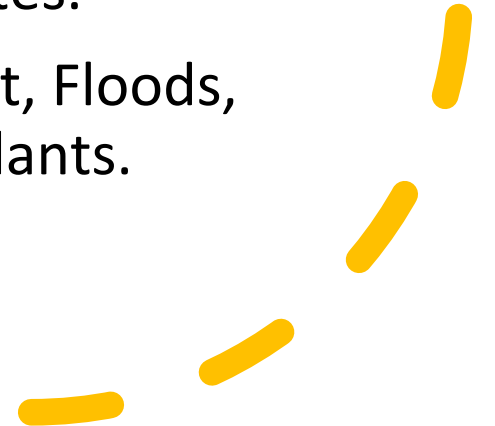


Basics of Ozbreed



- Australian landscape plant breeding company, specialising in tough plants. Not a grower.
- Open to all nursery growers Australia wide. Hundreds of growers. Lots of competition. Remuneration via small royalty per plant sold.
- Home of No fuss, Functional and Reliable Green Life.
- Plants available Australia wide, all states.
- Richmond NSW, Heavy Frosts, Drought, Floods, Summer humidity. Great place to test plants.





Decade long research identifies suitable plants for wet conditions

Evaluation of survivability of different landscape plants
in various wet feet conditions.

Adajar, C.A.M.M.1, Tulipan, J.2, Layt, T.3

Location; Richmond, NSW.

Learning Objectives

- Understanding plants that can survive extreme weather events, including extreme waterlogging and severe drought.
- Treating Phytophthora and other waterlogging diseases.
- How this knowledge can help landscape designers and architects design more reliable and sustainable landscapes, with an emphasis on Micro Catchments.



Before this study,
a drought tolerant
study confirmed
drought tolerance
of many species.

https://ozbreed.com.au/download/research-papers/measuring_drought_tolerance_plants.pdf



Between 2006 and 2012 many plants were tested in tubs of water for up to 3 years.



These trials got us thinking. Some plants of a species died while others lived. Hence this monster waterlogging trial.



2012 to present.
Having bred many
new plants, it was
time to test them. We
also added our
existing plants to
testing.

Hypothesis;

- 1) Many drought tolerant plants can cope with excessive waterlogging.
- 2) Breeding can select for wet feet tolerant plants that do not normally occur.



The study aimed to identify plant species that can thrive in extreme wet conditions, providing landscape architects with opportunities to create more resilient landscapes in Australian developments.

We also tried to breed new wet and dry loving plants.



- Three testing procedures showcased extreme waterlogging over a 10-year period.

- Area 1 Excessive Irrigation

- Area 2 Bio-retention swales.

- Area 3 Floodplains.



Area 1 evaluated plants' ability to withstand waterlogging, excessive irrigation.



Over the decade many plants died and were replaced with new trial plants



Area 2 examined plants effectiveness in bio-retention swales



Halfway through the trial some plants still lived that died later including Nandina.



After a decade

Water run off for almost every day for 10 years



Nursery and rain runoff



Ozbreed experienced 8 floods.

**Area 3 observed plant
adaptability over 8
floods or less**





Large Areas of Ozbreed Gardens were repeatably flooded 2020 to 2022.



Key takeaway points from research

Many tested plants thrived in excessive irrigation, drought, bio-retention swales, extreme weather events including flooding, and poor drainage.



Study highlights the importance of variety over species when selecting plants. Eg; most Westringia died, but 2 thrived.



Many drought tolerant plants thrived in all three waterlogging trials, providing landscape professionals with an increased plant pallet to ensure a buffer against failure.

What is Phytophthora?

- Phytophthora, also known as water moulds.
- Can cause extensive damage to plants.
- These fungi thrive in wet and waterlogged conditions, making them a common issue in landscapes with poor drainage.
- Caused large biodiversity loss in Australia, and many landscape failures.
- Symptoms include wilting, yellowing or browning of leaves, stunted growth, dieback, and overall plant decline, often leading to plant death.

Preventative options

- Improving drainage systems.
- Use of micro catchments, contours, raised garden beds.
- Phytophthora resistant plants as highlighted in this research.
- Mixing plants or intercropping with resistant plants.
- Using chunky mulch rather than mulch with lots of fines.
- Improving soil with well composted organics.
- Systemic fungicides; Aliette is a good example.
- Increase beneficial microorganisms which we trialled.

-
- Phytophthora biological treatment trial revealed that Tanika Lomandra with an application of Metcalf TdAVC1 & TdAVA2 and Rhizovital42 from OCP Organic Crop Protectants significantly improved survival rates in wet conditions. 62.5% survival rate. Worth Specifying?
 - Agri-Fos was far worse than the control at zero survival.
 - Control group showed a 25% survival rate
 - The trial year was humid, the soil extra wet and Phytophthora was present.



Key takeaway points from research

- Mature plants survived the floods better than young plants.
- Plants survive floods better if not fully submerged.
- Summer floods damaged plants more than winter floods.
- Longer flood duration = more plant deaths.
- Statistically a Pearson correlation table showed that the smaller the number of floods the plant experiences, the better chance the plant will survive.

- Lomandra had fourteen varieties in replicated plots that were flooded multiple times, most being new breeding breed for wet feet. Three types died. Shara and Tropic Cascade thrived in large plantings on flood plains.
- More evidence that the varieties and the breed are more reliable indications of survival traits compared to the genus and species.
- Many young plants died including very young Pennisetum, and 8-month-old Magnolia after flooding but the older plants established for at least a year all lived.
- A flood plain turf grower survey showed Empire Zoysia, Nara Native Zoysia, and Couch turf survived floods well, while Buffalo grass had mixed results, and Kikuyu generally struggled.

Summary Table; Mainly based on this study.

Trade Name and Variety, or botanical name	Regularly waterlogged soils	Bio-retention Swales	Floods Extreme, Moderate, or Small
Agapanthus	Generally not	No	Extreme
Aloe	No	No	Minor
Purple Lea ® Pennisetum alopecuroides 'PA400' PBR	Yes	Yes	Extreme
Nafray ® Pennisetum alopecuroides	Yes	Yes	Extreme
Common	Yes	Yes	Extreme
Common	No	No	Moderate
Slim ™ Callistemon viminalis 'CV01' PBR	Yes	Yes	Extreme
Macarthur ™ Callistemon viminalis 'LC01' PBR	Yes	Yes	Extreme
Red Alert ™ Callistemon viminalis 'KPS38' PBR	Yes	Yes	Extreme
Better John ™ Callistemon viminalis 'LJ1' PBR	Yes	Yes	Extreme
Green John ™ Callistemon viminalis 'LJ23' PBR	Yes	Yes	Extreme
Camelia Various forms	Probably not	No	Extreme
Casuarina cunninghamiana	Yes	Probably	Yes
Casuarina glauca	Probably Not	No	Moderate
Cordyline australis	Probably Not	No	Moderate
Cupianopsis anacoides	Probably Not	Probably not	Moderate
Baeckea virgata breeding			
	No	No	Moderate
Breeze ® Dianella caerulea 'DCNCO' PBR	Yes but spotted leaves	No	Extreme
Lucia ™ Dianella caerulea 'DC101' PBR	Yes	No	Extreme
Fine Divine ™ Dietes bicolor 'DI2'	Probably Not	No	Extreme
Blue Horizon ™ Eremophila glabra prostrate 'EREM1' PBR	No	No	Moderate
Fraxinus griffithii New breed	Probably Not	No	Moderate
Yalba ™ Imperata cylindrica	Yes	Yes	Moderate
Isabella ® Liriope muscari 'LIRF' PBR	Yes	Yes	Extreme
Just Right ® Liriope muscari 'LIRJ' PBR	Yes	Yes	Extreme
Katie Belles ™ Lomandra hystrix 'LHBYF' PBR	Yes	Yes	Extreme
Lomandra longifolia ' Katrinus Deluxe ' PBR	Mixed results	No	Extreme
Shara ™ Blue Lomandra Fluviatililis LM380	Yes	Yes	Extreme
Lucky Stripe ™ Lomandra hystrix 'LMV200' PBR	Yes	Yes	Extreme
Nyalla ® Lomandra longifolia 'LM400'	No	No	Extreme
Shara ™ Lomandra fluviatililis 'ABU7' PBR	Yes	Yes	Extreme
Tanika ® Lomandra longifolia 'LM300' PBR	No	No	Extreme
Tropic Cascade ™ Lomandra hystrix 'LHWP' PBR	Yes	Yes	Extreme
Magnolia	No	No	Moderate
Melaleuca linariifolia	No	No	Moderate
Melaleuca Narrow form	No	No	Moderate
Yareena ™ Myoporum parvifolium 'PARV01' PBR	No	No	Minor
Blush ™ Nandina domestica 'AKA' PBR	Yes	No	Moderate
Flirt ™ Nandina domestica 'MURASAKI' PBR	No	No	Moderate
Obsession ™ Nandina domestica 'SEIKA' PBR	Yes	No	Moderate
Green Mist® Phormium			
	No	No	Minor
Plectranthus cillatis	No	No	Minor
Cosmic Pink ™ Rhabdialepis indica 'RAPH02' PBR	Yes	Yes	Moderate
Cosmic White ™ Rhabdialepis indica 'RAPH01' PBR	Yes	Yes	Moderate
Grey Box ™ Westringia fruticosa 'WES04' PBR	Yes	Yes	Extreme
Mundi ™ Westringia fruticosa 'WES05' PBR	Yes	Yes	Extreme
Ozbreed Zen Grass ® Zoysia spp. 'ZOY01' PBR Intended	Unknown	Unknown	Extreme
Nara Native Turf	Yes	Yes	Extreme
Empire Zoysia	Probably	Unkown	Extreme
Evergreen Baby ™ Lomandra labill 'LM600' PBR	Yes	Yes	Extreme
Amethyst ™ Liriope muscari 'LIRTP' PBR	Yes	Yes	Extreme

- Lot of plants in the study
- Nara Native Turf did well for 5 years, and then it modified, as it allowed wetland plants to grow and shade it partially out, but it was still there providing some erosion control after a decade.
- Seven Acacia varieties were planted in the floodplain. Most plants survived the first flood, but subsequent floods killed most. Only 5 out of 7 Acacia implexa survived all floods, providing more evidence that the Variety and breeding is more important than the Species.

Buffer Plants, insurance against failure

Excessive Irrigation, Bio-retention swales, Floods and drought.

- Visit www.ozbreed.com.au and search "waterlogging."
- All plants that did well in all three tests all do well in Queensland.
- Is there a link between humidity tolerant plants and wet feet tolerance? All Lomandra that did well in wet work in Qld and Australia wide.

Slim™ Callistemon viminalis 'CV01' PBR	Macarthur™ Callistemon viminalis 'LC01' PBR
Better John™ Callistemon viminalis 'LJ1' PBR	Green John™ Callistemon viminalis 'LJ23' PBR
Yalba™ Imperata cylindrica	Isabella® Liriope muscari 'LIRF' PBR
Just Right® Liriope muscari 'LIRJ' PBR	Amethyst™ Liriope muscari 'LIRTP' PBR
Katie Belles™ Lomandra hystrix 'LHBYF' PBR	Lucky Stripe™ Lomandra hystrix 'LMV200' PBR
Shara™ Lomandra fluviatilis 'ABU7' PBR	Evergreen Baby™ Lomandra labill 'LM600' PBR
Tropic Cascade™ Lomandra hystrix 'LHWP' PBR	Cosmic Pink™ Rhabdiolepis indica 'RAPH02' PBR
Cosmic White™ Rhabdiolepis indica 'RAPH01' PBR	Grey Box™ Westringia fruticosa 'WES04' PBR
Mundi™ Westringia fruticosa 'WES05' PBR	Nafray™ Pennisetum alopecuroides

Tropic Cascade™ Lomandra hystrix 'LHWP' PBR

- High performance, erosion, weed suppression, drought, extreme water logging.
- Performed in Drought without irrigation.
- Best in Flood.
- Best in Bio-retention swale.
- One of the best in excessive irrigation.
- Performed better than Katie Belles and other Lomandra hystrix.
- Highly ornamental



Shara™ Lomandra fluviatilis 'ABU7' PBR

- High performance, erosion, drought, water logging.
- Performed in drought without irrigation.
- Good performance, excessive irrigation, flood and bio-retention swale.
- One of the best in excessive irrigation.
- Has performed well in Queensland.



Callistemon viminalis varieties all did well

- Macarthur™ *Callistemon viminalis* 'LC01' PBR
- Slim™ *Callistemon viminalis* 'CV01' PBR
- Green John™ *Callistemon viminalis* 'LJ23' PBR
- Better John™ *Callistemon viminalis* 'LJ1' PBR
- Bio-retention swale and flooding
- No losses in drought or waterlogging



Most *Westringia* died except for two.

- Grey Box™ *Westringia fruticosa* 'WES04' PBR
- Mundi™ *Westringia fruticosa* 'WES05' PBR
- They get larger in waterlogging
- Performed well in wet and dry
- Some now in wet for 12 years in pre-trial still going strong.
- Why?



Rhaphiolepis

- Cosmic White™ *Rhaphiolepis indica* 'RAPH01'
PBR
- Cosmic Pink™ *Rhaphiolepis indica* 'RAPH02'
PBR
- Stayed smaller than the same age plants in regular landscape
- Out competed weeds well
- Bio-retention swale and flooding
- No losses in drought or waterlogging
- No seed due to non fertilisation.



Liriope
performed well
in all areas

- Just Right® *Liriope muscari* 'LIRJ'
PBR Larger and best for Bio-retention
swale as outcompetes weeds best
- Isabella® *Liriope muscari* 'LIRF'
PBR
- Amethyst™ *Liriope muscari*
'LIRTP' PBR



Yalba™ Imperata cylindrica

Erosion protection and waterlogging, or dry. Ideal near head walls, or high erosion areas. Rhizomes grow through silt.



Lots of plants died.



Considering our more extreme weather conditions, how important is it to have a core group of plants that can survive extreme wet and dry?



Where does this research help landscape designers and architects in a practical way.

- A buffer for poor irrigation practices.
- Bioswales and micro catchments (Rain gardens).
- Floodable landscapes caused by extreme weather.

Are landscapes sustainable without capturing water. No?

- Not all landscapes can have large Bioswales or wetlands, but almost all can incorporate micro catchments, or permeable paving, or infiltration trenches.
- Plants and Micro catchments are the most sustainable option. Nature.
- Micro catchments refer to small areas or features designed to collect and retain rainwater, usually within a landscape. They can come in various forms, including bioswales, rain gardens, infiltration basins, and more.
- The plants in this study are ideal for these. A good varied selection.



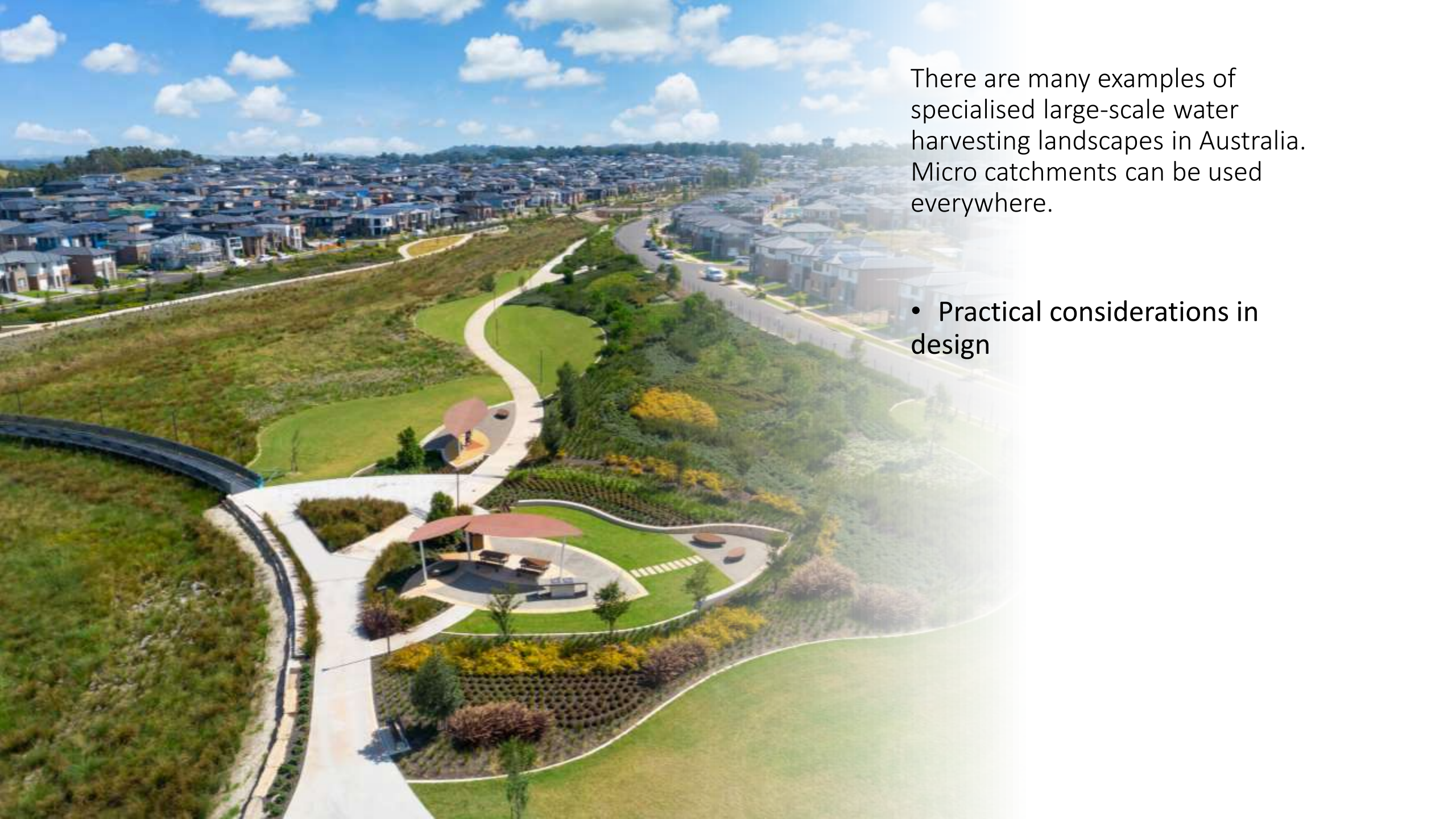
What are the sustainability benefits of micro catchments.

- Increased Water Efficiency, reducing dependence of irrigation.
- Enhanced Plant Health: Micro catchments ensure that water is delivered directly to the plants' root zones.
- Biodiversity Support: By creating micro-habitats, micro catchments can help support diverse flora and fauna.
- Improved erosion control
- Enhanced water quality filtering pollutants.
- Recharging ground water, and desertification, and improved plant drought tolerance.



Other benefits of Micro catchments

- Aesthetic appeal.
- Cost Efficiency; lower cost than hard landscapes or constructed drainage systems.
- Increased Property Value: Well-designed landscapes with integrated micro catchments can increase the property value.
- Plants are well known to improve wellbeing.
- Saving money on water costs of irrigation.



There are many examples of specialised large-scale water harvesting landscapes in Australia. Micro catchments can be used everywhere.

- Practical considerations in design



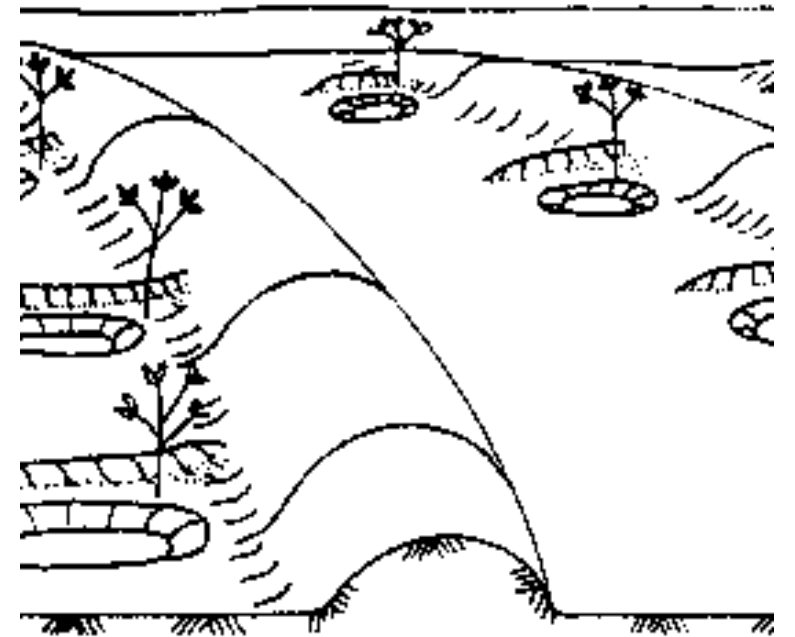
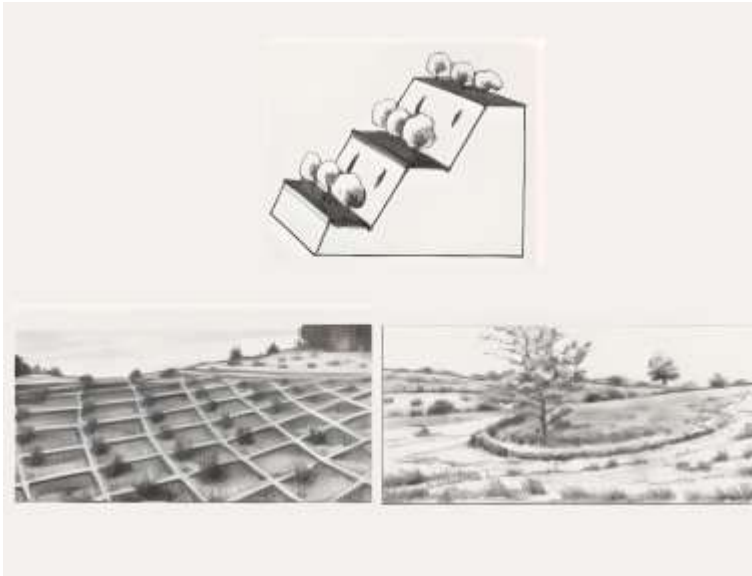
Rain gardens are growing in popularity.





Using evergreen ornamental plants like in this study make rain gardens so much more accepted and ornamental.

- Use contouring, bunding or cross swales and use your design knowledge to incorporate them into the landscape. Lessons learnt from De-desertification.



-
- Bioswales can be improved by a chain of ponds or rock barriers to slow the water down. More water retention.





Hard surfaces can have sunken planting beds to capture water. Right plant choice for your geographical area is important.



Road medium strip water capture.



-
- We are a 3-dimensional world, so are flat landscapes always appropriate for catching water.
 - Would taking a topographic map or satellite image of an area and using it to help design the contours work? What is large can be scaled down.

