Statewide Stormwater Provisions in the Planning Scheme

November 2024

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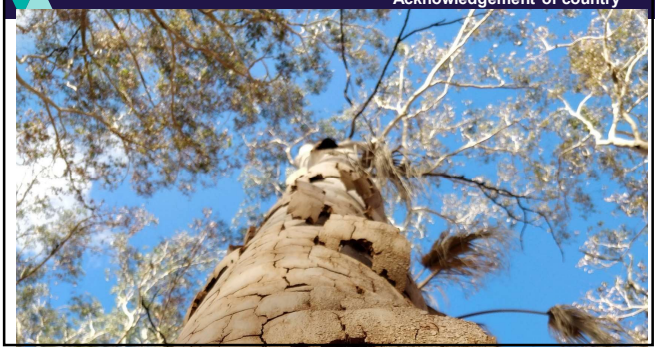
Acknowledgement of country



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Today's activities

TIME	SESSION
9:30 – 10 am	Welcome and introductions
10:00 – 10:20 am	• Why is stormwater management important? • Policy context
10:20 – 11:30 am	Introduction to planning requirements – what, why, how
MINI BREAK (15 mins)	
11:45 am – 12:45 pm	WSUD assets and achieving best practice standards
LUNCH (45 mins)	
1:30 – 2:00pm	Tools and resources
2:00 – 2:30 pm	Worked example and discussion - residential
2:30 – 3:00 pm	Break out room activities (planning & STORM)
MINI BREAK (10 mins)	
3:10 – 3:30 pm	• Sediment erosion control and maintaining assets • Future direction of stormwater management
3:30 – 3:50 pm	Worked examples and discussion – 53.18 (building and works)
3:50 – 4:00 pm	Wrap up

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Prior to this training how familiar are you with Victoria's planning requirements?

Would you feel confident explaining to a developer or colleague what Water Sensitive Urban Design is?

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Why is stormwater management important?

Policy context

Mandy's slides

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Introduction to planning requirements

Kate's slides

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Integrated Water Management: Why, What, How?

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WSUD assets and achieving best practice standards

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Acronyms and definitions

Integrated Water Management (IWM) describes a collaborative approach to water planning and management encompassing water supply (drinking and non-drinking water), wastewater, stormwater, and groundwater that supports sustainable environments and healthy communities. IWM involves collaboration between State and local governments and the private sector, delivered through urban planning, design and development. IWM is sometimes referred to as Integrated water cycle management (IWCM) or whole of water cycle management.

Water Sensitive Urban Design (WSUD) is a holistic approach to water management that integrates urban design and planning with social and physical sciences in order to deliver water services and protect aquatic environments in an urban setting. Water management assets (e.g. wetland, rain garden, passively irrigated tree pit, swale, pond, etc) are sometime referred to as WSUD or blue green infrastructure.

Blue Green Infrastructure are in-ground assets that consist of vegetation that is supported by water and a growing medium which is typically soil.

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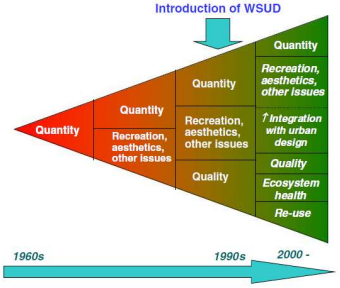
Stormwater management is evolving



Emerging Concepts:

- Integrated Water Management (IWM)
- Multifunctional infrastructure (e.g. flood and reuse storages)

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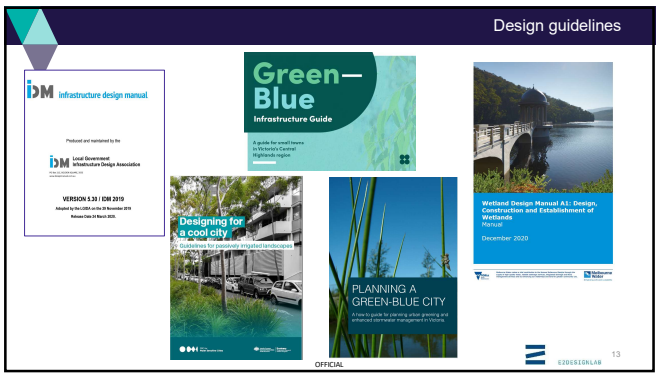

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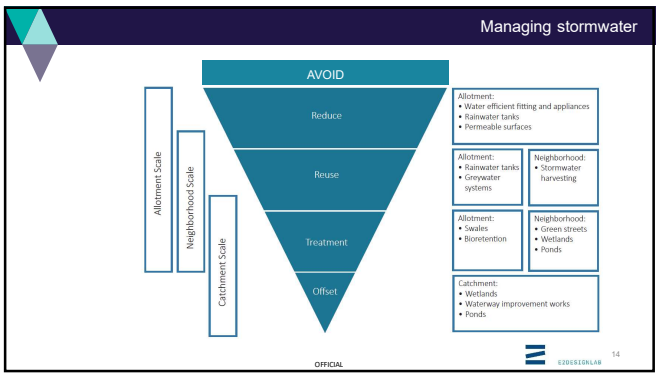

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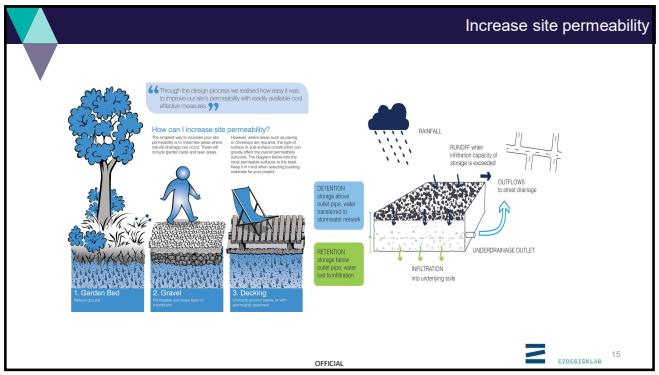

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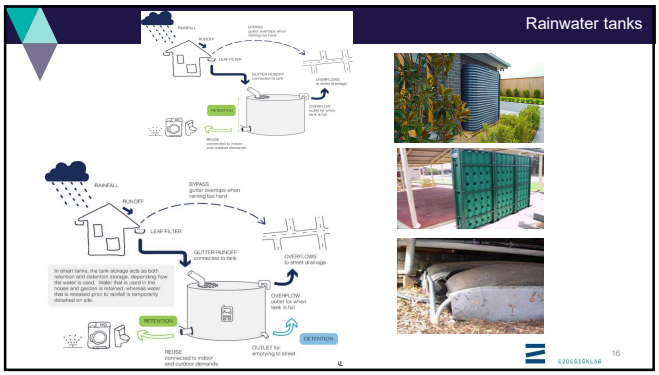

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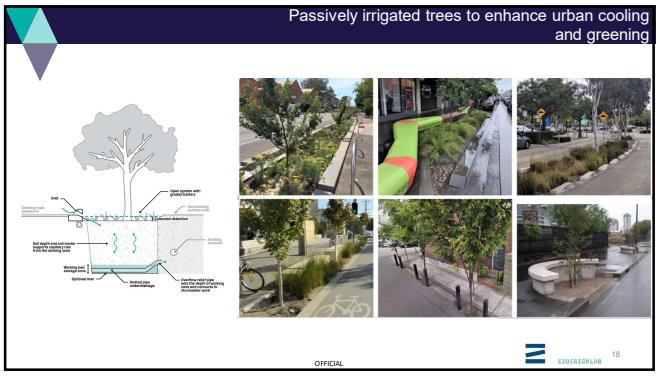

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Passively irrigated trees to enhance urban cooling and greening

- The Cooperative Research Centre for Water Sensitive Cities (CRC-WSC): Designing for a Cool City https://watersensitivecities.org.au/content/designing-for-a-cool-city-guidelines-for-passively-irrigated-landscapes/
- Victorian Department of Environment Land Water Planning (DELWP, now DEECA): Trees for Cooler and Greener Streetscapes https://www.planning.vic.gov.au/guides-and-resources/guides/all-guides/trees-for-cooler-and-greener-streetscapes
- City of Melbourne: Permeability Testing of Permeable Pavement Systems https://urbanwater.melbourne.vic.gov.au/wp-content/uploads/2021/07/

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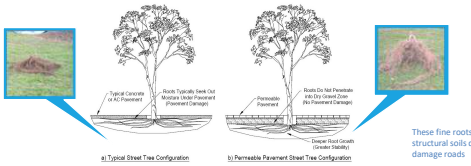
Passively irrigated trees to enhance urban cooling and greening



These fine roots in structural soils don't damage roads

- Promotes larger range of benefits via green infrastructure irrigation
  - Improved tree health and canopy growth
  - Consequent enhancements in greening, cooling, volumetric losses and pollutant removal

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What influences urban cooling?

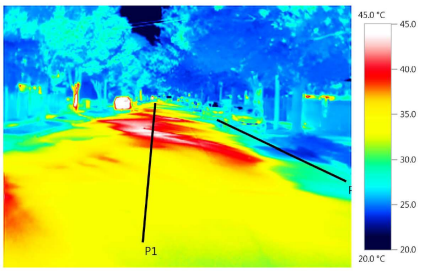

Image 2: Thermal imagery of a streetscape where unshaded asphalt reaches 45 degrees Celsius and shaded areas are 25 degrees and below. Source: City of Greater Geelong

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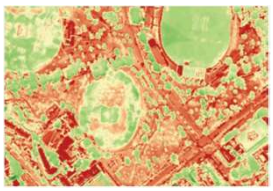
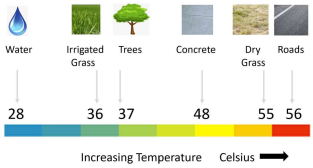
What influences urban cooling?

- Irrigated landscapes (grass, trees, garden beds) to maximise soil moisture retention and evapotranspirative cooling processes
- Canopy cover providing shade
- Lighter coloured materials (note, no other water cycle nor landscape benefits achieved)





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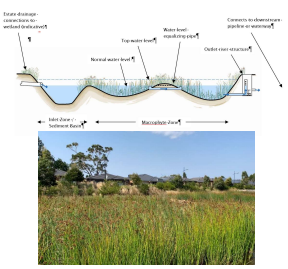
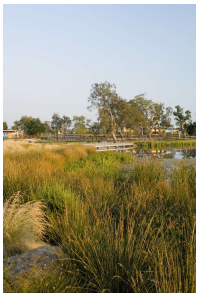
Wetlands





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Raingardens

Raingardens are a good fit for an office complex forecourt with a landscape/gardening contractor. Not a great choice for a warehouse forecourt due the high chance of being run over by vehicles and general neglect.

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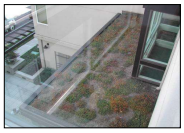
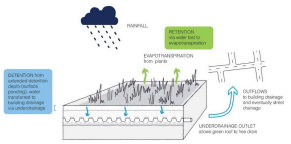
Urban greening – green roofs





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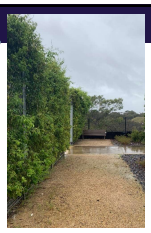
Urban greening – green walls and facades



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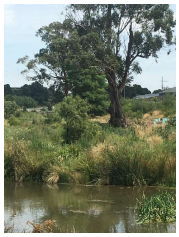
Swales and vegetated channels



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Ponds and lakes

Ponds and lakes should be considered receiving waters with treatment upstream to protect their water quality

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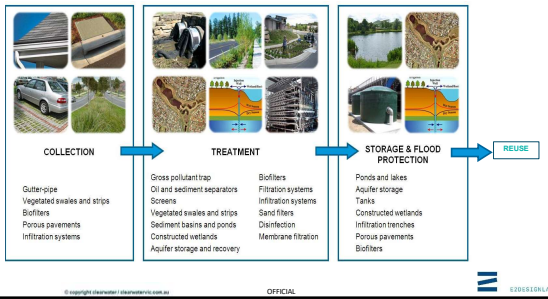
Harvesting and reuse – water quality management



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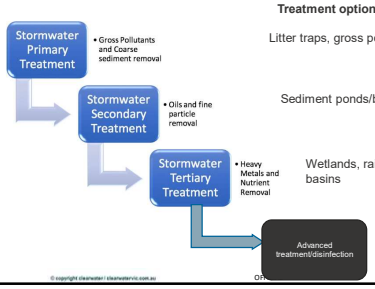
Harvesting and reuse – water quality management

Treatment depends on method of irrigation



Treatment options :

Litter traps, gross pollutant traps

Sediment ponds/basins, swales

Wetlands, raingardens / bioretention basins

UV, chlorination and ozonation

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Harvesting and reuse

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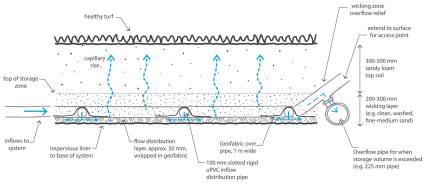
Harvesting and reuse - wicking systems



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WSUD in the context of flood management

- Good planning of floodplains and overland flows paths is an (the) essential part of flood management.
- WSUD assets for stormwater treatment and reuse are (usually) not a replacement for traditional flood mitigation measures. **Pipes, overland flow paths and storage are still needed.**
- WSUD assets **will not** (and should not be expected to) control all large storm events.
- This does not mean they not useful. WSUD **can** be effective in mitigating development and climate change impacts to sustain the *level of service* provided by the existing drainage system into the future.

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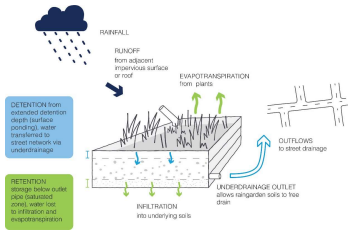
WSUD in the context of flood management

What about other WSUD assets?

Impact of rain gardens and infiltration systems on flood management can be improved through promoting infiltration to underlying soils and increasing the volume of above ground storage.



Commonly adopted sizing: surface area 1-2% of catchment area results in *modest flood management benefits at best.*

- Increasing the surface area to 2% of the catchment area can achieve a 25% reduction in Mean Annual Runoff Volume
- Increasing the surface area to ~4-5% is required to achieve significant flood management benefits.

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WSUD in the context of flood management

Flooding reductions in the Elizabeth St catchment

THE DRIVERS

Alleviate flood risks of a highly constrained urban environment

- Reduce flood risk:
  The Elizabeth Street Catchment is categorised by Melbourne Water as being at Extreme Flood Risk – the highest level. The plan aims to reduce this flood risk from 'extreme' to 'high'.
- Develop alternative water supplies:
  To irrigate the municipality's existing and future parks, gardens, trees and open spaces.

- Elizabeth St catchment: ~308 ha
- IWM Strategy to achieve 1 in 20 year ARI (~5% Annual Exceedance Probability) peak flow containment
- Equivalent cost to big pipe solution (cost neutral)
- Enhanced landscape amenity
- Smart tank supplying irrigation water to Carlton Gardens plus provide flood mitigation

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WSUD in the context of flood management

WSUD should be intentionally designed to have greatest benefit

- Larger size
- Regulated outlet
- Maximise reuse of the stored water
- Include an on-site detention (or reliably drawn-down) element

WSUD can influence small to medium sized events, which cause the most damage

- 5% - 50% Annual Exceedance Probability (AEP)
- Also referred to as the 1 in 2-year to 1 in 20-year Average Recurrence Interval (ARI)

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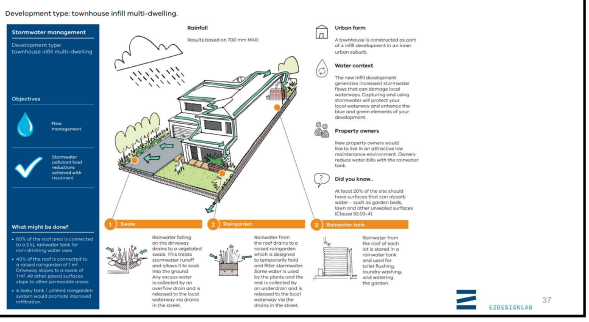
Lot scale – how does it all come together ?



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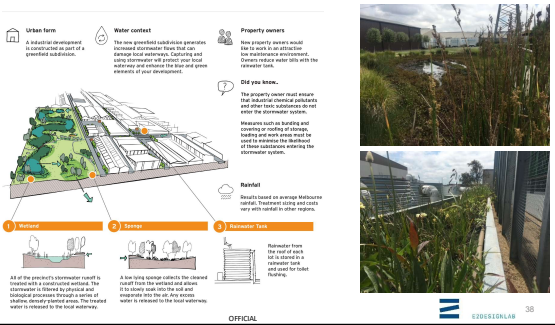
Subdivision – how does it all come together ?



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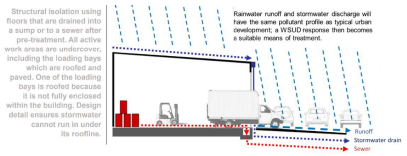
Industrial subdivision – how does it all come together ?



Minimise the impact of chemical pollutants and other toxicants including by, but not limited to, bunding and covering of roofing of storage, loading and work areas (requirement of Standard W2)

Lot scale separation of undercover storage areas and wash down areas from general stormwater drainage

- Internal drainage design – polluted run off directed to sewer/sump

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How can the water quality standards be achieved?

Development type	WSUD assets required to achieve standards
Greenfield residential subdivision 10 ha catchment area	Surface area 3.4% of catchment area Wetland
Greenfield industrial subdivision 10 ha catchment area	Surface area 5.2% of catchment area Wetland
Infill townhouses (per townhouse) Site area per townhouse: 210 m²	1.5 m² Raingarden
Commercial precinct 4.35 ha catchment area	100 m² Sediment basin 100 m² Raingarden
Office block Site area 1100 m²	x1 Sediment trap 2 m² Raingarden

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Checking compliance

Model Urban Stormwater Improvement conceptualisation (MUSIC)

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.11	2.61	15.9
Total Suspended Solids (kg/yr)	271	38.1	85.9
Total Phosphorus (kg/yr)	0.723	0.397	45.1
Total Nitrogen (kg/yr)	7.2	3.95	45.1
Gross Pollutants (kg/yr)	110	19.1	82.5

Melbourne Water's MUSIC Guidelines can be found here: https://www.melbournewater.com.au/sites/default/files/2018-02/Music-tool-guidelines-2018.pdf

MUSIC software can be found here: https://ewater.org.au/products/music/

Check these numbers to confirm Best Practice requirements have been met.

- Total Suspended Solids (TSS) >= 80% reduction
- Total Phosphorous (TP) >= 45% reduction
- Total Nitrogen (TN) >= 45% reduction
- Gross Pollutants (GP) >= 70% reduction

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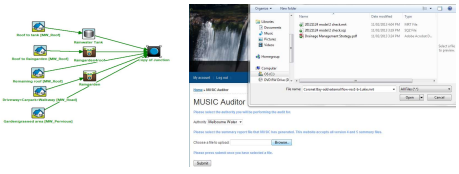
Checking compliance

Request that an applicant **submits a MUSIC file (.sqz) or .mrt file for MUSIC auditor**



As part of the assessment of the development application the assessor should review the MUSIC file submitted. The MUSIC Auditor can be accessed from: https://www.musicauditor.com.au/

In order to use the Auditor:

Register as a user or login: (https://www.musicauditor.com.au/user/register)
Create a summary report from your MUSIC model (help on how to do this here: https://musicauditor.com.au/FAQ)
Upload your summary report file by using the 'Choose File' radio button (https://musicauditor.com.au/auditor), and press 'Submit'
Download pdf report to review.

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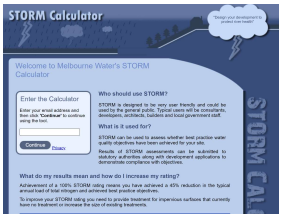
Checking compliance

Stormwater Treatment Objective - Relative Measure (STORM) tool



- Designed for the general public to easily assess WSUD measures on their property.
- Developed specifically for small residential developments to demonstrate policy compliance
- Uses rainfall data for the municipality in which the development is located.

https://storm.melbournewater.com.au/

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Checking compliance

Stormwater Treatment Objective - Relative Measure (STORM) tool

Melbourne Water STORM Rating Report

TransactionID:	1470299
Municipality:	DAREBIN
Rainfall Station:	DAREBIN
Address:	100 Bones road, Darebin
	VIC
Assessor:	
Development Type:	Commercial/Retail
Allotment Site (m2):	6,000.00
STORM Rating %:	120

Description	Impervious Area (m2)	Treatment Type	Treatment Area/Volume (m2 or L)	Occupants / Number Of Bedrooms	Treatment %	Tank Water Supply Reliability (%)
Roof_1_to_raingarden	2,112.00	Raingarden 100mm	45.00	0	128.70	0.00
Roof_1_to_tank	1,268.00	Rainwater Tank	15,000.00	30	95.60	85.00
Walkways, carpark	966.00	Raingarden 100mm	80.00	0	133.35	0.00

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Checking compliance

Stormwater Treatment Objective - Relative Measure (STORM) tool

New STORM tool underway - beta version testing phase

New features:

- more rainfall regions than the old tool - covers all of Victoria
- more development types to select from (commercial/retail, industrial, multiunit, dwelling, mixed use)
- will assess developments against their nitrogen, phosphorus, suspended solids and gross pollutant removal
- will still generate a 'score'. 100% score means you have the compliance requirements for best practice in stormwater management
- reports harvesting and evapotranspiration reductions, flow reductions, and infiltration reductions
- designed for small less complex development types - MUSIC remains the preferable tool for larger developments

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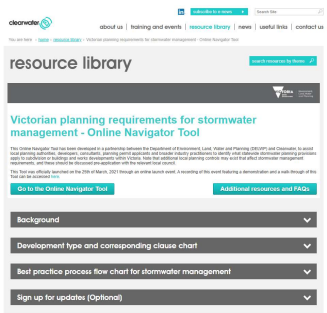
Tools and Resources



Mandy's section/slides

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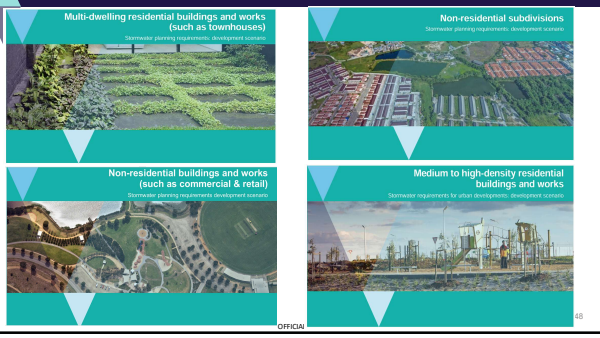
Worked example – residential development



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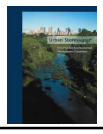
Checking compliance

Zone	Development Type	IWM/Stormwater clause	Site Management clause
RESIDENTIAL	Subdivisions	56.07	56.08
	Apartments (buildings & works)	55.07-5 B30 56.03-4 D13*	At responsible authority's discretion (65.01)**
	Multi-dwelling (buildings & works)	55.03-4 B9	At responsible authority's discretion (65.01)**
NON-RESIDENTIAL	Subdivisions	53.18-4 W1	53.18-6 W3
	Buildings & Works	53.18-5 W2	53.18-6 W3

* The Permeability and Stormwater Management objectives in these clauses are identical – the applicable clause is dependent on the zoning and number of storeys in the development.

** Clause 65.01 specifies decision guidelines which list matters the responsible authority must consider, as appropriate, before deciding on an application or approval of a plan. This includes consideration of whether a proposed development is designed to maintain or improve the quality of stormwater within and exiting the site. They do not apply to VicSmart permits.



Pollutant type	Current best practice performance objective
Suspended solids (SS)	80% retention of the typical urban annual load
Total phosphorus (TP)	45% retention of the typical urban annual load
Total nitrogen (TN)	45% retention of the typical urban annual load
Litter	70% reduction of typical urban annual load (S)
Flows	Maintain discharges for the 1.5 year ARI at pre-development levels

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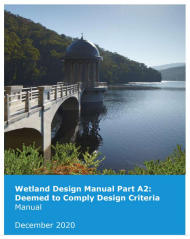
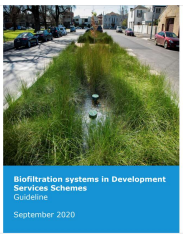
Wetlands vs biofiltration systems (also referred to as bioretention systems and rain gardens)



https://www.melbournewater.com.au/building-and-works/developer-guides-and-resources/standards-and-specifications/constructed-wetlands



https://www.melbournewater.com.au/building-and-works/developer-guides-and-resources/standards-and-specifications/biofiltration

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Wetlands vs bioretention systems

WSUD asset	Land take	Capital cost	Maintenance cost	Life span
Wetlands	Larger foot print	Higher capital costs	Lower on-going maintenance costs	Less frequent reset
Bioretention (rain garden) systems	Smaller foot print	Lowe capital cost	Higher on-going maintenance costs	More frequent reset

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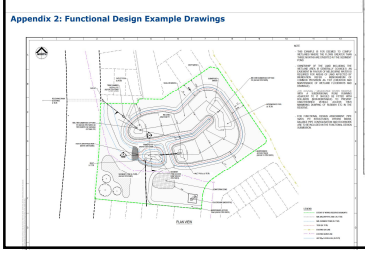
Functional – detailed design stage

Details at functional/detailed design stage
- civil design
- landscape design



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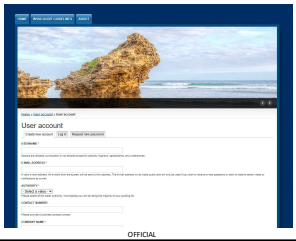
Checking compliance

Lets take a look at the MUSIC auditor

Go to: https://www.musicauditor.com.au/
Create new account (or log in if you already have one)



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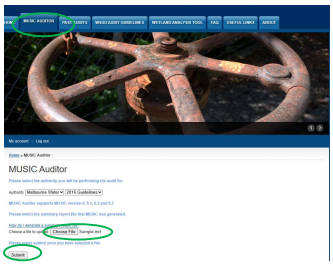
Request .mrt file from consultant (generated from MUSIC this is not the MUSIC file itself)



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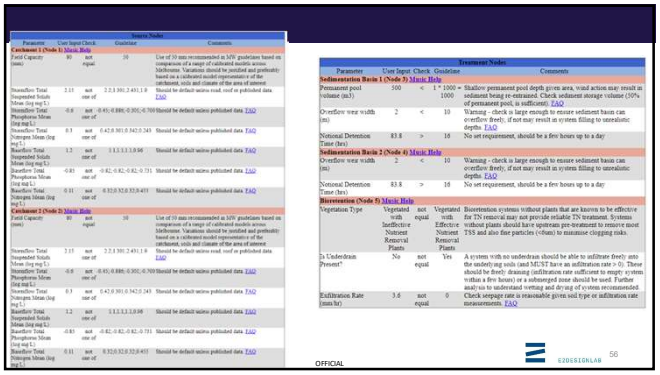

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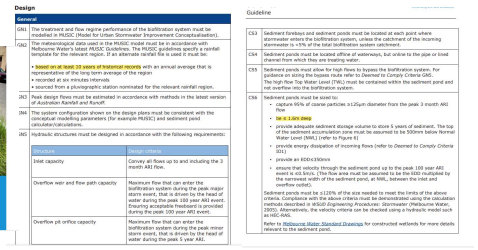
biofiltration systems (also referred to as bioretention systems and rain gardens)



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Site management & WSUD maintenance

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Suggested components of a stormwater management plan or similar

Item 1:	Drainage and WSUD Summary Report	*What is the best strategy to manage drainage and improve stormwater quality for the site?* *Are the best practice standards achieved?*
Item 2:	Site Layout Plan	*Are the drainage and WSUD layout shown on planning drawings?*
Item 3:	Design and engineering calculations	*Are the site drainage and flood requirements met?* *What are the engineering and landscape details of proposed WSUD treatment system?*
Item 4:	Site Management Plan	*How will construction be managed so that stormwater is protected?*
Item 5:	Maintenance Program	*How will your WSUD treatment be maintained over time?* *What are the costs?*

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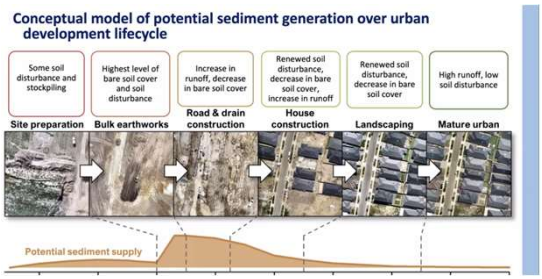
Why sediment and runoff control is important during construction



Source: Dr Kathy Russell

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Site management plan

56.08-1 Site management objectives (residential subdivision)

To protect drainage infrastructure and receiving waters from sedimentation and contamination.

To protect the site and surrounding area from environmental degradation or nuisance prior to and during construction of subdivision works.

To encourage the re-use of materials from the site and recycled materials in the construction of subdivisions where practicable.

Standard C26 A subdivision application must describe how the site will be managed prior to and during the construction period and may set out our requirements for managing

- Erosion and sediment
- Dust
- Runoff
- Litter, concrete and other construction wastes
- Chemical contamination.

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Site management plan

53.18-6 Site management objectives (non residential subdivisions and building and works)

To protect drainage infrastructure and receiving waters from sedimentation and contamination.

To protect the site and surrounding area from environmental degradation prior to and during construction of subdivision works.

Standard W3 An application should describe how the site will be managed prior to and during the construction period and may set out requirements for managing:

Erosion and sediment.

Stormwater.

Litter, concrete and other construction wastes. Chemical contamination.

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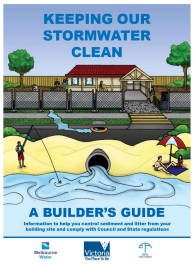
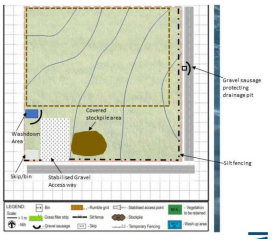
Site management plan resources



- For small developments less than 10 dwellings, a short form site management plan response referring to EPA, Guidelines for Keeping Our Stormwater Clean on building sites can be found here: https://www.melbournewater.com.au/sites/default/files/Keeping-our-stormwater-clean-builders-guidelines.pdf



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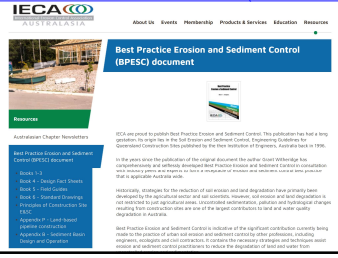
Site management plan resources

EPA's refers to IECA's Best Practice Erosion and Sediment Control. The document outlines a risk-based approach to preventing and minimising impacts from erosion and sedimentation and the measures to prevent risk to the environment.

Books 1-3 - International Erosion Control Association (austieca.com.au)



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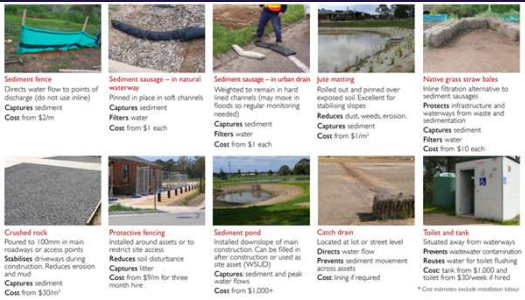
Treatment measures for sediment and erosion control



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Controlling sediment during construction activities

Appendix B of IECA guidance - contains info on High Efficiency Sediment Basins which offer higher levels of performance and operational efficiency for sodic/dispersive soils are present.

[Publications - International Erosion Control Association (austieca.com.au)](https://www.austieca.com.au/documents/item/818)
https://www.austieca.com.au/documents/item/818

Chemical coagulants and flocculants

SEDIMENT CONTROL TECHNIQUE

Type 1 System	✓	Sheet Flow	✓	Sandy Soils	[1]
Type 2 System		Concentrated Flow	✓	Clayey Soils	✓
Type 3 System		Instream Works		Dispersive Soils	✓

[1] Chemical treatment of 'sandy soils' may be required if the dispersive clay fraction contained within the soil is sufficient to cause undesirable turbidity within discharged waters.

1. Introduction

Coagulants and Flocculants perform an important function in the operation of sediment basins. The fact sheet describes why they are needed, the coagulation and flocculation process and also provides guidance and a process for product and dosing system selection for use with sediment basins.

2. Clay and colloids

Clay is the predominant particle type found in suspension within runoff captured by sediment basins. Clay particles are extremely small (less than 0.002 mm in size) and will not settle readily, if at all, even in still water. The small size of these particles means that they have an extremely high surface area relative to the volume of the particle. Soil colloids are made up of the smallest particles of humus and clay in the soil. Only particles less than 0.001 mm are officially defined as colloids. Humus particles are tiny pieces of organic matter and are known as 'organic colloids'. The clay particles are known as 'inorganic colloids'.

When negatively charged clay particles and other colloids are suspended in water, they tend to repulse each other, much the same way similar poles of two magnets repel each other. The cumulative effect of the repulsion of a vast number of small particles prevents their aggregation into larger, heavier particles that would settle more readily.

Colloids (which includes clay particles) remain suspended in water because:

- Colloids have a very large surface area relative to their mass.
- Colloids typically have a static electric charge. Most colloidal particles in water have a negative charge.
- Static charge is a surface effect. The greater the surface area relative to the particle mass, the greater the effect of the charge.
- The mass of the particles is small enough that even Brownian motion is sufficient to 'stir' the clay particles in suspension.
- The colloids cannot agglomerate into larger particles and settle because they repel one another.

Suggested components of a stormwater management plan or similar

Item 1:	Drainage and WSUD Summary Report	*What is the best strategy to manage drainage and improve stormwater quality for the site?* *Are the best practice standards achieved?*
Item 2:	Site Layout Plan	*Are the drainage and WSUD layout shown on planning drawings?*
Item 3:	Design and Engineering Calculations	*Are the site drainage and flood requirements met?* *What are the engineering details of proposed WSUD treatment system?*
Item 4:	Site Management Plan	*How will construction be managed so that stormwater is protected?*
Item 5:	Maintenance Program	*How will your WSUD treatment be maintained over time?* *What are the costs?*

Suggested components of a stormwater management plan or similar

The design of the local drainage network should:

- …
- Include water sensitive urban design features to manage stormwater in streets and public open space. Where such features are provided, **an application must describe maintenance responsibilities, requirements and costs.**

Any flood mitigation works must be designed and constructed in accordance with the requirements of the relevant floodplain management authority.

Maintenance program

Melbourne Water Corporation
Report for Kelletts Road Wetland
Detailed Design
June 2009

9.2 Ongoing Maintenance

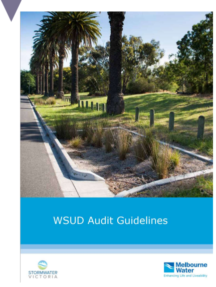
There are items in the proposed wetland system that will require ongoing attention and maintenance. The key maintenance and lifecycle issues are expected to be as follows:

Table 10 Maintenance Requirements

Description	Assets	Maintenance Works	Frequency of Maintenance Works
Gross Pollutant Trap	Underground GPT	Removal of Captured Litter	Litter removal typically once every month
Wetlands	Wetland and associated water bodies including aquatic planting zones and plating areas up to the top water level.	Removal of litter	Litter removal typically a minimum of twice a year or as required.
	Aquatic Plants	Macrophyte harvesting	As required.
		Weed Removal	As a minimum 4 times a year.
		Lower the Orifice Plate during winter and remove plugs	During winter months when the NWL is raised for extended periods.
Sediment Ponds		Removal of litter	Litter removal as required.
		Removal of litter, sediment, weed control and nuisance species management (including algae, exotic fish, etc…)	Sediment removal once accumulation is 500 mm below the normal water level or when it is significantly compromising the operation of the asset

Description	Assets	Maintenance Works	Frequency of Maintenance Works
		Weed Removal	As a minimum 4 times a year.
		Rock Replacement	Inspection after storm events and as required.
Grassed Areas	All Terrestrial Grass Areas	Mowing	Monthly
		Removal of litter	As required
		Broad leaf weed spray	As a minimum 4 times per year.
Flow Control Structures	Inlet Structures	Clear blockages upstream pipe diversion at Kelletts Road.	Inspect monthly. Inspect integrity of structure annually.
	Outlet Structures	Clear blockages from orifice plate, and hood.	Inspect orifice plate and hood monthly. Inspect integrity of structure annually.
Path	3 m Wide Maintenance Track	Replacement of surface material.	Inspect annually.
		Broad leaf weed spray	As required.
Landscape Furniture	Signage	Repair of vandalised components	As required
	Entry Signage	Repair of vandalised components	As required
Fencing	Post and wire fence and tube fencing.	Maintenance and replacement.	As required to ensure that fence continues to serve intended function.

Maintaining your assets



Document chapter	Section content	Audience
Introduction	- purpose of the guidelines - audience - how to use guidelines (structure) - relationship with other documents - what is WSUD - WSUD assets covered by the Guidelines - WSUD audits and maintenance works defined	- All users
WSUD asset management	- why WSUD asset maintenance is important - asset lifecycle - roles and responsibilities - relationship to other asset management	- Asset managers
WSUD asset audits	- target performance for each asset type - inspection and audit frequency - audit sheets - typical audit items	- Asset managers - Asset inspectors
Identification and prioritisation of maintenance and rectification actions	- maintenance and rectification identification - maintenance and rectification prioritisation - scoring - budget allocations	- Asset managers - Asset inspectors
Maintenance and rectification works	- undertaking maintenance and rectification works - maintenance and rectification works guidance	- Asset managers - Asset maintainers
Glossary	- glossary of common terms	
Resources	- list of additional relevant resources	
Attachments	- WSUD asset factsheets - Asset data management	- Asset managers - Asset maintainers

Figure 1 - Guidelines structure and intended audience

Maintaining your assets

2.4 INSPECTION AND MAINTENANCE SCHEDULE

This is an example schedule to guide the timing of your inspection and maintenance activities. This schedule outlines the average service the assets require, but you can adjust these timings to suit your assets. This schedule and the "Inspection and Maintenance form" (see over page) have been designed to be copied and used on site.

Responsibility of assets

Example:
Regular inspections should be carried out every 3 months. The inspection and maintenance of the raingarden including all civil and landscape components is the responsibility of Council/contractor.

The operation and maintenance of adjacent stormwater infrastructure, parklands, garden beds, recreational assets, pathways and road surfaces is the responsibility of Council.

Item	What to check for	Action	Frequency
Civil components – Raingarden			
Inlet	No evidence of erosion, blockage, damage or standing water.	Clear inlet of accumulated sediment or debris.	Storm events
		Eroded areas should be locally re-profiled or reinforced, and re-planted if necessary.	3 months
		Refer to Water by Design (2012) *Rectifying Vegetated Stormwater Treatment Assets* if the erosion is either recurring or severe.	
Outlet	No evidence of erosion, blockage, damage or standing water. Outlet freely draining.	Clear outlet of accumulated sediment or debris.	Storm events
		Refer to Water by Design (2012) *Rectifying Vegetated Stormwater Treatment Assets* if standing (backwatering into the raingarden) is present.	3 months
Other structures	No evidence of erosion and damage to other structures, e.g. pits, pipes, access ramps, walls and rock protection.	Repair minor damage to structures. Eroded areas should be repaired (reinforced). This may involve minor re-profiling or re-planting works. For severe damage, i.e. where flows have scoured down the side of a structure refer to Water by Design (2012) *Rectifying Vegetated Stormwater Treatment Assets.*	3 months
Batters and bunds	No evidence of erosion.	Eroded areas should be locally re-profiled or reinforced, and re-planted if necessary.	Annually
Hydraulic conductivity	Filter media is draining freely. No water ponded on the surface of the raingarden for more than 12 hours after rainfall.	If water is ponded on the surface of the raingarden for more than 12 hours after rainfall, refer to Water by Design (2012) *Rectifying Vegetated Stormwater Treatment Assets.* Note: the disposal of raingarden filter material must comply with EPA Victoria guidelines for the disposal of contaminated soil (Appendix C).	Storm events
Sediment accumulation	Sediment forebay less than 75% full. No major sediment accumulation on surface of the raingarden.	Clean out accumulated sediment from the sediment forebay. Accumulated sediment to be removed from the surface of the raingarden and the system replanted as required.	Annually
Filter media surface	No surface scour, depressions.	Filter surface to be repaired. This may involve evening out the surface, importing additional filter media and replanting.	3 months
Fine sediment surface crust	No impermeable or clayey surface on the filter media. No major surface crusting (<3mm depth across less than 10% of the filter area is permissible).	Repair surface layer by scarify filter media surface, re-profiling and re-establishing vegetation, if required. If the problem persists refer to Water by Design (2012) *Rectifying Vegetated Stormwater Treatment Assets.*	3 months

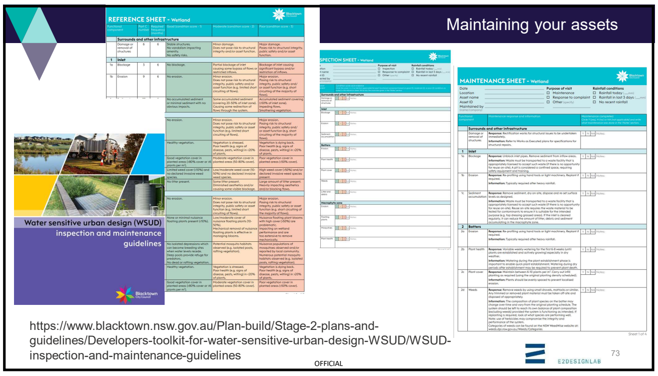
2.5 INSPECTION AND MAINTENANCE FORM

This form should be used during inspection and maintenance, as it provides a checklist of the key inspection elements and a permanent record of the maintenance activities undertaken. This form should be submitted to the asset manager following every inspection and maintenance event, so that any persistent problems or issues requiring further investigation can be identified and responded to.

Raingarden inspection and maintenance form

Asset ID

Item	What to check for	Inspected	Maintenance undertaken	Further action required or comment
Sediment accumulation	Sediment forebay less than 75% full. No major sediment accumulation on surface of the raingarden.			
Filter media surface	No surface scour, depressions.			
Fine sediment surface crust	No impermeable or clayey surface on the filter media. No major surface crusting (<3mm depth across less than 10% of the filter area is permissible).			
Mulch layer	Even depth and distribution of the mulch layer. Surface of the mulch layer is at least 100 mm below the top of the outflow pit. Mulch is not touching the plant stems.			
Algal or moss growth	No major algal growth (less than 10% of raingarden area is permissible). No moss growth.			
Inspection openings	Water level is below filter media layer. No sediment accumulation in underdrain system.			
Landscape components – Raingarden				
Vegetation cover – filter media	Greater than 90% vegetation cover.			
	Plants healthy, free from disease and vigorously growing.			
Vegetation cover – batters	Continuous vegetation cover along the lower batter. Greater than 90% vegetation cover. Plants healthy, free from disease and vigorously growing.			
	Greater than 90% vegetation cover.			
	Plants healthy, free from disease and vigorously growing.			



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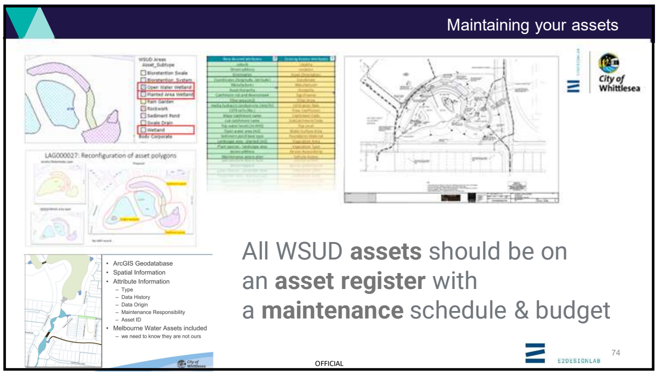

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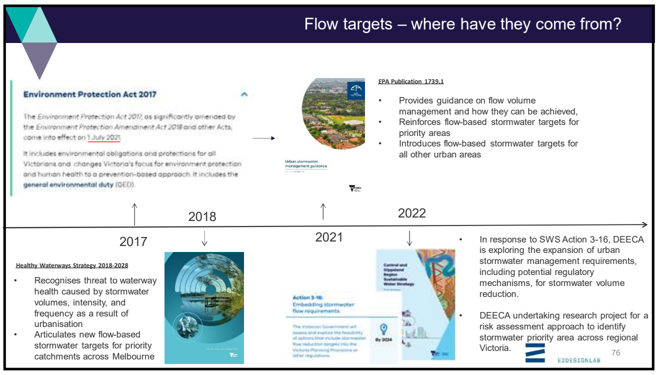

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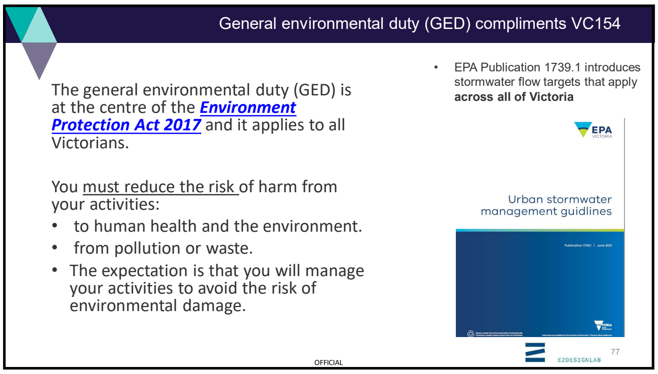

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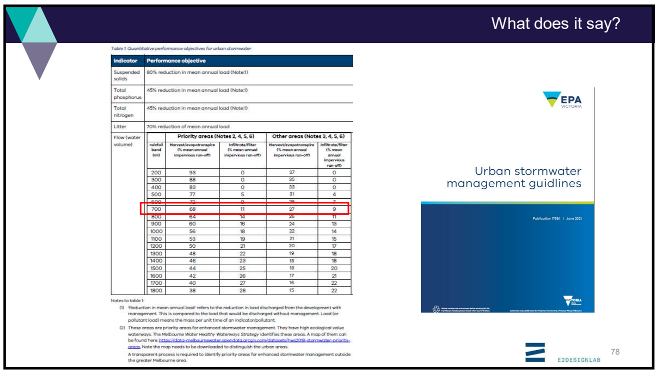

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Design guidelines

Existing design guidelines & resources

IDM Infrastructure design manual

Update in progress 24/25

WSUD Asset Selection and Design Standards Guideline

In development- design guidelines & resources

- **New asset guide** complements existing industry design guidelines (such as, stormwater harvesting guidelines, constructed wetland guidelines, etc.) and introduces key assets that promote infiltration and or harvesting/evapotranspiration processes.

- **MUSIC guideline** replaces existing industry guidelines on how to model stormwater assets and demonstrate compliance with water quality targets as well as flow-based targets.

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Wrap up

Clearwater questionnaire

https://www.surveymonkey.com/r/XJTH5KM

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Thank you for your input and attendance!

Contact details

sara@e2designlab.com.au

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