Northern Environmental Design

WATER SENSITIVE URBAN DESIGN REPORT

Proposed School Addition Development
Baird Street
North Fawkner

FOR

DARUL ULUM COLLEGE OF VICTORIA

9 June 2022

File 419A

Table of Contents

Issue	Date	Prepared by	Checked by	Status
A	10 May 2022	JD	MD	Draft
A	9 May 2022	JD	MD	Final

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1. EXECUTIVE SUMMARY

This Water Sensitive Urban Design (WSUD) Report is intended to support the planning application and demonstrate how the proposed development meets the WSUD objectives of the City of Moreland. The WSUD guidelines (Stormwater Management SDAPP-4.0) of the City of Moreland have been utilised in order to identify the best WSUD opportunities and water management options for residents which will:

- reduce potable water consumption;
- reduce wastewater discharge;
- maximise water reuse; and
- achieve best practice management goals

2. INTRODUCTION

Northern Environmental Design has been engaged by Darul Ulum College of Victoria to identify and provide WSUD opportunities in relation to the proposed school addition development at Baird Street, North Fawkner.

This report was based on plans provided by Design Core Architects Pty Ltd:

Drawing No.	Description	Revision	Date
TP000	Cover	A	May 2022
TP001	Site plan existing	A	May 2022
TP002	Site plan proposed	A	May 2022
TP003	Development summary	A	May 2022
TP100	Existing/demolition plan	A	May 2022
TP101-102	Proposed floor plans	A	May 2022
TP103	Roof plan	A	May 2022
TP200	3D	A	May 2022
TP201-202	Elevations & sections	A	May 2022
TP203	Isometric	A	May 2022
TP300	Section	A	May 2022
TP400	Shadow diagram	A	May 2022

- Discussions and correspondence with:
    - Design Core Architects Pty Ltd

3. WSUD INITIATIVES & WATER MANAGEMENT

We have reviewed the plans prepared by Design Core Architects Pty Ltd and recommended a package of WSUD initiatives with the aim of meeting the WSUD objectives of Moreland Council.

3.1 Water Management

Rainwater Harvesting

Design Response/ Performance Commitments	Notes
Details about rainwater harvesting system proposed for the development are listed below: • Collection area: Selected roof areas • 16,000 litres tank (including 1,500L for onsite detention) • Re-use of water for toilet flushing	Rainwater tank reliability analysis has been undertaken to estimate annual mains water savings Savings: 151KL Supply reliability for toilet flushing: 79% Refer to WSUD plan (Appendix 2) for details about catchment areas. Please refer to Appendix 3 for details of predicted harvested rainwater volumes.

Water Efficient fittings

Design Response/ Performance Commitments	Notes
Water efficient fittings will be specified in accordance with the following minimum performance standard as rated by the Water Efficiency Labelling Scheme (WELS) • Tap minimum 5-stars WELS rated • Toilets minimum 4-star WELS rated • Showers minimum 4-star WELS rated (maximum 7.5L/min)	

Water Efficient Appliances

Design Response/ Performance Commitments	Notes
Water efficient appliances will be 5 WELS star.	This includes dishwashers and any other appliances using water.

3.2 Stormwater Management

Stormwater Quality

Design Response/ Performance Commitments	Notes
The development achieves a STORM score of 133%. Rainwater tanks connected to toilets and planterbox raingarden are used to pass the storm rating.	The STORM rating achieved indicates that the proposed development meets the best practice performance objectives outlined in the *Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO 1999)* and therefore meets the policy objectives of Council's Stormwater Management Policy. Refer to Appendix 1 for the STORM report.

3.3 Landscaping

Planterbox raingarden

Design Response/ Performance Commitments	Notes
Raingarden will be used to treat storm water runoff from selected roof area. - 4.0 m^2 planterbox raingarden to treat runoff selected roof area (approximately 155 m^2).	Note that design details (e.g. Section of raingardens) will be produced during final design stage. Refer to WSUD plan for details about catchment areas.

Plants

Design Response/ Performance Commitments	Notes
Water efficient/drought tolerant plants (native and indigenous plants) will be selected	

3.4 Site Management Plan for Stormwater

Implementation Strategy

Design Response/ Performance Commitments	Notes
The following strategies should be considered: • Clean-up of general site litter on a weekly basis, prior to anticipated heavy rainfall and after significant rainfall events (>25mm/24hours). • Sediment traps or drain filters should be installed on all pit inlets. • Stabilised vehicle entrances with suitable crushed rock or suitable material • Erosion control blankets for mounded earth to minimise sedimentation after rainfall • Suitable bins are provided for general litter as well as where food is consumed. • Separate bins for paints and solvents to allow for safe removal and disposal at accredited locations. • Correct stockpiling away from drainage paths to prevent stormwater contamination & site pollution.	This should be done to reduce sediment build-up, restrict runoff to adjoining properties and ensure minimal earth disturbance during construction. Refer to Appendix 7 for guidelines about site management plan for stormwater. A Site Management Plan (Page 52) and Clean Site Checklist (Page 53) will be prepared by the builder prior to construction

Temporary downpipes to prevent localised flooding due to lack of site drainage	

Monitoring

Design Response/ Performance Commitments	Notes
Sediment control measures to be inspected by the site manager (or nominated representative) during periods of runoff-producing rainfall, and de-silted, repaired. (a) **Weekly site inspections** must include: • all drainage, erosion and sediment control measures; • occurrences of excessive sediment deposition (whether on-site or off-site); • occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements; • litter and waste receptors; • oil, fuel and chemical storage facilities. (b) Site inspections immediately **prior to anticipated runoff-producing rainfall** must include: • all drainage, erosion and sediment control measures; (c) Site inspections immediately **following runoff-producing rainfall** must include: • treatment and de-watering requirements of sediment basins; • sediment deposition within sediment basins and the need for its removal; • all drainage, erosion and sediment control measures; • occurrences of excessive sediment deposition (whether on-site or off-site); • occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements;	

Identification of Incident or Failure

Design Response/ Performance Commitments	Notes
Non-compliance with agreed performance criteria will be identified by: Visual inspections identifying: • build-up of sediment off the site; • excessive sediment build-up on the site; • excessive erosion on the site; • release of construction material from the site.	

Corrective Action

Design Response/ Performance Commitments	Notes
After any identification of incident or failure, the source/cause is to be immediately located and the following measures implemented: • Build-up of sediment off and on the site – the material must be collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; • Release of construction material from the site – collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm; then inspect litter and waste receptors	

3.5 Maintenance Program

Rainwater Harvesting System

Design Response/ Performance Commitments	Notes
Once a rainwater tank is installed, it is recommended that the following components of the roof catchment and tank be inspected at least every twelve months: • Gutters – they generally will need cleaning as well as inspection. If inspection finds large amounts of leaf material or other debris, then the inspection and cleaning frequency may need to be increased. • Roof – check for the presence of accumulated debris including leaf and other plant material. Accumulated material should be cleared. If tree growth has led to overhanging branches these should be pruned. • Tank inlets, insect-proofing and leaf filters – if necessary these should be cleaned and repaired. • Pipework – check for structural integrity. Sections of pipework that are not self-draining should be drained. Buried pipework, such as with 'wet systems', can be difficult to drain or flush. Where possible drainage points should be fitted. For an underground tank with mains back-up, get a plumber to check the back-flow prevention valves every 12 months. • Rainwater pumps typically need servicing or replacing after approximately 10 years of use.	

Raingardens

Design Response/ Performance Commitments	Notes
• Water to promote plant growth and survival, especially during the first two years and during dry spells. • Inspect site following rainfall events. Add/replace vegetation in any eroded areas.	As Needed (Following Construction)
• Prune and weed swale to maintain appearance. • Remove accumulated trash and debris. • Replace mulch as needed.	Regularly (Monthly)
• Inspect inflow area for sediment accumulation. Remove any accumulated sediment or debris. • Inspect site for erosion as well as sediment and mulch which have been moved around in the garden. • Add/replace vegetation in any eroded areas. • Inspect rain garden for dead or dying vegetation. • Replace vegetation as needed. • Test planting bed for pH. If the pH is below 5.2, limestone should be applied. If the pH is above 8.0, iron sulfate and sulfur should be applied.	Annually (Semi -Annually During First Year)
• Remove and replace mulch	Every 2 to 3 Years

4. CONCLUSION

This report presents the Water Sensitive Urban Design (WSUD) principles and strategies identified for the proposed development at Baird Street North Fawkner.

The analysis presented in this report demonstrates that the proposed development meets the Council's WSUD Policy and complies with the best practice performance objectives outlined in the *Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO 1999).*

Jonathan Duverge
Director

Appendix 1: STORM Results

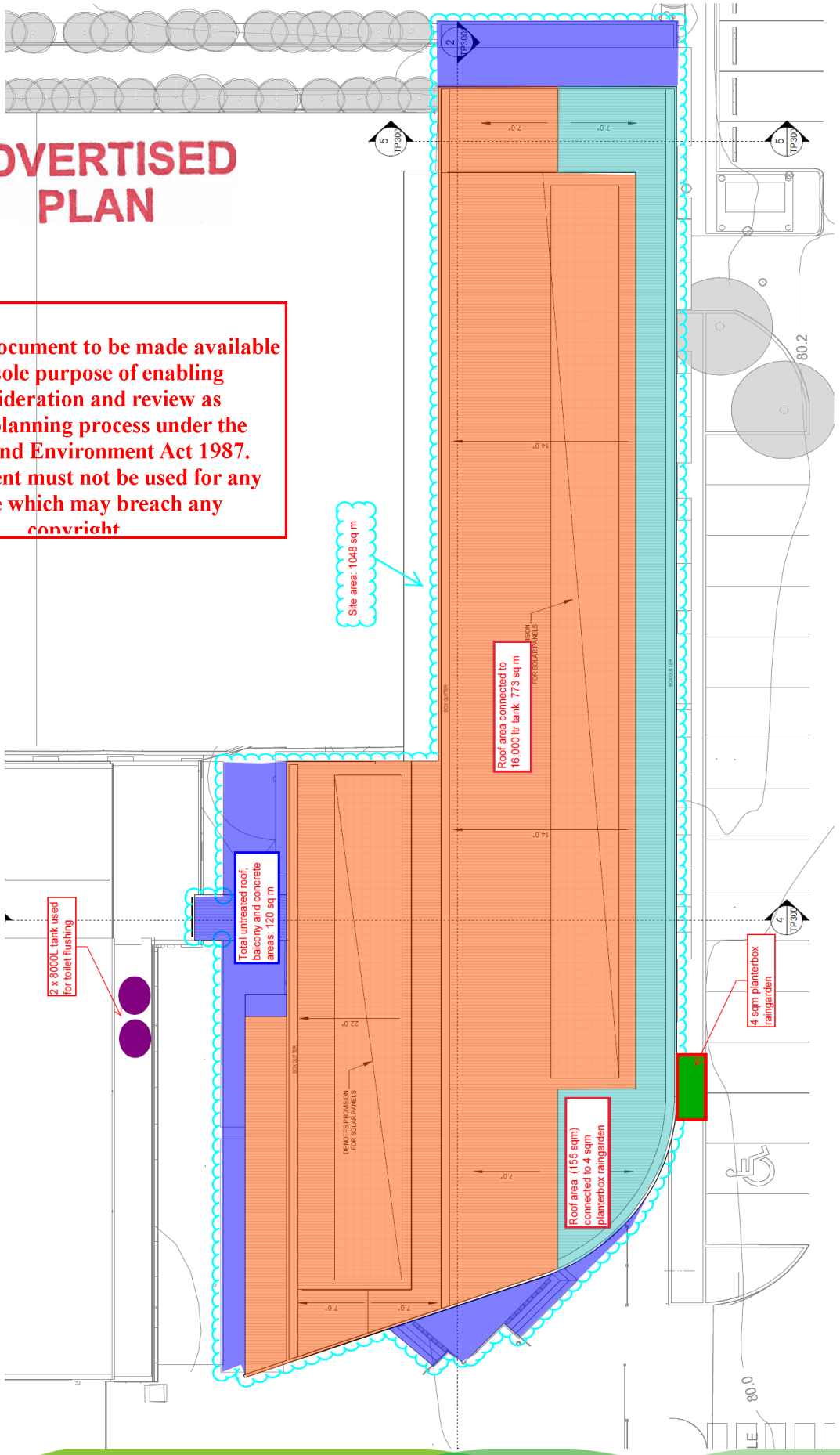
Melbourne Water STORM Rating Report

TransactionID:	1374005
Municipality:	MORELAND
Rainfall Station:	MORELAND
Address:	Baird Street
	(Darul Ulum College)
	North Fawkner
	VIC 3060
Assessor:	Jonathan Duverge
Development Type:	Other
Allotment Site (m2):	1,048.00
STORM Rating %:	133

Description	Impervious Area (m2)	Treatment Type	Treatment Area/Volume (m2 or L)	Occupants / Number Of Bedrooms	Treatment %	Tank Water Supply Reliability (%)
Selected roof to Tank	773.00	Rainwater Tank	16,000.00	60	153.60	79.00
Selected roof to RG	155.00	Raingarden 100mm	4.00	0	130.75	0.00
Untreated roof/balcony/concrete areas	120.00	None	0.00	0	0.00	0.00

Date Generated: 13-May-2022 Program Version: 1.0.0

Appendix 2: WSUD Mark-Up Plan



Appendix 3: Rainwater Tank Reliability Analysis

Summary of Required Parameters	
Item	Value
Rainfall Profile	415 mm/yr
Catchment Surface: catchment area	773 m^2
Catchment Surface: runoff coefficient	0.60
First-Flush Volume	0 litres
Rainwater Filter: filter coefficient	0.90
Additional Inputs profile	0.00 m^3/yr
Water Demand profile	190 m^3/yr

Analysis Criteria		
Max. tank size to simulate	16	m^3
Range: 2-1000		

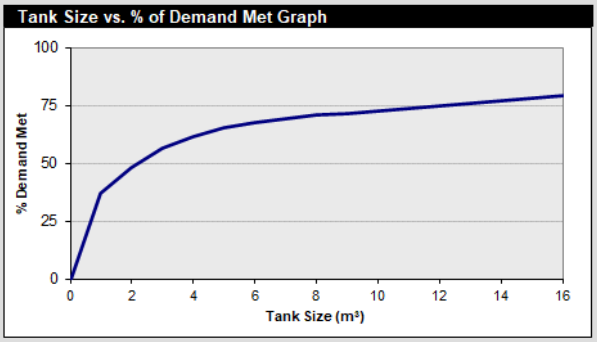
ANALYSE
Click to Start

Analysis status	Complete
Simulating tank size	16m³
% Demand Met	79.0%

Results

Table of Results	
Tank Size	% Met
16	79.0

Tank Size vs. % of Demand Met Graph

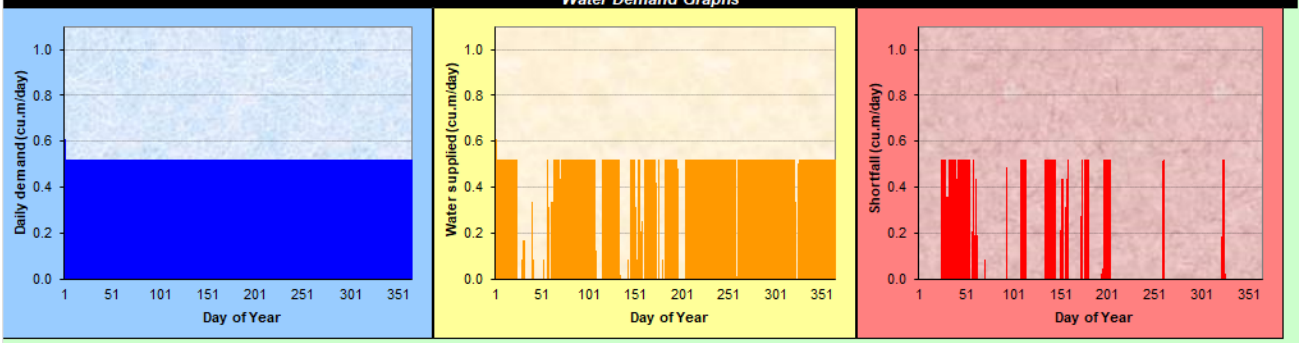


Water Demand Data	ViewModule
Yearly water demand	190 m³/yr

Summary of Water Demand Results			
		Total yearly water demand	191 m³/yr
		Average daily water demand	0.5 m³/day
Supplied	151 m³/yr	As % of total	79 %
Shortfall	40 m³/yr	As % of total	21 %

Toggle Graphs

Water Demand Graphs



Water demand/day | Water supplied from tank/day | Shortfall (mains top-up required)/day

Appendix 4: Insite Report

Stormwater Calculations

InSite
Integrated Water Management

Report for **Moreland**

Date report printed: 08/06/2022

Project Details

Project Name	Darul Ulum College		
InSite User Email	info@nedesign.net.au		
Web files link			
Site Area (m2)	1048	Project ID	3006
Planning number			
Development type	Non-residential development		
Existing site details	Commercial (including car parks)		
Street address	Baird Street, Fawkner VIC, Australia		

Results

VOLUME	FLOW	QUALITY	EFFICIENCY
Objective: Reduce annual average runoff volume by harvesting or infiltrating stormwater	**Objective**: Control peak discharge flow (litres per second) with adequate on site detention	**Objective**: Improve stormwater runoff water quality (Equivalent to STORM score)	**Objective**: Increase drought resilience
Target: No increase in pre-development annual average runoff volume (Up to a 10% increase is allowed to account for uncertainties)	**Target**: less than or equal to zero. If greater than zero this is the additional Site Storage Requirement (SSR) volume required	**Target**: Achieve a score of 100 or more This corresponds to a 45% reduction in nitrogen runoff	**Target**: Achieve greater than 25% potable water use reduction
VOLUME RESULT	**FLOW RESULT**	**QUALITY RESULT**	**EFFICIENCY RESULT**
-41.0	-0.1	127	27.5
% change in annual average volume	m^3 of additional site storage required	Pollution reduction score (out of 100)	% water saving
VOLUME PASSES	FLOW PASSES	QUALITY PASSES	EFFICIENCY PASSES

Design Criteria

The items on this page must be reflected on other project plans, specifications and engineering drawings.
The development must be designed and constructed in accordance with the following:

Rainwater Tank Specifications

Total rainwater tank volume (L)	16000		*This is the rainwater tank volume retention + detention
Total rainwater retention* tank volume (L)	14500		*This is the rainwater tank volume that is available for reuse
Total rainwater detention* tank volume (L)	1500		*This is the rainwater tank volume that is reserved for slow release to stormwater
Roof connected to rainwater tank (m^2)	773.0		
Rainwater tanks connected to	Toilet , Irrigation		
Other rainwater tank end uses (L/day)		Irrigated Garden Area (m^2)	50
% building rainwater end uses connected (to rainwater tanks)	100	First Flush Device?	0
Additional* Site Storage (L)			*Site storage added adjacent to the legal point of discharge for peak flow detention or volume infiltration
Recycled water source (Yes/No)			
Water tank reliability %	79.9		
Rainwater tank overflow %	34.6		*Note if this number is under 25%, then 30% of the tank's *retention* volume will be counted toward the *detention* volume

Water Efficiency Specifications

Basin WELS star rating	> 5 Star WELS rating
Toilet WELS rating	> 4 Star WELS rating
Bath WELS star rating	Default or unrated
Washing Machine WELS star rating	Not Applicable
Kitchen Taps WELS rating	> 5 Star WELS rating
Urinal WELS rating	Not Applicable
Shower WELS star rating	4 Star WELS (> 6.0 but <= 7.5)
Dishwasher WELS star rating	> 5 Star WELS rating

Stormwater management measures selected are

This includes all impervious areas in the site connected to Council or Stormwater Authority drains. This excludes pervious areas like garden, gravel, and lawn areas)

- For the 928m^2 roof area Selected roof area, Raintank Volume = 16000 litres connected to 773m^2 of roof, additional water tank based detention volume = 1500 litres. Total tank volume (retention + detention volumes) = 16000 litres
  In addition there is 155.0m^2 of roof Selected roof area draining to 4m^2 of treatment: Raingarden
- For the 120m^2 roof area Untreated roof,balcony and walkway, Raintank Volume = 0 litres connected to m^2 of roof
  In addition there is 120.0m^2 of roof Untreated roof,balcony and walkway

Building Occupancy Calculations

Building Spaces

•1680m^2 of School or childcare - BCA Class 9b with an average occupancy of 58.7 people

Estimated Total Building Occupancy	58.7

Stormwater VOLUME Calculations

Site Area (m^2)	1048
Post development total impervious area (m2)	1048.0
Rainwater Tank Overflow (kL/annum)	163.0
Pre-development Volume (kL/annum)	517.9
Post-development Volume (kL/annum)	305.5
Change in volume %	-41.0

Stormwater QUALITY Calculations

Rainwater Tank Runoff reduction (%)	65.4
Rainwater Tank(s) Total Nitrogen (TN) reduction	1123.4
Total Nitrogen (TN) % reduction	57.1
Equivalent STORM Score	127

Water EFFICIENCY Calculations

Benchmark water use (kL/year)	3835.1		
Predicted potable water use (kL/year)	2781.9		
Predicted potable water use (L/person/day)	144.2		
Water savings from tank (kL/year)	308.5		
Water saving from efficiency (kL/year)	744.70		
Total water saving % (efficiency + tank + recycled water)	27.5	Water saving (kL/year)	1053.2

Stormwater FLOW Calculations - **Swinburne Method**

This section outlines rational method calculations for On Site Detention (OSD) and Site Storage Requirements (SSR)

Permissible Site Discharge (PSD) Calculations

Calculated PSD	14.3
PSD Override Value Used	

Site Storage Calculations

Preliminary On Site Detention (OSD) tank size required estimate (m^3)	6.19	Swinburne Method Tank formula
OSD and storages* provided (m^3)	6.3	Includes storages: rainwater tank retention allowance, rainwater tank detention, and additional added storage volumes
Additional detention / retention volume required (m^3)	-0.1	
Base case (pre-development) fraction impervious (ratio)	0.90	
Base case runoff coefficient	0.83	
Post development total impervious area (in hectares)	0.1048	
Post development fraction impervious (ratio)	1.00	
Post development runoff coefficient	0.900	
Pre-development design storm	5% AEP (~1 in 20 ARI) - default industrial	
Post development detention required	20% AEP (~1 in 5 year ARI storm)	
Critical Storm Duration - the Catchment time of concentration – Tc(catchment) in minutes	20	
Rainfall Depth (mm) for Critical Storm Duration - Tc(catchment)	15.84	
Rainfall intensity - i at Tc(catchment) (mm/h)	47.5	
Travel time from discharge point to catchment outlet (min) - Tcs	10.0	
Rainfall Depth (mm) for Tcs - (IFD at Tcs)	14.06	
Rainfall intensity - i at tc(site) (mm/h)	84.36	

OSD tank flow restrictor orifice diameter = 83 mm

Detention Calculator - Site Storage Requirement (SSR)

Storm Duration (mins)	Rainfall Depth (mm)	Stored Volume (m^3)
5		
7.5		
10		
12.5		
15		
20		
30		
40		
60		

About In-Site Water

This report is generated by user inputs from the toolkit at InSite Water. In-Site water is an online Integrated Water Management tool designed for use on smaller sites (less than 2 hectares) in Australia that need quick and accurate stormwater engineering answers. InSite water is simple to use but provides robust stormwater design and engineering answers.

This report includes outputs from the InSite tool that has investigated:

– water tank sizing
– detention tank sizing
– water savings through efficiency
– water WSUD treatments such as raingardens

For enquiries, contact us through www.insitewater.com.au

Disclaimer

This guide is of a general nature only. Advice from a suitably qualified professional should be sought for your particular circumstances. Depending on each unique situation, there may be occasions where compliance is not achieved.

This report does not provide a detailed design and layout for the piping and general drainage system in your development, which should be prepared by a suitably qualified professional. In addition, InSite Water does not consider compliance for slope stability or foundation / slab / footing protection, which needs to come from a qualified geotechnical or structural engineer.

The following is outside the scope of InSite Water, however it is critical that all designers consider the following in drainage design and in using Water Sensitive Urban Design (WSUD) devices and approaches:

- *Manage expectations and risks around occasional surface water and ponding.*
- *Ensure that uncontrolled stormwater does not flow over property boundaries or otherwise cause a nuisance.*
- *Plan for major flood pathways – locate buildings away from, adapt (raise floors above predicted flood levels) and defend buildings against potential major flooding.*
- *Seek professional advice to reduce damage and safety risks.*
- *Design for local conditions such as vegetation, topography and soils (soil type, reactivity, permeability, water table level, salinity, dispersiveness, acid sulphate soils, contaminated land etc).*
- *Ensure that soil moisture and building clearance is considered in areas of reactive clays or where varying soil moisture levels could damage buildings or other infrastructure.*
- *For steeper sites, ensure the design includes geotechnical considerations such as slope stability with varying soil saturation levels.*
- *Ensure that a Stormwater Risk Assessment and Environmental Management Plan is undertaken for sites that pose a pollution risk.*
- *Ensure that a Construction Environmental Management Plan (CEMP) is implemented to control sediments and reduce stormwater pollution during construction.*
- *Compliance with ARR 2019, Australian Rainfall and Runoff: A Guide to Flood Estimation* http://arr.ga.gov.au/
- *Compliance with NCC plumbing and building standards.*
- *Compliance with AS/NZS 3500.*
- *Compliance with EPA and other environmental regulations.*
- *Compliance with other relevant Australian Standards, regulations and Council requirements.*

Appendix 5: Planterbox Raingarden Design Guidelines

INSTRUCTION SHEET

Building a planter box raingarden (lined)

healthy waterways Raingardens

What is a planter box raingarden?

Building a raingarden is a simple way to help the environment and the health of our local waterways while providing a self-watering garden for your backyard.

A raingarden is a specially prepared garden designed to receive and filter rain run-off from roofs or hard surfaces such as driveways or paving. You can even create a raingarden in a planter box, positioning it to collect water from a diverted downpipe or rainwater tank overflow.

Featuring layers of soil for filtration, gravel for drainage, and plants that can tolerate periods without rain, a raingarden helps to protect our streams and rivers from stormwater pollutants.

With a slotted pipe beneath the soil to take away the filtered rainwater and an overflow pipe on the surface to prevent flooding, raingardens are designed to collect water from a diverted downpipe, rainwater tank overflow or pavement runoff.

Please note: A certified plumber must be used for stormwater connections and modifications.

Did you know that a raingarden is only wet during and immediately after rain, leaving it dry most of the time? This is due to the drainage and filtration properties of the soil combination used in the raingarden.

Melbourne Water

Building your raingarden

Step 1 – getting started

Location

Build your planter box as close as possible to the water source whether it be a downpipe or rainwater tank overflow. This will help minimise the additional plumbing needed to bring water to the raingarden. Your raingarden needs to sit at least 300mm away from your house.

Having decided on a location, it is important to determine the proximity of the existing stormwater pipe to make sure your raingarden is connected properly. Your local plumber can help with this and also how and when to divert your downpipe so that the area doesn't flood during construction.

Stormwater reconnection

All connections or modifications to existing stormwater pipes need to be done by a licensed plumber. The plumber should ensure that pipes are reconnected into the property's stormwater and not another services such as the sewer.

Underground services

Be aware of any underground services (gas, electricity, water) that run near your house as this may determine where you can build your raingarden. Raingardens should not be built over or in close proximity to a septic system.

Materials

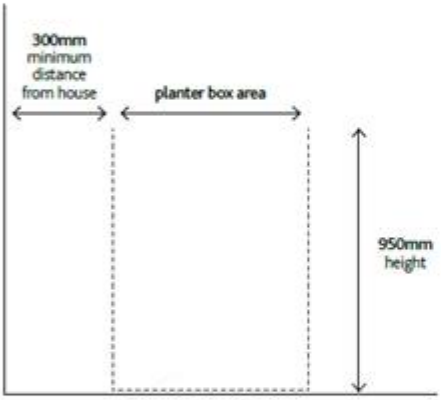
See *Materials List* for information about what you need to build a raingarden.

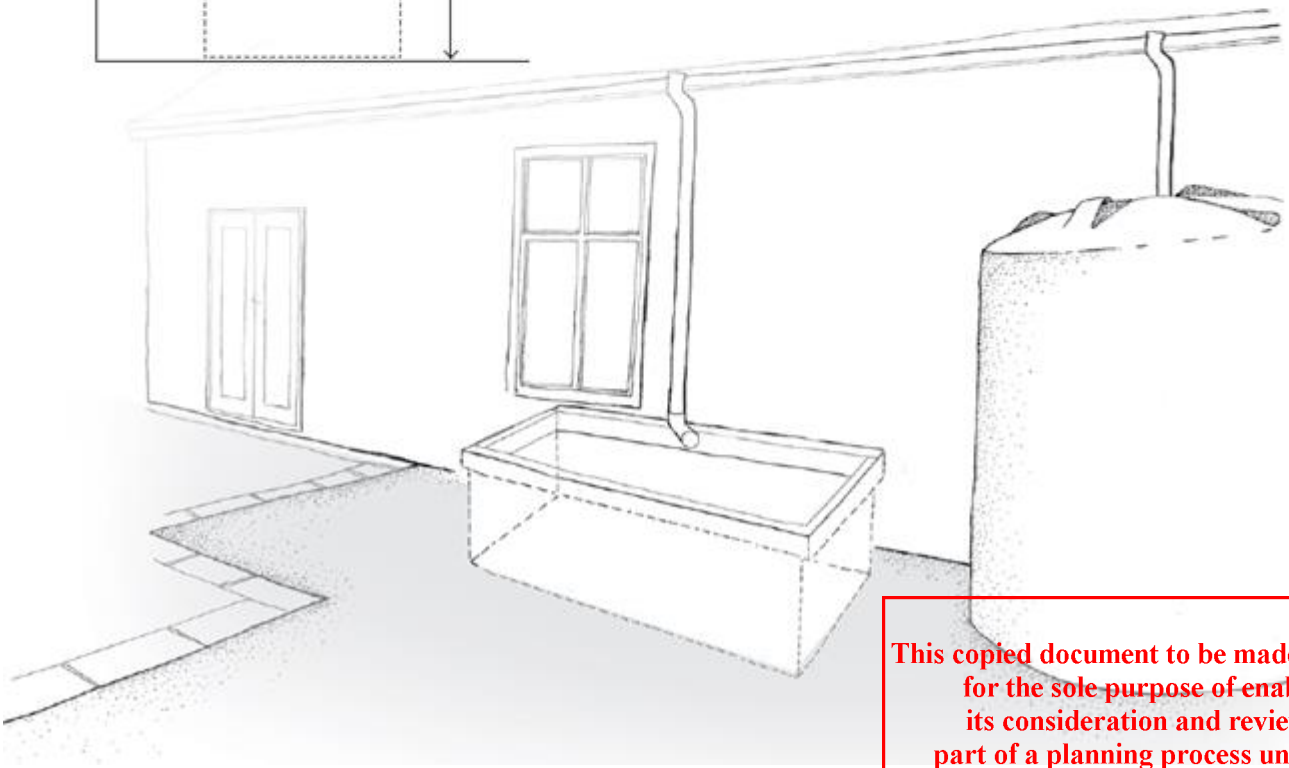
Size

You need to make sure that your raingarden is large enough to manage the amount of stormwater it will receive. If your raingarden is going to capture run-off from the roof via a downpipe, measure the area of roof that drains to that downpipe. Generally, the size of the raingarden should be approximately 2% of the run-off area. Table 1 will help you work out the correct size.

Table 1 – Raingarden sizing chart

AREA OF RUN-OFF (m²)	RAINGARDEN SIZE (m²)
50	1
100	2
150	3
200	4
250	5
300	6
350	7
400	8
450	9





Step 2 - planter box and pipe infrastructure

Preparing your planter box

You can create a planter box out of any material as long as it is strong enough to hold soil. This could be a corrugated iron 'tank', an old wine barrel, or you could build your own planter box using plantation hardwood or similar.

Line your planter box (sides and base) with a PVC liner. Overlap the sheets by 200mm and seal the joins with PVC tape.

Place the 7mm screenings (gravel) to a depth of 50mm. This will form a base for the slotted drainage pipe. Make sure the screenings are washed and cleaned of excess dirt as this can create blockages in the raingardens drainage.

Use the screenings to create a gentle slope towards the stormwater outlet (where the water will exit your planter box).

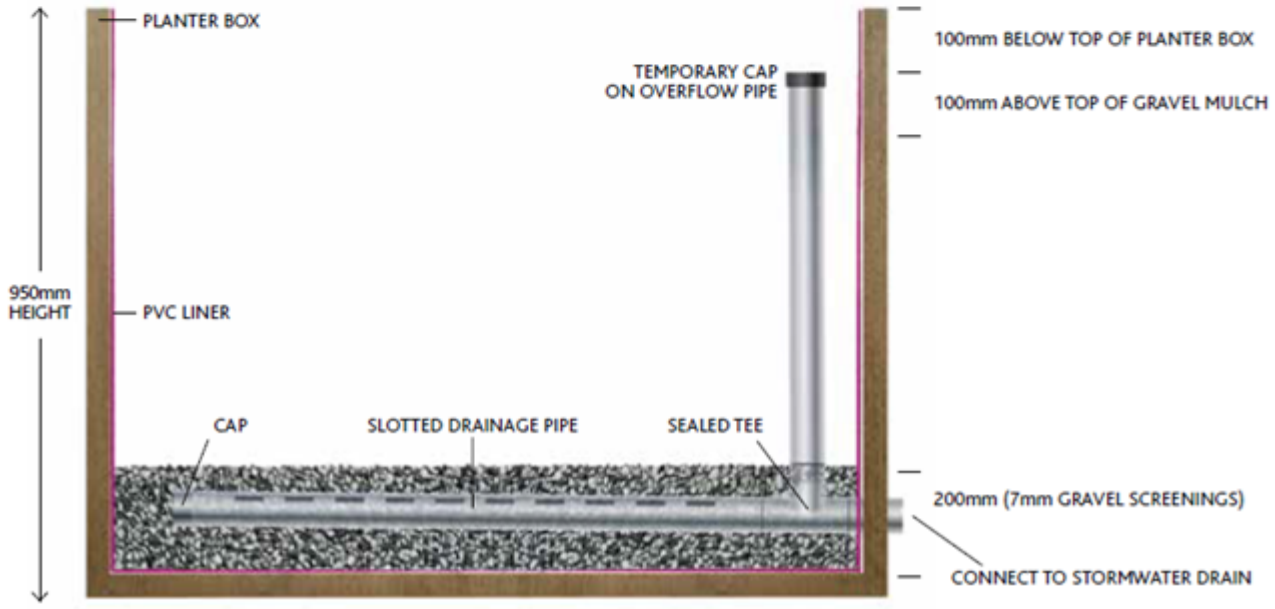
Pipe infrastructure

Lay a 90mm diametre slotted drainage pipe horizontally along the centre of the planter box base and cap one end of the slotted drainage pipe. Call your plumber to connect the drainage pipe back into the property's existing stormwater.

Handy Hint – If your raingarden is greater than 4m wide, you will need to install two slotted drainage pipes and two overflow pipes. These need to be evenly spaced across the planter box base to provide adequate drainage.

Connect the vertical 90mm diameter overflow pipe into the slotted drainage pipe using a 90 degree elbow pipe. When the raingarden is finished, the top of the overflow pipe should sit 100mm above the gravel mulch and 100mm below the top edge of the planter box.

Install a temporary cap on top of the overflow pipe to prevent materials dropping into it during construction. Some plastic taped across the top of the pipe will work fine.



Building your raingarden

Step 3 - soil layers

Screenings layer

Add 7mm screenings (gravel) to a depth of 150mm over the slotted drainage pipe in the base of your raingarden. This brings to total depth of screenings (gravel) to 200mm. Be careful when not to dislodge or damage the slotted drainage pipe when adding the additional screenings.

Sand layer

Place white washed sand to a depth of 100mm over the screenings (gravel) layer.

Sand/soil mix layer

Mix 4 parts white washed sand with 1 part topsoil. Add this mix to the raingarden to a depth of 400mm.

Handy Hint - Ensure you firmly pat down each layer of soil when building your raingarden to help reduce the layers from sinking.

Step 4 -pipe adjustments, plants and mulch

Pipe adjustments

Redirect your downpipe into the raingarden using pipe bends where required. If possible, use two 45 degree bends connected together as this will provide a much gentler and more even flow of water, reducing the risk of erosion and prevent blockages within the downpipe. A 90 degree elbow pipe will do as an alternative.

Plants

In general, plants that grow well in a raingarden:

- like dry conditions but can tolerate temporary wet periods
- are perennial rather than annual
- have an extensive fibrous root system.

A wide range of plants are suitable for raingardens and your local nursery will be able to guide you on what is right for your area.

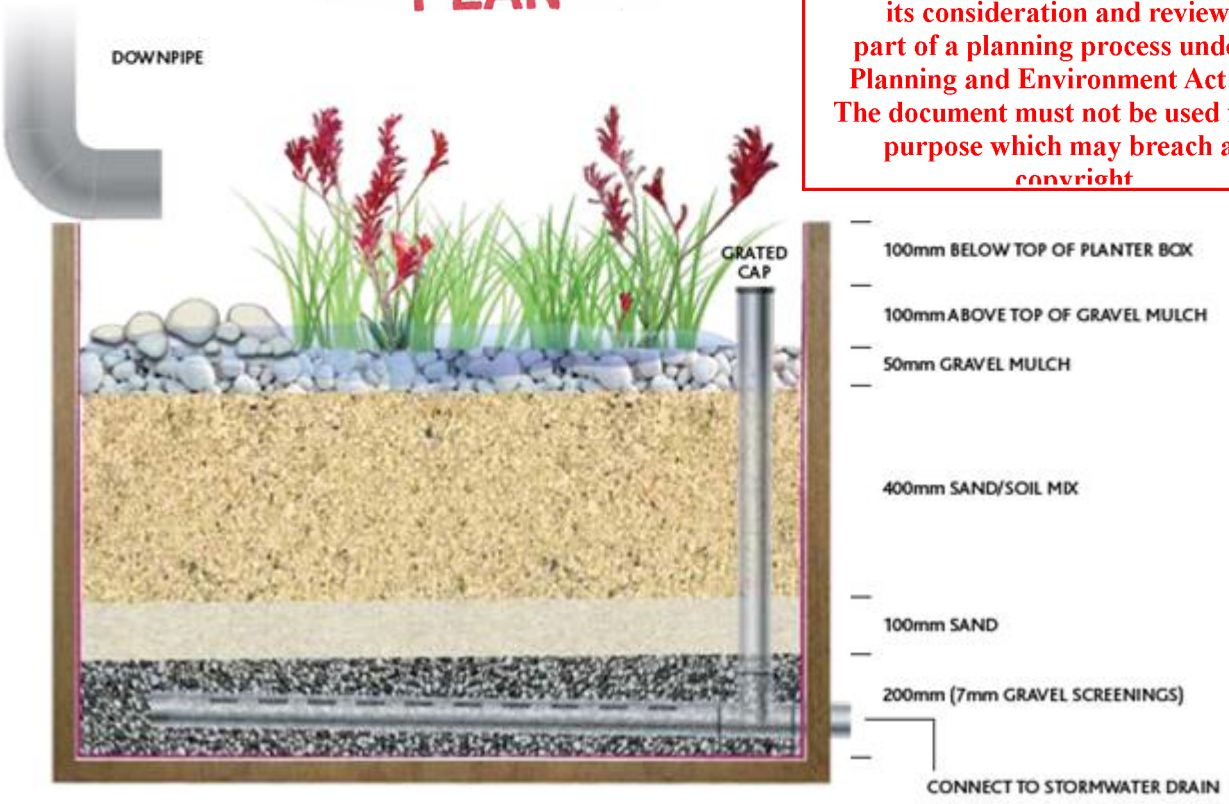
There are also particular plants that are really good at removing pollutants from stormwater. These include:

- *Carex appressa*
- *Lomandra longifolia*
- *Juncus flavidus*
- *Melaleuca ericifolia*
- *Goodenia ovate.*

50% of your raingarden should be planted with these species, the other 50% can be made up of plants that like a dry environment with intermittent wet periods. It is important that the plants you select are suitable for the amount of sun and shade on your raingarden. See the *Plant List* for a suggested list of suitable raingarden plants.

Regardless of the type of plants you select, it is important to plant densely to cover the raingarden. Set your plants out at roughly 6 plants per m². So for a 2m² raingarden, you will need to buy 12 plants. Now start planting.

(continued on next page)



Looking after your raingarden

Mulch

To allow the spread of water gently over the raingarden, place some large flat rocks where water flows from the downpipe. Place smaller rocks in between the large rocks to fill the gaps and help prevent erosion. Alternatively a flow spreading device can be fitted to the downpipe.

Spread gravel mulch to a depth of 50mm around the plants.

Remove the temporary end cap from overflow pipe and replace with a 90mm PVC finishing collar and domed pipe grate.

Water the plants in – complying with your local water restrictions.

Once established, raingardens are low maintenance especially when planted with native plant species. They don't need to be watered, mowed or fertilised. However, a few simple tips can help your raingarden mature and function well.

- Gravel mulch will help retain moisture in your raingarden and prevent weeds from growing.
- Ensure that the overflow is never blocked.
- Remove any sediment or build up from the downpipe.
- Some weeding may need to take place until plants have matured.
- Evenly distribute water flow into your garden to limit erosion from heavy rainfall. Strategically placed rocks may help with this.
- Inspect your garden regularly – replace plants and repair erosion when necessary.

Note – If necessary, water your raingarden until your plants have established in compliance with your local water restrictions.

Need help?
If you have questions about building a raingarden, your landscape gardener or local plumber may be able to help. For more information visit melbournewater.com.au/raingardens

Materials List – what you need to build your raingarden

Table 2 details the materials required to create a 2m² raingarden. While item prices may vary depending on the materials you select, building a 2m² raingarden is likely to cost between $400 and $500 (plus the cost of a planter box and plumber).

QUANTITY	MATERIAL
2 l/m	90mm diameter slotted drainage pipe (Ag Pipe)
2 l/m	90mm diameter uPVC pipe*
0.4m³	7mm screenings
0.85m³	Sand (white washed)
0.15m³	Topsoil
12	Plants (150mm pots)
0.1m³	Gravel mulch
1	90mm diameter uPVC 90 degree bend or 2x 45 degree bends
1	PVC grate 90mm finishing collar
1	PVC 90mm diameter domed pipe grate
1	PVC 90mm tee
1	PVC 90mm cap
10m²	PVC liner
	PVC tape

**Costs per square meter will depend on the length of connections back to the existing stormwater drain.*

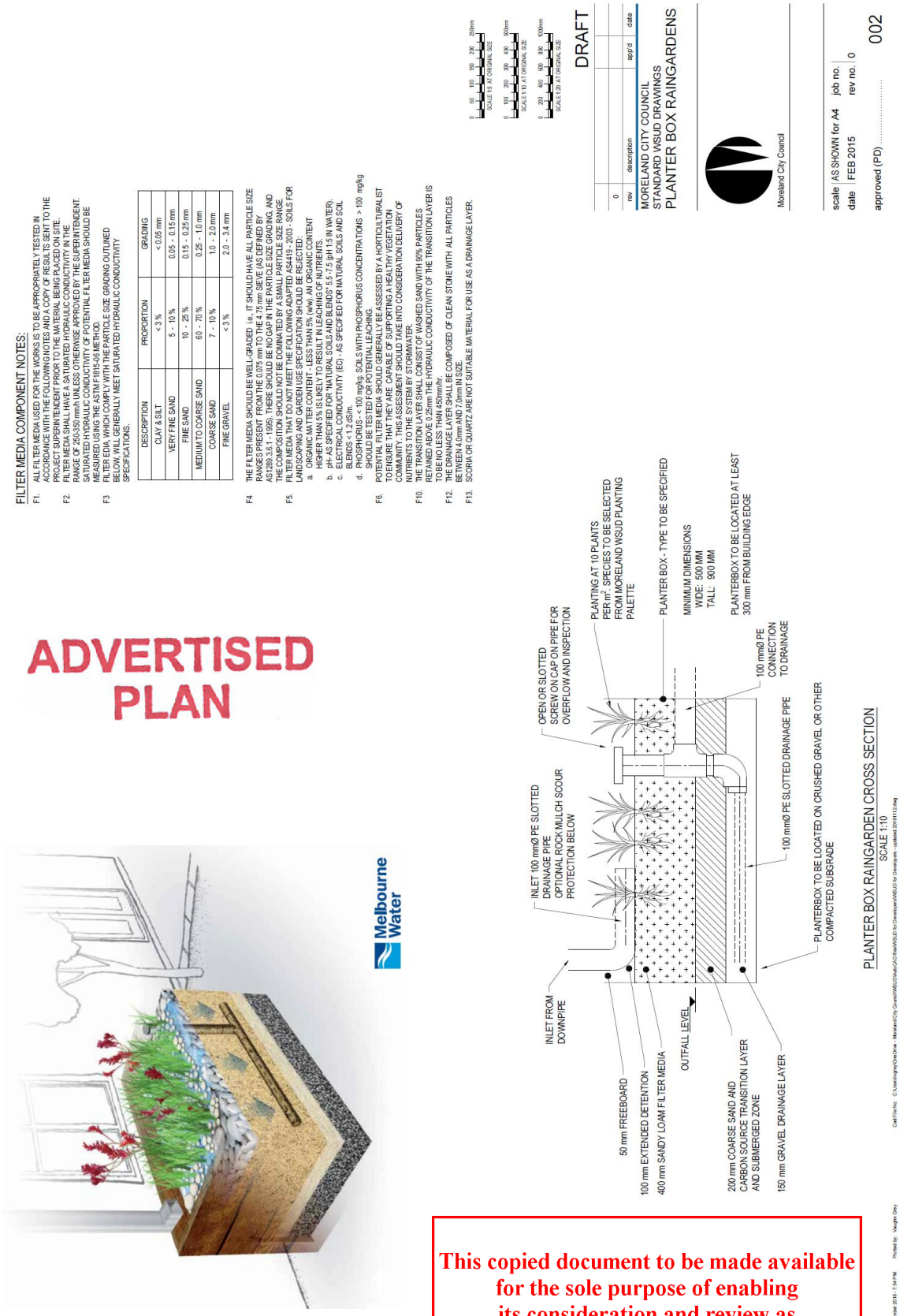
l/m = lineal metres m² = square metres m³ = cubic metres mm = millimetres

Plant List – the best plants for your raingarden

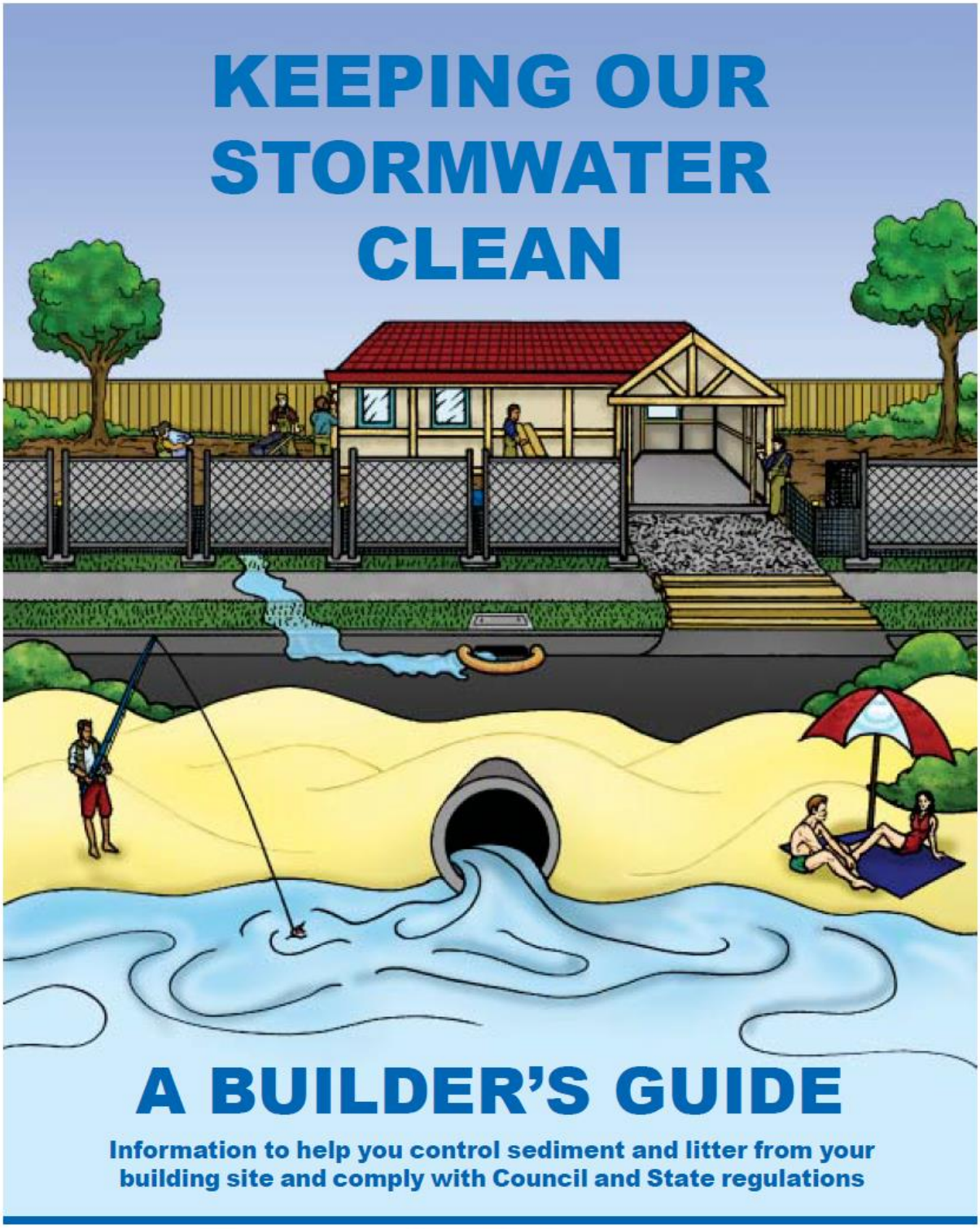
The following plants grow well in raingardens.

BOTANICAL NAME	COMMON NAME	CONDITIONS	SIZE (H x W) (cm)
Anigozanthos sp.	Kangaroo paw	Full sun	30-90 x 100-120
Blechnum nudum	Fishbone Water-fern	Full sun to partial shade	50-100 x 40-80
Calocephalus lacteus	Milky Beauty-heads	Full sun to partial shade	15-30 x 10-30
Carex Appressa	Tall Sedge	Full sun to partial shade	80-100 x 120
Carpobrotus modestus	Pigface	Full sun	20cm high and spreading
Chrysocephalum apiculatum	Common Everlasting	Full sun	30-90 x 10-30
Derwentia perfoliata	Digger's Speedwell	Full sun to partial shade	20-40 x 30-60
Dianella species		Full sun to partial shade	60-120 x 40-150
Ficinia nodosa	Knobby Club-rush	Full sun	50-150 x 60-200
Juncas amabilis	Hollow Rush	Full sun to partial shade	20-120 x 20-50
Juncas flavidus	Yellow Rush	Full sun to partial shade	40-120 x 20-100
Leucaphyta brownii	Cushion Bush	Full sun, salt tolerant	100 x 200
Lomandra species		Full sun to partial shade	60-120 x 50-100
Melaleuca ericifolia	Swamp paperback	Full sun to partial shade	4m high x 3m wide
Myoporum parvifolium	Creeping Boobialla	Full sun	20-30 x 300
Patersonia occidentalis	Native iris	Sun to partial shade	20-40 x 30-60
Pratia perdunculata	Matter Pratia	Partial shade	50-150 x 1.8-5
Wahlenbergia communis	Tufted Bluebell	Full sun	15-50 x 15

Appendix 6: Moreland Council's Standard Planterbox Raingarden Drawing



Appendix 7: Stormwater Management Builders Guidelines



Melbourne Water

Victoria
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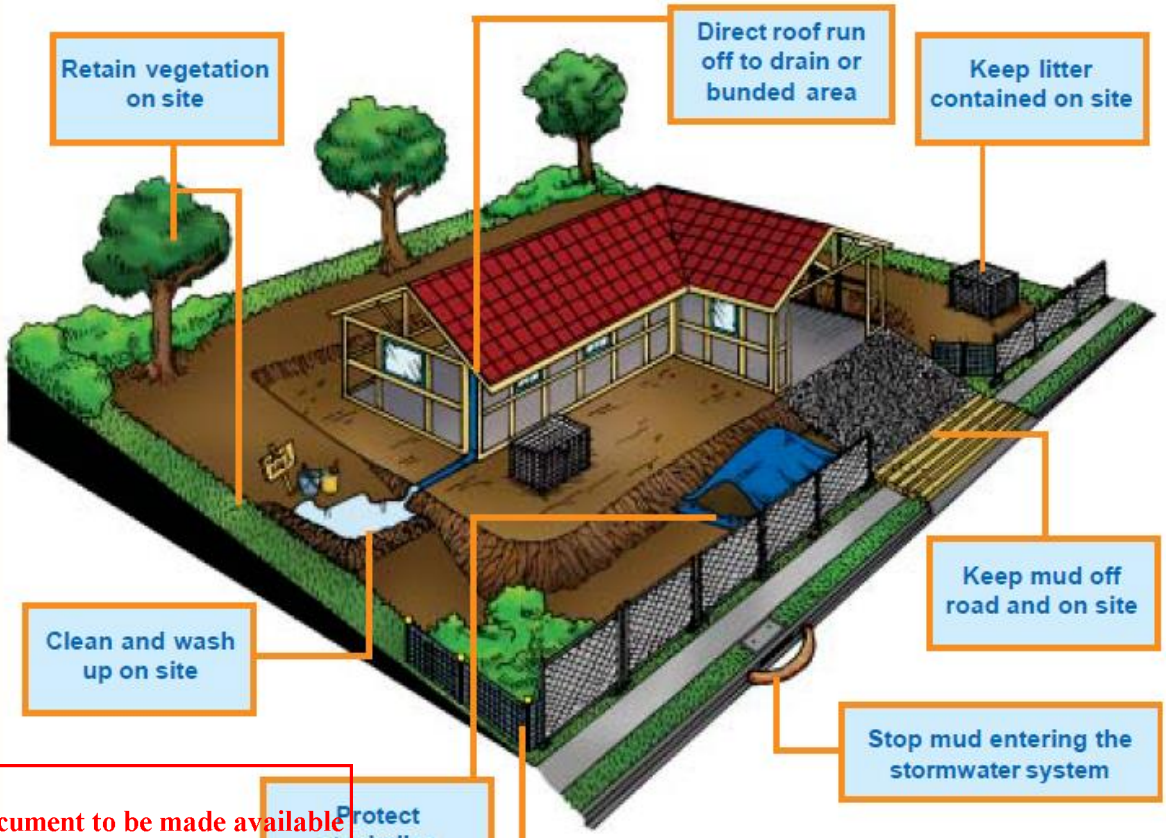
EPA VICTORIA

ACKNOWLEDGEMENTS

This revised booklet was originally produced with the support of the Victorian EPA, Melbourne Water, Cities of Kingston, Casey, Hume, Melbourne, Moreland and Moonee Valley.

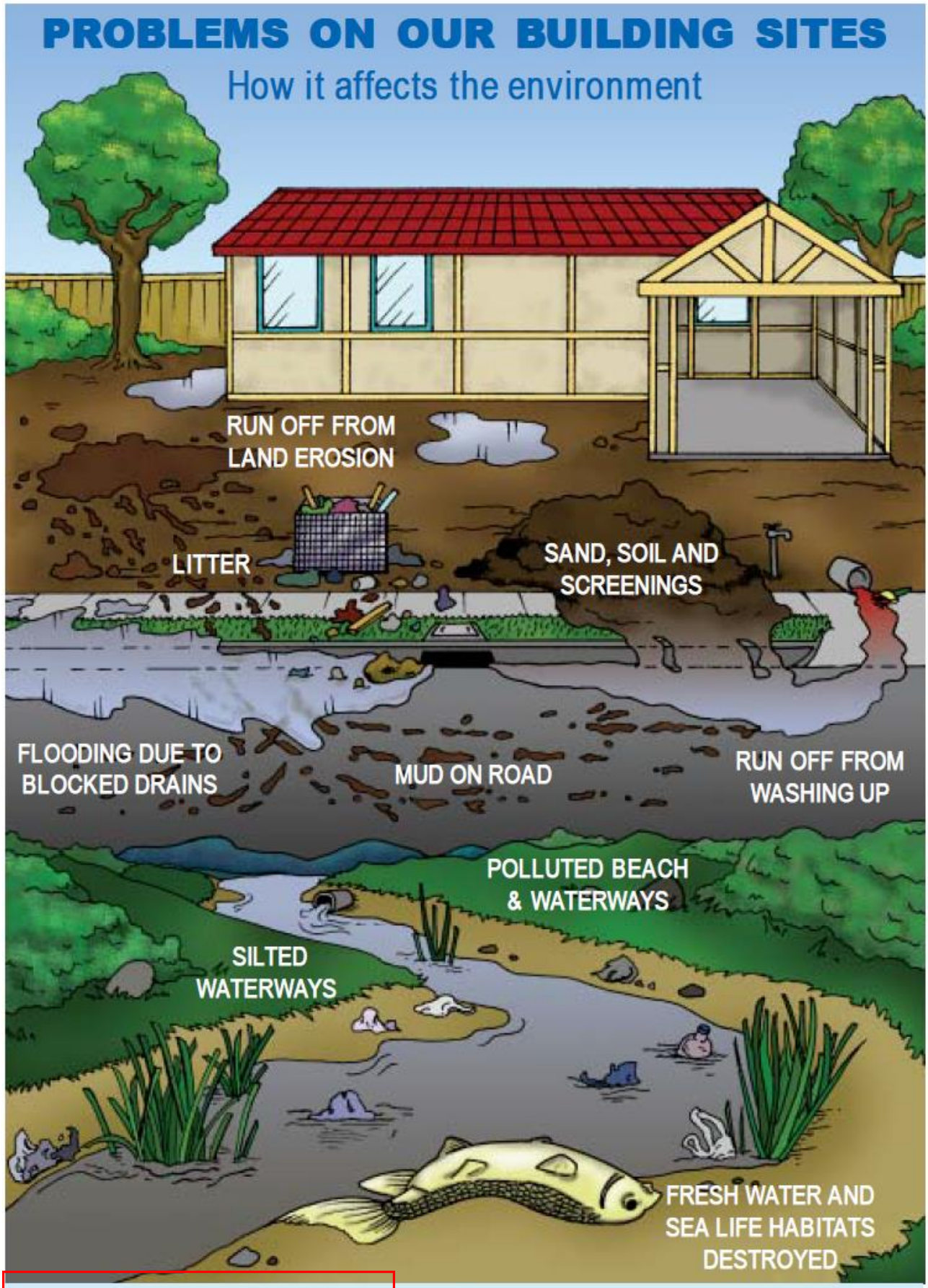
Check Council requirements and plan before you start work on site



Supplier information for sediment & erosion control on page 3

CONTENTS

6 SITE RULES TO KEEP STORMWATER CLEAN



1

WHY DO I NEED TO PROTECT OUR ENVIRONMENT?

It's the law!

Sediment from building sites can pollute stormwater. There are State and local council laws which make this an offence.

The developer or person managing the building site has the responsibility of making sure that the stormwater is not polluted.

Penalties apply for polluting stormwater.

To enjoy using our environment - now and in the future

Stormwater is not treated and carries pollution to local waterways and bays. Pollution in our stormwater can lead to short and long term damage to our environment.

To benefit builders

The site looks good (which is good for attracting new customers) **and you'll be helping to protect our environment.**

The site has fewer hazards. A well organised site has less loose material lying around causing a hazard. This reduces health and safety issues on a building site.

Downtime is reduced. A well managed and organised site is more efficient. This saves time and money.

2

USEFUL SUPPLIER INFORMATION

This information is provided for helpful contact details only. The companies are not listed in any particular order and are not necessarily recommended over others that may provide similar services.

SEDIMENT CONTROL

Approximate Price:
Geofabric fencing
100 m roll from $55 to $130
stakes $12 for 10
Filter socks unfilled: 2 m $4.50 filled $8 - $25

Geofabrics Australasia
03 8586 9111 www.geofabrics.com.au
Products: silt fencing

Southern Geosynthetics Supplies
0419 478 238 www.geosynthetics.com.au
Products: Silt fences, Silt Sausages

Statewide River & Stream Management
03 9702 9757 www.stateplanthire.com
Products: silt fence, stakes, silt logs
Installation service and site kits
Approx cost: $220 for 20 m frontage installed, $88 self installation

Treemax
03 98787 4111 www.treemax.com.au
Products:filter fence, silt worm, silt sock

Zerosion
0408 351 566 www.zerosion.com.au
Products: silt fence installation
Approx cost: $215 for up to 20 m frontage

STABILISED DRIVEWAYS

For aggregate look under sand, soil and gravel in the Yellow Pages
Recycled aggregate available from major suppliers.

TEMPORARY DOWNPIPE

Available from major plumbing suppliers

Art Plastic 25 m rolls of temporary plastic downpipe approx: $25

Temporary Flexible Downpipe
03 9786 3711 www.tfd.com.au
$135 per kit - does 2-3 16 sq houses

OTHER EQUIPMENT

Coates Shorco Sykes 131994
Supply : silt fence $125 100 m
Hire: Rumble Grids $180 p/week for 2 panels
Hire: Environmental settlement tanks 4 m tank $542 p/week

PORTABLE TOILETS

See Toilets – Portable in the Yellow Pages

TEMPORARY FENCING

See Fencing Contractors in the Yellow Pages
Australian Temporary Fencing 131716
Victorian Temporary Fencing 03 9484 4000

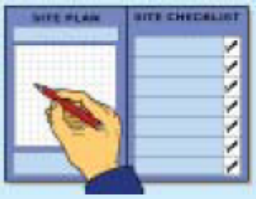
BRICK AND TILE CUTTING

Slop Mop Recycling Products
www.slopmop.com.au 0418 825 301 Brikasaurus: capture and recycle waste water for brick and tile cutting operations.
Slopmop: water delivery & waste clean up system for use behind concrete saws and grinders.

Useful information is available from:

Master Builders Green Living Builders
www.mbav.com.au
HIA GreenSmart Program
www.greensmart.com.au
Keep Australia Beautiful Victoria – CleanSites Program
http://www.kabv.org.au/
Victorian Litter Action Alliance
http://www.litter.vic.gov.au
Environment Protection Agency Victoria
www.epa.vic.gov.au
See Publication 981 – Reducing stormwater pollution from construction sites
Melbourne Water
www.melbournewater.com.au

3



SITE RULE 1

Check Council requirements and plan before you start work on site.

Questions to ask BEFORE you start

Planning, BEFORE you start a job, will make a big difference to how well you manage your site. Check Council requirements for site management. Complete a site management plan (one can be found at the back of this booklet).

Where is the lowest point on the site?

Water always runs to the lowest point. It is important to know where this point is when planning your site. It will affect where you put your crossover, stockpile materials and sediment fence. Leave a buffer of vegetation along the lowest boundary.

Where will I put the crossover?

Try to put the crossover as far away from the lowest point as possible. As water runs to the lowest point it is more likely to be wet and muddy. [See Page 16.]

Where will I keep my stockpile?

Stockpiles are best kept on site, as far away from the lowest point as practical. [See Page 12.]

Where will I build my sediment control fence?

Sediment control fences should be built on the lowest side/s of a site prior to erecting a temporary fence. A flat site may not need sediment control fences. [See Page 9.] These are a primary management measure to keep sediment on site.

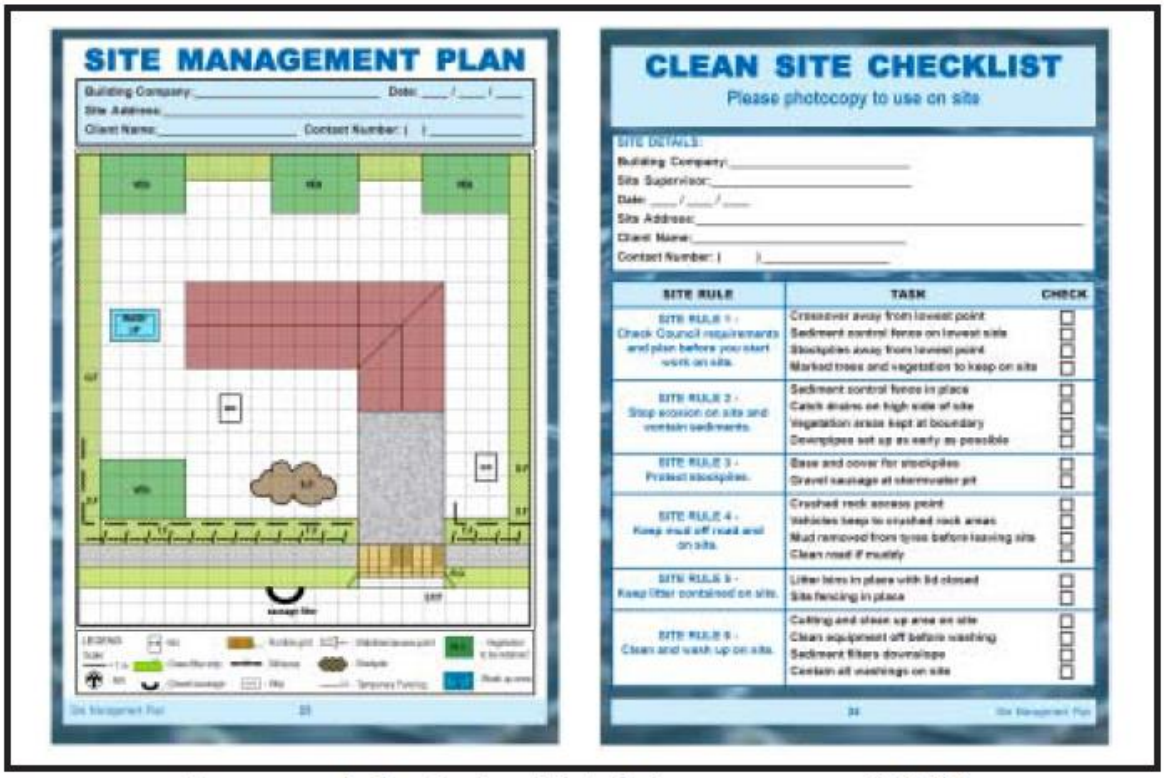
Which trees and vegetation will be kept on site?

Rope or fence off the areas you are going to keep. Keeping vegetation such as grassed areas will help to prevent damage to the surface of the site later on and may trap sediment. [See Page 7.]

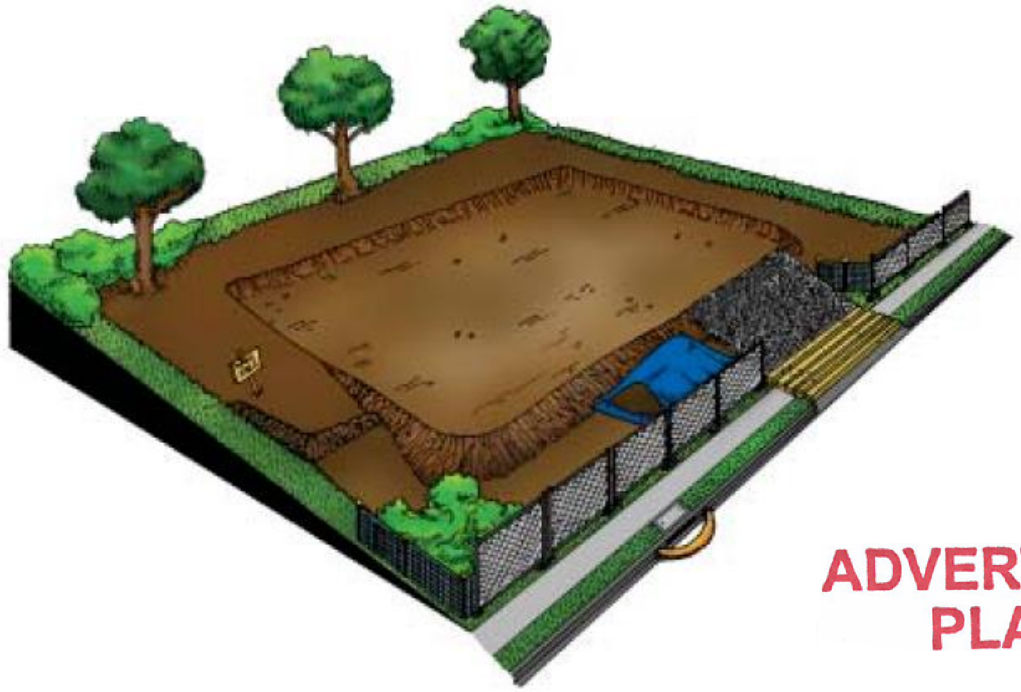
Why fence my site?

Many councils require sites to be fenced. Site fencing helps to keep building activities to the site, helps stop movement of litter, and helps to keep a site safe by stopping members of the public wandering on site. [See Page 20.]

SITE READY TO START JOB



For copy of plan & checklist photocopy pages 23 & 24.



ADVERTISED PLAN

Site Rule 1 - Plan before you start work on site. 5

SITE RULE 2

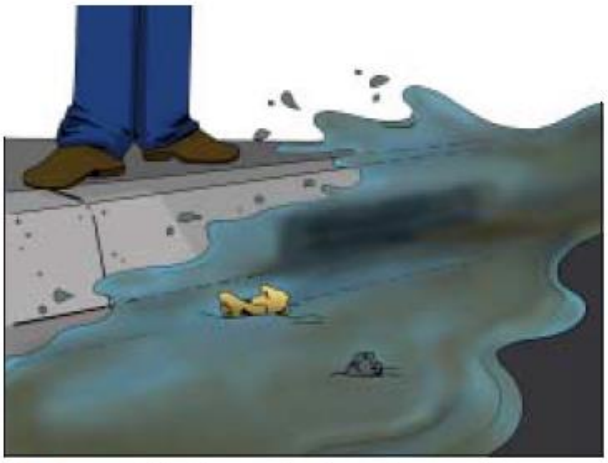
Stop erosion and keep sediment on site

Why is erosion a problem?

Sediment escaping from building sites can:

1. Make roads and footpaths slippery for vehicles and pedestrians, increasing public liability risk.

2. Enter the stormwater system and make stream and river water cloudy which can kill plants and animals in creeks and the bay.



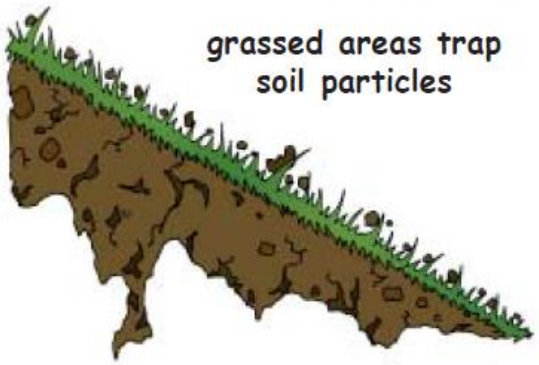
3. Cause blockages to the stormwater system including the side entry pit and pipes, increasing the chance of flooding and requiring regular cleaning.

4. Overload and clog local stormwater filtration systems such as raingardens and swales.

METHODS TO CONTROL EROSION

Control Method 1 - Keep areas of vegetation as a buffer strip at the site boundary.

To prevent sediment leaving site use existing grassed areas and a sediment control fence.



Vegetation helps protect the soil from the effects of rain and surface water by:

- Slowing the flow of water across the ground. Fast water is able to carry more soil particles off site
- Holding the soil together and minimising erosion
- Acting as a filter to trap soil particles.

Decide what areas of vegetation you are going to keep on site. Mark and protect trees, shrubs and grassed areas that you are keeping. Then apply for the relevant permits to remove vegetation.

Protect areas close to the boundary, drains and gutters, and where surface water flows may carry sediment off site.

Site Rule 2 - Stop erosion and keep sediment on site. 7

Control Method 2 - Early downpipe connection

Connecting downpipes to the stormwater or onsite detention system has a number of benefits:

- Less drainage problems on site
- Less mud on site after rain
- A safer site
- Reduce damage to building foundations
- Less downtime after storms
- Projects get finished sooner.

Aim to have the downpipes connected as soon as the roof is installed (temporary or permanent).

Control Method 3 - Pipe roof water onto a grassed or bunded area.

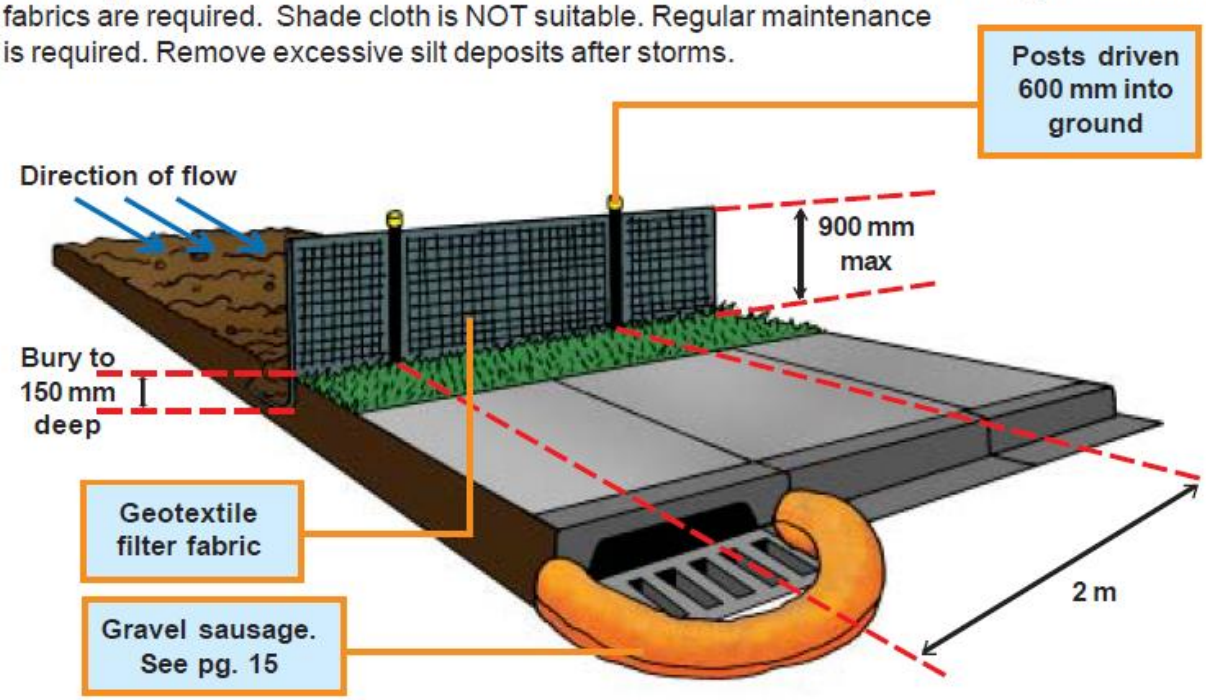
If you cannot connect to the stormwater system, pipe the water away from the building onto a vegetated area where there is good ground cover or to a bunded area.

This lets water seep into the ground with less damage to the surface of the soil.

METHODS TO CONTAIN SEDIMENT ON SITE

Method 1 - Sediment Control Fences

Sediment control fences stop sediment from being washed off site. The fence allows muddy water to pond behind it and for sediment to settle as the water slowly filters through. Geotextile fabrics are required. Shade cloth is NOT suitable. Regular maintenance is required. Remove excessive silt deposits after storms.

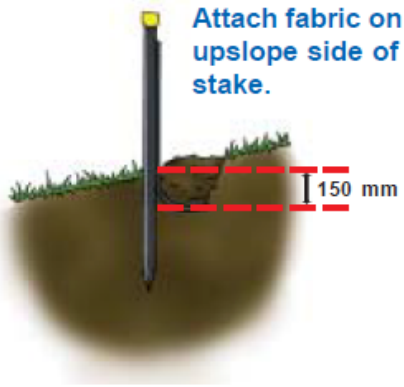


TO BUILD A SEDIMENT CONTROL FENCE:

a) Identify the low point of site.

Place sediment control fence along boundaries where the low point is.

This is the point where the land will allow water to carry sediment off the building site.



b) Dig a trench along the fence line before temporary site fencing is installed.

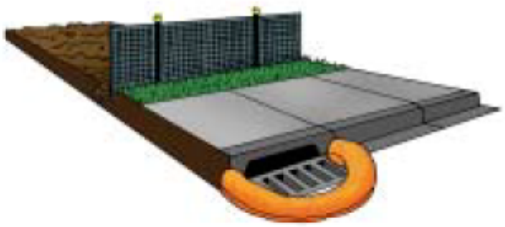
The trench will be used to bury the base of the sediment control fabric.

The trench should be 150 mm deep.

c) Put in 1500 mm wooden posts (38 mm) or star pickets.

Put 1.5 m star pickets at a maximum of 2 m apart and 600 mm deep.

Put 1.5 m wooden posts (38 mm) at 1.2 m intervals (max 2 m) and 600 mm deep.



d) Fix geotextile to posts

Geotextile material allows water to pass through but traps sediments.

Use cable ties or staples to attach the geotextile to the upslope side of the fence posts.

Only join fabric at the pickets with a 150 mm overlap (wrap around post).

e) Spread volume of water.

Put a star picket 1.5 m upslope of the others every 20 m (if the fence is longer than 20 m). This spreads the volume of water that flows through each section of fence.

Turn ends up slope to allow for ponding.

Method 2 - Control dust and slurry from cutting

A large amount of dust can be made from cutting materials such as concrete, bricks and tiles. When mixed with water this material can be turned into slurry and washed into waterways. Cement changes the acidity of water which may then kill water plants and animals. The following methods will help keep this waste on site and out of the waterways:

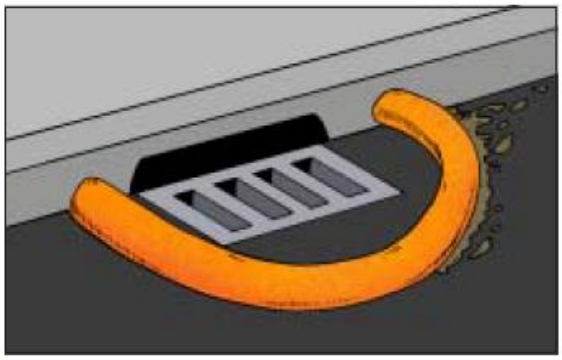
a) Cut materials on site

Choose a set area to do all your cutting. This area should be on the building site and away from all stormwater drains.

Equipment is available that captures water used in the cutting process (see page 3).

b) Put sediment control filters downslope

Sediment logs should be placed downslope to catch cutting slurry. A back-up sediment fence may also be used.



c) Use a gravel sausage or sediment log

When cutting must take place near stormwater drains, use gravel sausages or sediment logs.

Alternatively, you can buy sleeves from geotextile companies and fill these with sand.

Always clean up and correctly dispose of captured sediment.

d) Clean up when finished

When you have finished cutting, clean up your equipment in the cutting area.

Use a broom to clean up and get rid of the slurry where it can't get into the stormwater system. Dispose of in waste container

DO NOT HOSE THE SLURRY AWAY

Site Rule 2 - Stop erosion and keep sediment on site. 11

SITE RULE 3
Contain stockpiles on site

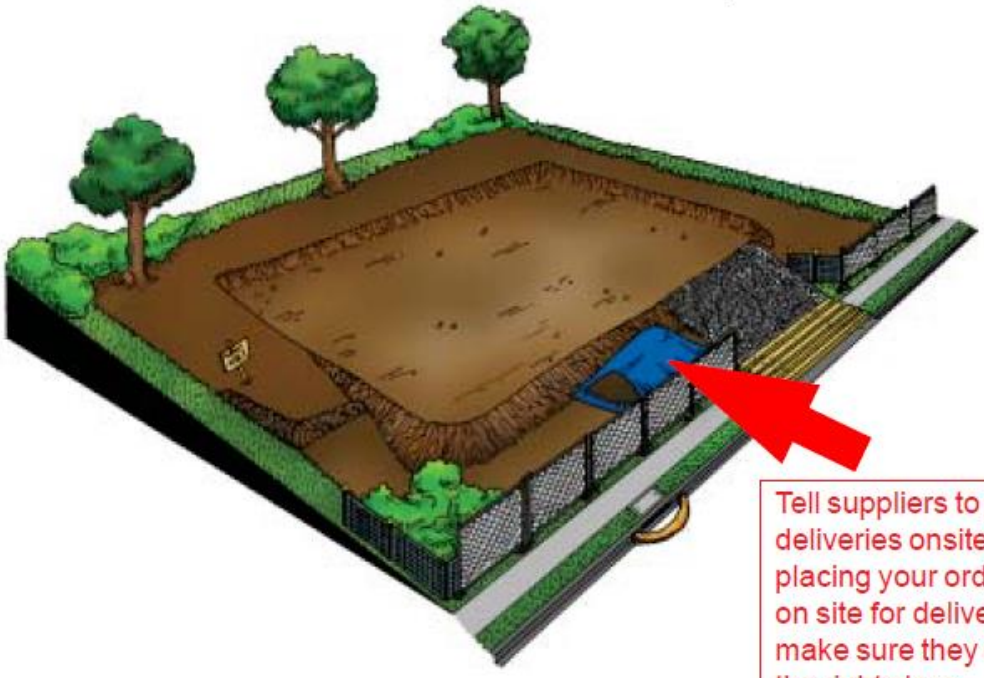
Why are sand, soil and screenings a problem?

Sand, soil, screenings, dust or sludge from concrete and brick cutting, and other materials escaping from building sites can cause many problems.

Putting stockpiles such as sand, gravel, topsoil and mulch across footpaths and roads will cause a hazard to both vehicles and pedestrians.

Sediment can smother stormwater filtering systems including swales and raingardens.

Stockpiles should be stored on site, not on footpaths or roads.

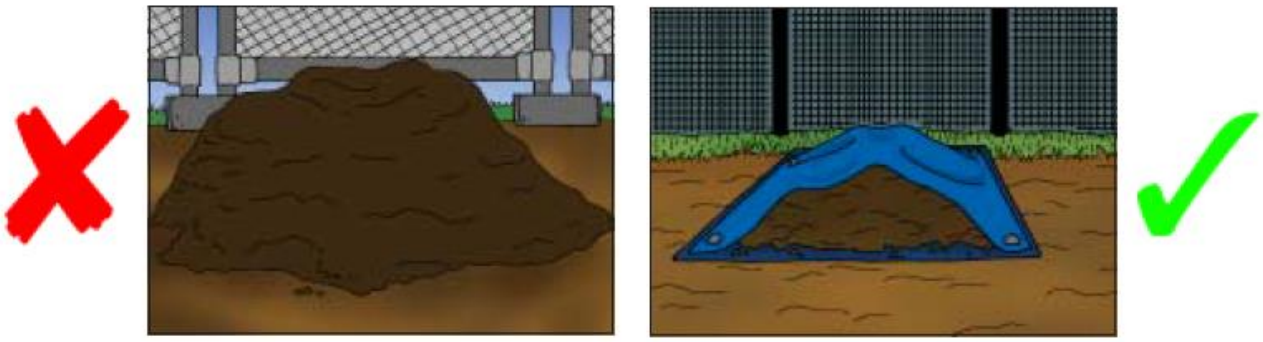


Tell suppliers to place deliveries onsite when placing your order or be on site for deliveries to make sure they are put in the right place.

Stockpiles not stored properly can get washed or blown away and pollute the stormwater.

This is particularly true of stockpiles that:

- Are high
- Have steep sides
- Are put on hard surfaces where they can be blown or washed away.



KEEPING STOCKPILES ON SITE

Place the stockpile in a designated area on site, and upslope of the sediment control fence.

If exposed for some time, stockpiles should be covered with a tarp.

In some cases it may be impossible to store stockpiles on site. In this case, a different set of control methods will be used.

Site Rule 3 - Contain stockpiles on site. 13

WHEN UNABLE TO STORE STOCKPILES ON SITE

You may have to store a stockpile off site (although never on the footpath, gutter or road). Contact the council to make sure that you have the appropriate council permits.

The council will tell you how stockpiles stored off site are to be managed. Materials may be stored on tarps or on pallets. Containers such as rubbish skips with opening sides that you can get into easily are a good idea.

Material must not get into drains, gutters or the stormwater system

The following control methods can be used when storing materials or working off site.

Method 1 - Cover Stockpile

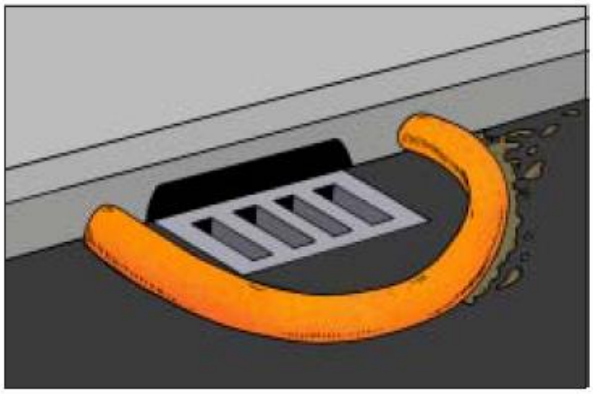
a) Place a tarp, plastic or bunded pallet under the area where the stockpile will be placed.

b) Place a secured covering over the stockpile.

c) Then place sediment control logs around the downslope base of the stockpile.

Method 2 - Protect Downstream Stormwater Pit with a Gravel Sausage or Sediment Log

A gravel sausage or sediment log is a temporary collection device that can be used when stockpiles are stored or cutting is done off site.
It is also a useful precautionary measure at all sites.

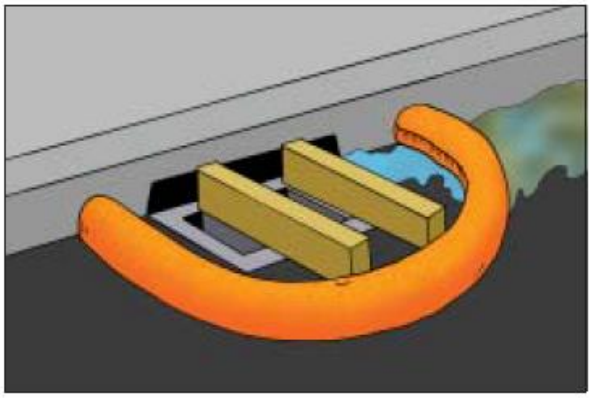


TO BUILD A GRAVEL SAUSAGE:

a) Make the sausage sleeve

A gravel sausage is made from a geotextile sleeve filled with 25 - 50 mm gravel.

The gravel sausage should be 150 mm high.



b) Put the gravel sausage across the opening of the inlet pit

Make sure that the sausage is tight with the kerbing on the upslope side of the inlet pit and extends beyond the grate.

There should be a 100 mm gap between the front of the pit and sausage. Use wooden blocks to keep the 100 mm gap.

c) Clean out gravel sausage regularly

When soil and sand builds up around the gravel sausage, this should be collected and disposed of on site.

Regular maintenance is required.

DO NOT HOSE SEDIMENT DOWN THE GUTTER

Site Rule 3 - Contain stockpiles on site. 15

SITE RULE 4

Keep mud off road and on site

Why is mud a problem?

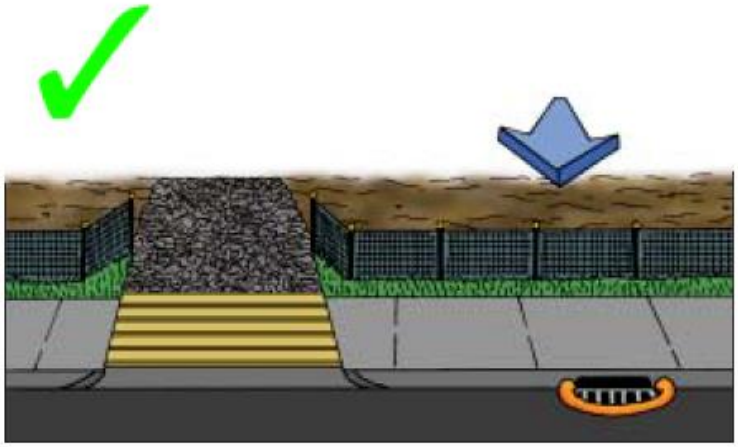
Two things happen when vehicles go on and off the site:

1. The surface area of the site is damaged making it dangerous.

2. Mud is carried back onto the roads and footpaths, and washes into the stormwater system.

METHODS TO CONTROL MUD

The following simple methods will help you to protect the surface of your site and help stop vehicles from dropping mud on the road from their wheels. The best way to do this is to put crushed rock on the crossover or access point of your building site.



Putting crushed rock on the access point of your site is a good way to prevent damage and provide a dry access point for vehicles. Where possible park vehicles off site.

Make sure gravel does not collect in the gutter or on the footpath.

Control Method 1: Build a crushed rock crossover

Remove a 3m or greater strip of soil from road (or where concrete crossover ends) to nearest building point or a minimum of 5 m.

Use road base or 40 mm aggregate or crushed rock to a depth of 200 mm.

Restrict vehicle access to this point.

Control Method 2: Keep to crushed rock path

Only drive where you need to. Keep to a set path (preferably on crushed rock).

Control Method 3: Remove mud from tyres

Use a shovel to remove mud from truck tyres before leaving site.

Control Method 4: Clean road

If mud goes on road, remove as much as possible and put it back on site.

Use a broom or a shovel.
DO NOT USE A HOSE.

Site Rule 4 - Keep mud off road and on site. 17

SITE RULE 5

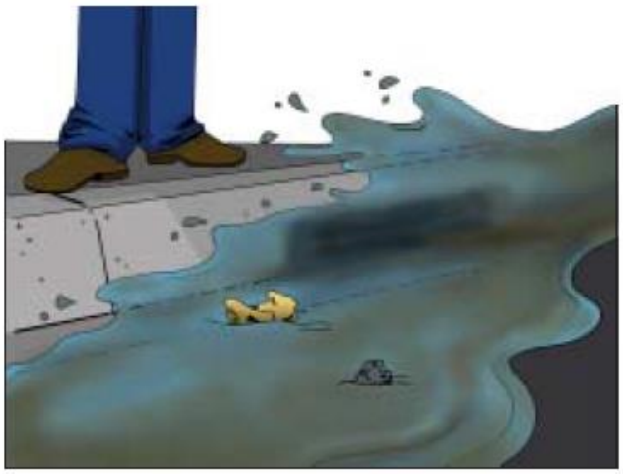
Keep litter contained on site

Why is litter a problem?

Many building sites have both building rubble and other rubbish spread across them.

This causes many problems:

You may now have an UNSAFE WORK ENVIRONMENT!
This could increase the chance of legal and public liability problems



Litter blowing off site can block stormwater drains.

Litter may spoil local creeks and eventually find its way to the coast.

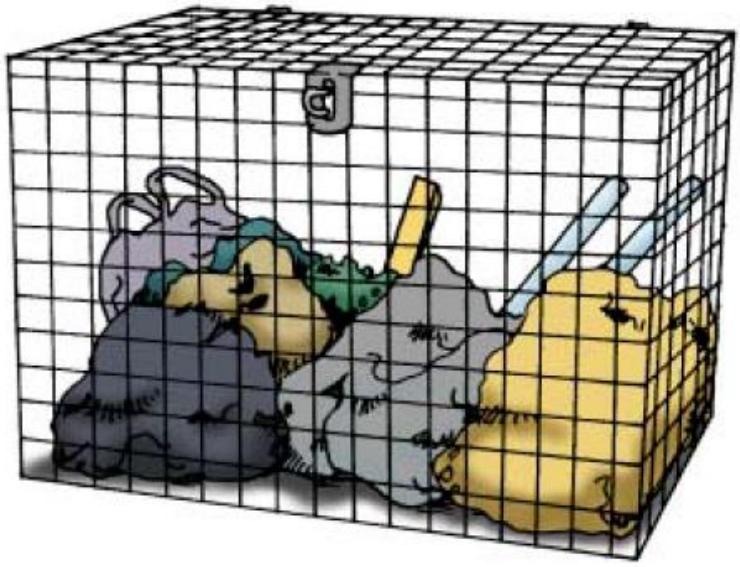
METHODS TO CONTROL LITTER

The following simple methods will help you to stop litter leaving your site or being a hazard on site.

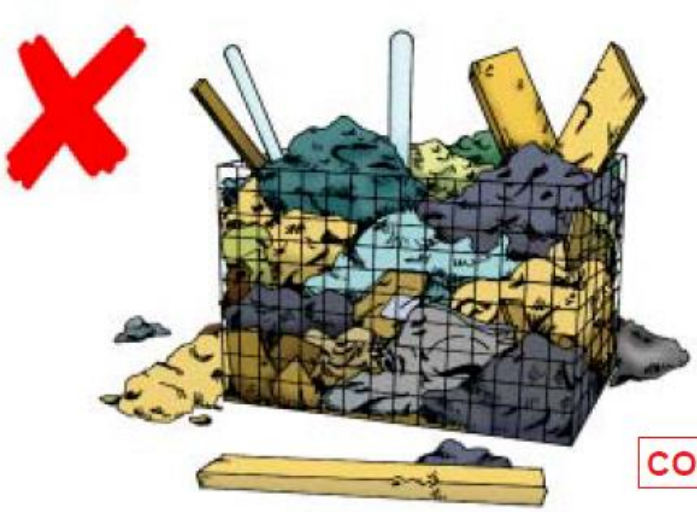
Control Method 1: Litter bins or covered skips

A mesh bin with a closeable lid is suitable for larger items like cardboard boxes, plastic wrapping and polystyrene.

Mesh to be 50 mm or smaller



A smaller bin is okay for smaller rubbish like paper, food wrapping and drink containers that may be blown off site. Council bins may be restricted from building sites.



Empty the litter bin regularly. Don't allow overflow. Where possible, collect the materials from the litter bin for recycling and /or keep different materials in separate bins.

CONSIDER A RECYCLING BIN

Control Method 2: Site fencing

Site fencing will help to keep litter from being carried off site by wind or water and provide security.

A FENCE DOES NOT NEGATE THE NEED FOR A BIN.

Check council requirements for temporary fencing and avoid trip hazards on footpath.

Remember to install a sediment control fence prior to installation of the temporary fence.

SITE RULE 6

Clean and wash up on site

Why is washing up a problem?

When cleaning up after painting, plastering or concreting it's most important to keep the wash water out of the stormwater system.

Problems to the environment include:

1. Oil based paints form a thin film over the surface of the water. This starves water plants and animals of oxygen
2. Paints and petrol chemicals can contain toxic compounds
3. Concrete changes the acidity of waterways which can kill water plants and animals. Concrete washings can harden and block drains
4. Roads around a building site can become dirty, slippery and dangerous.

METHODS TO CONTROL WASHING UP

The following simple methods will help you to stop the contamination of stormwater from paint, plaster or concrete washings.

Control Method 1: Have a set washing up area

Choose a set area to do all your washing up. This area should be on the building site and away from all stormwater drains. It should be bunded and contain wash out barrels.

You could use the same area you have chosen for tile and brick cutting.
Contain chemicals and slurry onsite.
Put sediment control fences downslope.

NOTE: SEDIMENT CONTROL FENCES WILL NOT STOP CHEMICALS

Control Method 2: Get rid of concrete slurry on site

Collect wash water from concrete mixers and pumps in a wheel barrow and get rid of it in your wash area. You can also safely get rid of concrete slurry by tipping small amounts in a ditch lined with plastic or geotextile liners. When the water evaporates or soaks into the surface the solids can then be put into a skip bin or recycled in construction or as road base.

Control Method 3: Clean equipment off before washing

Brush dirt and mud off equipment before you wash it. Spin rollers and brushes to remove paint before you wash them in a wash out bin.

You will then need less water to clean this equipment.

Control Method 4: Clean painting tools carefully

Use one container to wash the brush and another to rinse it. Let the first container stand overnight to let solids settle. Then pour out the water on to the ground if it is not too dirty and put settled solids in a bin.

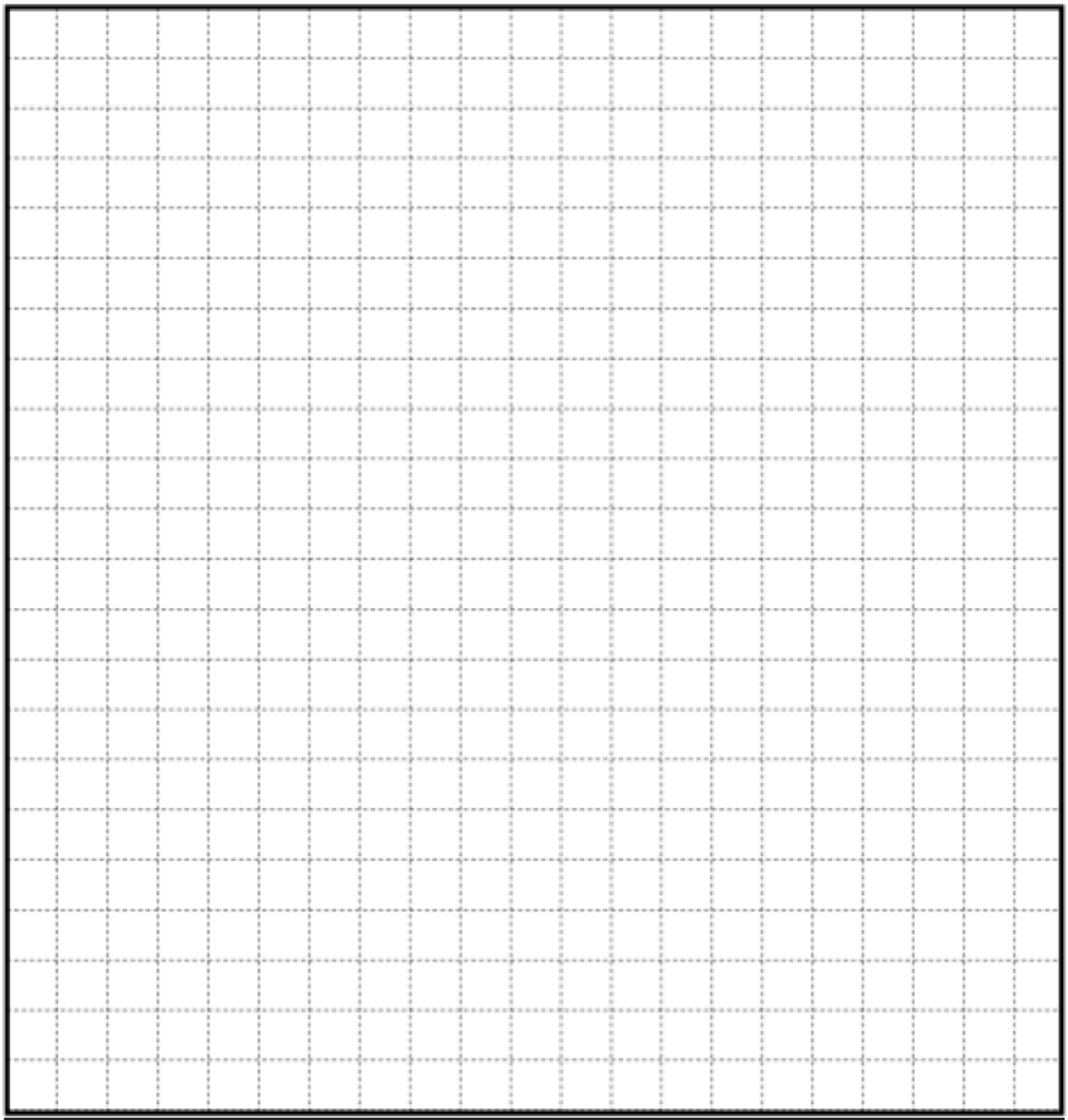
Wash oil based paints in solvent baths until clean. DO NOT PUT THE SOLVENT ON THE GROUND. Contact a waste disposal company for removal.

SITE MANAGEMENT PLAN

Building Company:_____ Date: ____ / ____ / ____

Site Address:_____

Client Name:_____ Contact Number: ( ) _____



LEGEND:

Scale: = 1 m

- Nth
- Bin
- Grass filter strip
- Gravel sausage
- Rumble grid
- Silt fence
- Skip
- Stabilised access point
- Stockpile
- Temporary Fencing
- Vegetation to be retained
- Wash up area

Site Management Plan 23

CLEAN SITE CHECKLIST

Please photocopy to use on site

SITE DETAILS:

Building Company:_____ Date: ____ / ____ / ____

Site Supervisor:_____

Site Address:_____

Client Name:_____ Contact Number: ( ) _____

SITE RULE	TASK	CHECK
SITE RULE 1 - Check Council requirements and plan before you start work on site.	Crossover away from lowest point	☐
	Sediment control fence on lowest side	☐
	Stockpiles away from lowest point	☐
	Marked trees and vegetation to keep on site	☐
SITE RULE 2 - Stop erosion on site and contain sediments.	Sediment control fence in place	☐
	Catch drains on high side of site	☐
	Vegetation areas kept at boundary	☐
	Gravel sausage at storm water pit	☐
	Downpipes set up as early as possible	☐
SITE RULE 3 - Protect stockpiles.	Base and cover for stockpiles	☐
	Gravel sausage at stormwater pit	☐
SITE RULE 4 - Keep mud off road and on site.	Crushed rock access point	☐
	Vehicles keep to crushed rock areas	☐
	Mud removed from tyres before leaving site	☐
	Clean road if muddy	☐
	Clean stormwater pit and maintain gravel sausage	☐
SITE RULE 5 - Keep litter contained on site.	Litter bins in place with lid closed	☐
	Site fencing in place	☐
SITE RULE 6 - Clean and wash up on site.	Cutting and clean up area on site	☐
	Clean equipment off before washing	☐
	Sediment filters downslope	☐
	Contain all washings on site	☐