FAWB
Facility for Advancing
Water Biofiltration

ABOUT FAWB

The Facility for Advancing Water Biofiltration, FAWB, is a joint venture research facility between Ecological Engineering Holdings Pty Ltd and Monash University under the auspices of the Victorian Government's Science Technology and Innovation Initiative.

What is Water Biofiltration

Water biofiltration is the process of improving water (stormwater and wastewater) quality through the processes of filtration through biologically influenced media. Stormwater biofiltration systems include:

- Bioretention systems
- Constructed surface-flow wetlands
- Constructed sub-surface-flow wetlands

Main Aims

The main aims of FAWB are to:

- Provide scientific "proof of concept" for the application of stormwater biofilter technologies
- Facilitate industry-wide adoption and implementation of the technology

The specific outcomes of FAWB's work will be innovative stormwater biofilter technologies underpinned by:

- New scientific knowledge about the key physical, chemical, and biological performances which underpin the effectiveness of stormwater biofilters
- Design specifications for biofilters that form the basis for written technical guidelines to accompany legislation/regulation
- Algorithms that assist the design of biofilters for a wide range of applications
- Prototypes of modular units for specific applications (e.g. devices for stormwater treatment and re-use at the level of an individual household or a single commercial site)

Collaborators

Adelaide and Mount Lofty Ranges Natural Resources Management Board, SA
Auckland Regional Council, New Zealand
Brisbane City Council, Qld
Landcom, NSW
Manningham City Council, Vic
Melbourne Water, Vic
VicRoads, Vic

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Laboratory columns set up in greenhouse for column experiments

FAWB team

Monash University carpark biofilter facility

Victoria Park, Sydney – biofilter installation

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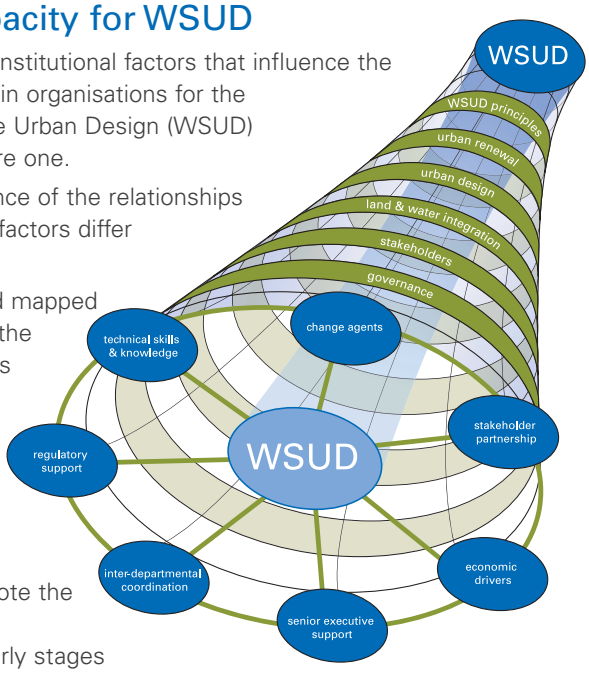
INDUSTRY CAPACITY ASSESSMENT AND IMPROVEMENT FOR BIOFILTER TECHNOLOGIES

Mapping Industry Capacity for WSUD

This research aims to assess the institutional factors that influence the opportunities and constraints within organisations for the implementation of Water Sensitive Urban Design (WSUD) technologies, of which biofilters are one.

The strength and relative importance of the relationships and inter-linkages between these factors differ between organisational types.

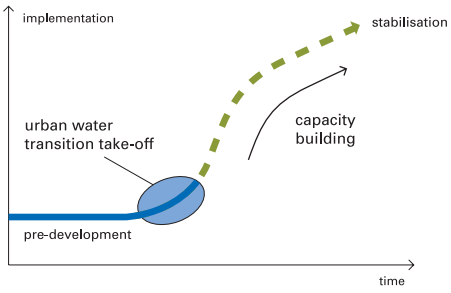
These factors are investigated and mapped for industry sectors to determine the current institutional capacity trends for WSUD technologies.



Building Industry Capacity for Biofilters

Adoption of Technologies

A central aim of FAWB is to promote the widespread adoption of biofilter technologies. Australia is in the early stages of a transition away from the traditional water servicing approach and towards more sustainable urban water management. For this transition to become stable, with technologies such as biofilters being adopted as mainstream practice, industry capacity needs to be improved.



FAWB aims to build industry capacity for biofilter technologies by delivering a number of products and services to industry:

Modelling Tools

- Algorithms for improved prediction of the performance of biofilters including bioretention systems and constructed wetlands
- Implementation of enhanced algorithms in MUSIC

Technical Guidelines

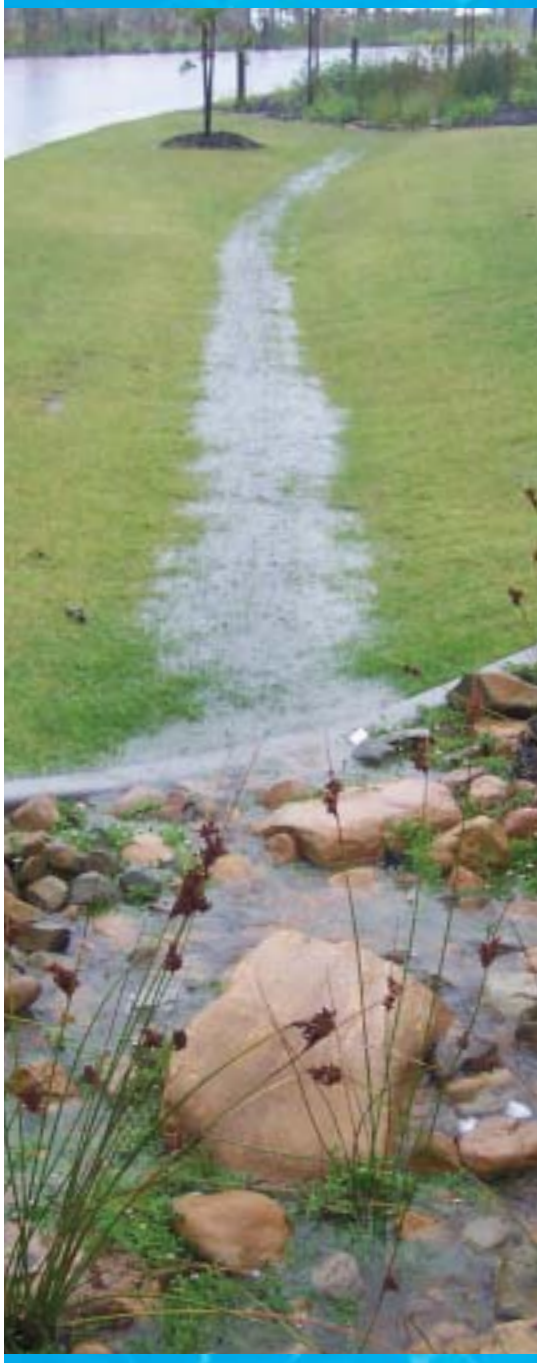
- Design recommendations for multi-functional biofilter systems
- Design and construction guidelines for biofilter systems

Demonstration and Testing

- Building demonstration systems and showcasing applications
- Providing testing and certification facilities and advisory expertise to enable further WSUD technology developments by industry

Education/Capacity Building

- Training courses and seminars for industry and agencies
- Technical tours of demonstration sites
- Undergraduate and postgraduate teaching
- Presence in technical and scientific forums



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OPTIMISING & DEMONSTRATING BIOFILTRATION TECHNOLOGY

Testing plant species suitable for bioretention systems

Laboratory Experiments

Laboratory studies of bioretention systems are being undertaken to determine the optimum design configuration (vegetation, media, outlet specifications) and operating conditions for achieving long-term, sustainable pollutant removal. The laboratory experiments involve 800 experimental-scale bioretention columns, which are being subjected to a range of test conditions.

Large bioretention columns for testing design and operating conditions

Choosing the best plant species...

Which species can best accommodate the wetting and drying pattern in a bioretention system? Which species will support the best long-term removal of pollutants? We are testing 20 different species (including grasses, sedges, reeds, shrubs and trees) to find out, by dosing vegetated bioretention "columns" with stormwater, and measuring the growth rate and pollutant uptake of each species.

We also measure the pollutant concentration in the filter media, and the stormwater effluent.

Advanced bioretention columns for testing the performance of anaerobic zones in nitrate removal, and for determining optimum filter characteristic

Influence of design and operating conditions on performance

Test set up

150 large (375mm diameter) bioretention columns have been constructed, to test the:

- Optimal filter media type (e.g. sandy loam, sandy loam with vermiculite/perlite, low pH sandy loam, activated carbon, etc)
- Optimal filter depth (up to 700mm, plus 'transition layer')
- Benefit and configuration of an anaerobic zone for promoting denitrification, for sustainable nitrogen removal
- Influence of plants (using 5 species chosen from the subset of 20 (above) on bioretention effectiveness in pollution reduction
- Influence on bioretenion operation and effectiveness of climate, pollutant concentration and storm size

Experimental rig for testing resistance of filter-media to long-term sediment loads

Water quality monitoring

Each column is dosed with stormwater, and the outflow rate and pollutant (sediment, nitrogen, phosphorus, heavy metals, hydrocarbons, etc) concentration monitored.

Health aspects

Each column is tested for its ability to produce water suitable for stormwater reuse. Testing is undertaken for pathogens, viruses and other contaminants.

Long-term sustainability

Bioretention systems need to perform effectively over long periods.
We are conducting experiments to

- Test designs and specifications of filter media and vegetation that maintain the permeability of the soil filter media
- Measure the long-term efficacy of different filter media types (ie. their pollutant adsorption capacity)

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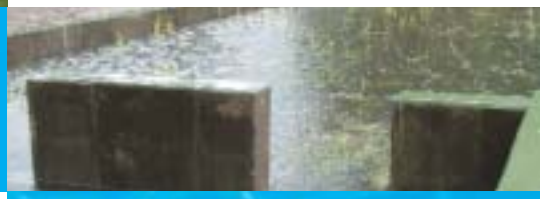


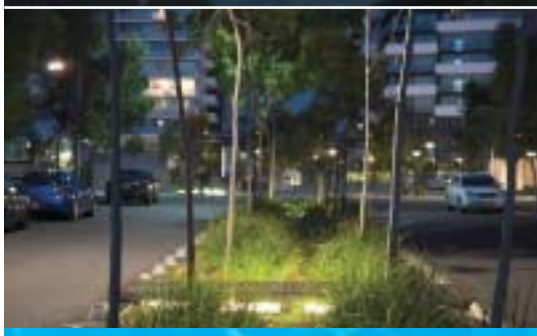
Bioretention performance during a 50 year ARI storm

Field Trials

A key aim of FAWB's research is to develop biofiltration technologies that provide effective and sustainable treatment of stormwater. Bioretention systems are a form of biofilter that are becoming widely used owing to their efficiency and adaptability to urban landscape design.

We are using a combination of laboratory experiments and field trials of bioretention systems to test the influence of design configurations and operating conditions, and to demonstrate their full-scale applications. The field trials are being documented, to provide guidance on construction, operation and maintenance of biofiltration systems, for achieving long-term performance and sustainability.

Constructed bioretention cells for stormwater harvesting and treatment



Bioretention application in an urban streetscape

Aims of Field Trials

A number of field trials of bioretention systems in Melbourne, Sydney and Brisbane are undertaken to:

- Validate laboratory studies and address site specific issues
- Provide demonstrations of bioretention systems in a range of urban environments (streetscapes, greenfields, inner-city retrofits, etc)
- Provide the basis for monitoring of long-term robustness under real operating conditions
- Document construction procedures, for use in guidelines and standard drawings

Mixing trial filter media for field comparisons

Bioretention for stormwater harvesting (Melbourne)

A bioretention system has been constructed to treat stormwater runoff from a car park, prior to its harvest for reuse.

This system has been designed as three separate cells allowing field-scale trials of biofilter media (including additives) and hydraulic loadings.

Bioretention system in sodic soil environment (Sydney)

The application of bioretention systems in sodic soil environments requires particular attention to preventing any increases in discharge to groundwater and leaching of saline water into receiving waters.

Field trials are undertaken to investigate if special construction techniques need to be adopted in constructing bioretention systems in sodic soil environments.

Wakeley bioretention system: regional-scale trial of biofiltration for nitrogen removal

Large-scale bioretention system (Brisbane)

This regional-scale bioretention system treats stormwater runoff from an 87ha residential catchment. Specifically, this trial will examine the effectiveness of an anaerobic zone for removal of nitrogen from urban stormwater.

The system is designed with three hydraulically separate filtration cells, each with a different sub-surface drainage configuration and vegetation specification thus providing a unique monitoring opportunity.