Appendix F: Biofilters that look good – Enhancing aesthetics, community appreciation and acceptance

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Introduction

Urban landscapes must be designed for everyone. Yet not everyone will look at a landscape in the same way: what some people will like, others might not. Nevertheless, studies have shown that most people like urban landscapes with trees, smooth ground surfaces, curving lines, the presence of water, and a hint of mystery. Landscapes that appear healthy, with lush green vegetation, are preferred to landscapes that do not. Similarly, natural urban landscapes that are manicured are preferred to those that appear messy (Kaplan and Kaplan, 1989).

Similar landscape elements were important in preferences for constructed wetlands (Dobbie and Green, 2013, Dobbie, 2013, Cottet et al., 2013), a common feature in water sensitive urban design:

- The inclusion of trees
- The presence of vegetation rather than bare soils
- Water visible in the landscape
- Systems that appear healthy (i.e. lush, green vegetation and clear water)
- Characteristics that are generally compatible with ecological function

These same principles might usefully be applied in the design of biofilters. However, more than attention to these is required to ensure that biofilters will achieve community acceptance. The way in which these landscape elements are combined and arranged and the selection of plant species are also important. Specifically, the design of biofilters that are visually appreciated and accepted in our urban landscapes requires:

- an understanding of the site context,
- the application of good design principles, and
- careful selection of materials, both hard and soft.

Context

A biofilter is not an isolated landscape element but is 'read' with all the other elements within a landscape or streetscape. Any design must be site-specific, taking into consideration the appearance of the surrounding area, which may vary from dense urban environments, to leafy suburban streets or parks, to semi-urban areas fringing natural bushland. The character of suburban streets and neighbourhoods can also vary widely. An appealing landscape design for one environment might not be suitable for another.

Context is critical. Different contexts can apply to a project, depending on the landscape scale. Landscape scale can vary from a regional scale, to a city scale, to a neighbourhood scale, to a street scale, down to a lot scale. In designing biofilters, the relevant scale is likely to be neighbourhood scale for biofilters in parks, or street scale for raingardens incorporated into road reserves, car parks, etc.

Context informs many design decisions. Context must be understood and generally it requires a visit to the site. A site visit will reveal the neighbourhood character, related to the land use, building scale, form and density, and predominant vegetation. For understanding at a finer scale, details of the specific street in which one or more raingardens are to be sited are required. A site visit provides insight into the community for which you are designing the biofilter, and its landscape preferences.

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It reveals the physical context of the site. The design of biofilters should generally respect both neighbourhood and streetscape characters.

Things to look out for on a site visit are:

1. Land use
2. Predominant period of architecture, e.g. Edwardian, post-World War 2, contemporary
3. Predominant hard landscaping materials
4. Predominant planting style, i.e. formal or informal
5. Predominant plant selection, i.e. native, exotic, or mixed

Land use is an important factor in designing biofilters. It influences the physical context of the biofilter and so, too, its design. This is especially the case in residential streets. In residential streets, the residents are likely to consider the street as an extension of their domestic domain. Therefore, it is very important that the design process considers the landscape preferences of residents so that the biofilter 'fits in' visually to their street. It is essential that the residents appreciate, accept and value the biofilter in order that it can deliver the intended stormwater management service. This acceptance is less critical in commercial or industrial locations, where the property occupants are likely to be less critical of changes in the streetscape. Every opportunity should be taken to adopt innovative biofilter designs in these locations. They offer an opportunity to make biofilters accessible to the public, capture their attention and engage with them and demonstrate the function of biofilters.

Design of a raingarden should reflect its context, including land use, predominant style of architecture, and plant selection in existing streetscape. A suitable design for a raingarden in one context might not be suitable in another. Photos: M. Dobbie

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Good design principles

Principles of good design apply to landscape projects at any scale. The design of even the simplest biofilter will benefit from an understanding of good design principles.

Commonly adopted design principles are:

Unity and variety: There should be a balance of unity and variety within the design. Unity creates wholeness to the design, a sense of order and cohesion. On the other hand, variety creates interest, holding the viewer's attention. Another way of thinking about this is to aim for coherence, legibility, complexity and order in your design. These are thought to be important when people 'read' a landscape (Kaplan and Kaplan 1989). The same principles can be applied to biofilters. The design should be coherent: it should hang together. It should also be legible, i.e., it should be able to be 'read' as an entity. There should be some complexity so that the landscape is interesting, but within this complexity, there should be order.

Much research has shown that orderly urban landscapes are generally preferred to disorderly, or messy, landscapes (Kaplan and Kaplan, 1989, Nassauer, 1995). This applies even to the smallest biofilter. Messy biofilters are unlikely to be appreciated and accepted in an urban setting. If the design of the biofilter must appear 'messy' because of the choice of plant, e.g. sedges, grasses, reeds, consider including 'cues to care' (Nassauer 1995). 'Cues to care' are such things as regular maintenance, mown edges, street furniture, signage and flowering plants. These indicate that the apparent messiness of the biofilter is intended and that the area more generally is cared for and valued. 'Cues to care' provide an 'orderly frame' to a 'messy ecosystem' (Nassauer 1995).

Raingardens should sit comfortably within the urban setting, contributing positively to the streetscape. Multiple raingardens within a street should be designed to be read together, creating coherence in the streetscape. Raingardens with strappy plants can appear messy. 'Cues to care', such as good maintenance, are important to communicate that the 'messy' plants are intended. Photos: M. Dobbie.

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Form: The three-dimensional shape of the design should be carefully considered. The location and form of the various landscape elements should be chosen with an appreciation of how they relate to each other and how that relationship might change over time as the plants grow. All landscapes, including biofilters, are dynamic. A biofilter will change in form with time. The challenge is to design a biofilter that not only looks good when first constructed but that continues to look good as it matures. In situations where naturalistic plantings are desired and maintenance is intentionally less, an understanding of plant succession is necessary to anticipate likely changes in form of the plants and so, too, of the whole biofilter. Undesirable changes can be avoided by appropriate plant selections.

Scale: Scale relates to proportions of the different elements within the biofilter and of the biofilter in relation to the broader landscape. The elements within the biofilter should be in proportion to each other. In turn, the biofilter should be in proportion to its setting. This can be a subjective assessment. Nevertheless, scale should be considered in developing the design.

Seasonal variation: A biofilter can be designed to provide seasonal variation through the thoughtful choice of appropriate vegetation. The easiest seasonal variation is provided through flowering. Generally, deciduous plants are unsuitable in a biofilter so the seasonal variation of change in leaf colour in Autumn, leaf loss in Winter, to reveal the sculptural form of the plant, and new colour of Spring is not possible. Choice of flowering plants can be guided by the planting in nearby private gardens.

Inclusion of flowering plants adds interest through seasonal variation throughout the year. Choice of species or flower colour can be guided by existing vegetation in private gardens nearby. The results can be dramatic or more sedate; it is up to the designer to decide.
Photo: M. Dobbie; photo manipulation: H. Smillie.

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Patterns: Landscape perception operates at the level of landscape patterns (Gobster et al. 2007). Landscape patterns are what people notice in the landscape, i.e. the perceptible realm. Patterns can be created within a biofilter through the placement of plants with contrasting form, foliage and flowers, and the use of hard landscaping materials. Patterns can also be created by playing with solid masses of vegetation and areas of open space. Water can also be used. Formal patterns tend to be geometric whereas informal patterns tend to be random or curvilinear. However, this is not a clear-cut distinction: it is possible to have curvilinear formal patterns. When creating formal patterns, it is important to understand the growth of the plants within the biofilter and implement a suitable maintenance regime. With growth, the various plants might obscure the original pattern. Maintenance might involve regular pruning to retain the design intent.

Light and shade: In a biofilter, choice of plants and placement of those plants can create a play of light and shade, to create visual interest. Light and shade might be achieved literally through the use of different-height plants, so that shadows are cast through the day, perhaps within the biofilter or onto the surrounding paved surfaces. Alternatively, light and shade can be achieved by the use of contrasting vegetation colour, e.g. golden-brown grasses contrasting with dark green shrubs.

The pattern of the raingarden outside the Victorian College of the Arts, in St Kilda Road, Melbourne, is very strong, formal and geometric, creating interest. Photo: Spiire; http://www.spiire.com.au/case-studies/victorian-college-arts-forecourt

Selection of vegetation with contrasting colours can simulate light and shade for visual interest. Photo: M. Dobbie

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Texture: Texture can be both physical and visual. Physical texture can be used in the design of biofilters to create visual texture and thus visual interest. Texture is especially important when the choice of colour within a biofilter is limited. Texture can be provided by any of the materials used to construct the biofilter, including plant material and hard landscaping materials, e.g. concrete, stone, timber, etc. Texture can be fine or coarse. Small-leaved plants provide fine texture; large-leaved plants provide coarse texture.

Colour and tone: There is colour (or hue) in every biofilter. Green should always be present in the vegetation. Additional or different colours can also be provided by the vegetation, for example by the flowers or foliage. Colour can also be provided by hard surfaces, such as paving, edging and grilles. Tone relates to colour. A tone is a hue to which some black and white have been added. In a biofilter with foliage of a single colour, visual interest can be created through selection of a mix of vegetation with different tones of that colour.

Texture provided by different types of vegetation can create interest in a raingarden. Photo: M. Dobbie

Green comes in many tones, which can add interest in a raingarden, even without the addition of another colour. Paving can also contribute visual interest. Photo: M. Dobbie

Material selection

Hard landscaping materials: Context, budget, and maintenance requirements will determine the choice of hard landscaping materials. There is a wide range of proprietary products on the market for such things as grilles, paving, bollards, etc. If the budget allows, bespoke structures can be designed and manufactured.

Fixtures can be designed and manufactured specifically for a raingarden. An example is the outlet of the stormwater downpipes, collecting and diverting water to the raingarden outside the Victorian College of the Arts. Photo: Spiire; http://www.spiire.com.au/case-studies/victorian-college-arts-forecourt

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Plant material: Careful plant selection for biofilters is critical to ensure their technical function and their visual appreciation and acceptance by the local and broader communities. Plant selection to meet performance objectives is discussed in Section 3.6.14. This section provides guidance on selection for appearance. In this case, context is all-important.

Plant selection in residential locations is more constrained than elsewhere. In commercial, industrial, and public open space, the designer has more freedom to create a biofilter that is eye-catching and perhaps even provocative. However, to enhance the visual appreciation and acceptance of biofilters retrofitted into existing streetscapes, the biofilters' design should reflect the predominant garden preferences of the residents. Predominant garden style is more important than predominant style of architecture. For example, in a street with predominantly informal gardens with native vegetation, raingardens should have an informal design with native plants. Conversely, in a street with predominantly formal gardens with exotic vegetation, raingardens should have a formal design with an emphasis on exotic plants. Sufficient plants proven to function in stormwater treatment should always be included. At least 50% of all vegetation should be proven to improve stormwater quality (Section 4.4.14). However, these plants should be supplemented with a selection of plants reflecting the street's residents' preferences, which is expressed in their own gardens. These preferences will influence the planting style, structure and composition, plant selection and maintenance regime for the biofilters.

Both exotic and native species can be used, depending on the surrounding neighbourhood:

- Exclusively native species might be appropriate in bushland, semi-urban or urban areas with native gardens. Look to combinations found occurring naturally together (Water by Design, 2014). A guide to plant selection and arrangement can be found in nature. Plants that occur together in nature are likely to survive well together in a constructed landscape such as a biofilter. Alternatively, plant selection could be based on what is used in nearby gardens. When considering native species, it might be important to use endemic plants of local provenance, depending on the setting. Include ornamental native plant species, e.g. kangaroo paw or Gymea lilies, where appropriate. Also consider biodiversity: plants can be selected to attract insects and birds and to discourage predators, e.g. cats.

- Exotic species might be most appropriate in heritage or older suburban landscapes. Again, take your cue from the context and popular garden plant combinations.

Incorporate structural complexity. If trees are planted, this might include a canopy layer with an understorey of multiple layers below. If trees are not to be planted, structural complexity might derive from vegetation of different heights, including groundcovers, sedges, rushes and shrubs.

Within any mix of plant types, consider using a mix of:

- different sized and shaped foliage, e.g. Leucophyta, to create different textures,

- different foliage colour,

- plants that flower across different seasons, with contrasting or complementary flower colour.

Plant selection in this raingarden reflects the choice of plants made by owners of adjacent properties, contributing to a sense of place in the streetscape. If the raingarden includes plants used in neighbouring gardens, it is more likely to be appreciated (and perhaps maintained) by residents of the street. Photo: M. Dobbie

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Context is all-important. In this bushy outer suburban setting, different raingarden designs are possible but not all are equally successful in respecting the context. The bottom right-hand option, with the abundant exotic flowering plants, does not relate well to the setting or the planting of the nearby gardens, with which the raingarden will be 'read'. Photo: M. Dobbie; photo manipulation: H. Smillie.

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Trees as landscape features

Trees are a popular feature in our urban landscapes. They contribute greatly to the visual amenity of a streetscape or broader landscape. Studies have shown that landscapes with trees are preferred to treeless landscapes (Kaplan and Kaplan 1989; Dobbie 2013). Trees provide structural complexity to a design, a permanent framework for other plantings in understorey layers.

The tree canopy contributes to the form of the biofilter itself and also to the wider landscape. The canopy provides important shade, which can help mitigate the urban heat island effect. It is important to know the canopy density of selected trees. Canopy density will influence selection of plants for the understorey. Trees with an open canopy support a greater range of species in the understorey than trees with a closed canopy. Shade-tolerant species, i.e. those adapted to forests or rainforests, must be used under trees with a dense canopy (Water by Design, 2014).

A single tree can be used as a feature in a small biofilter. Clumps or groups of trees are suitable in larger systems. Odd-numbered groups of trees are more visually pleasing than even-numbered groups. Trees can be arranged formally or informally. For informal plantings, inspiration can be found in naturally occurring groups of trees. Placement and spacing of trees should be chosen with the size of the mature tree in mind.

Evergreen trees, not deciduous ones, should be selected for planting in the biofilter. Evergreen trees will have less leaf litter, which can foul the biofilter. They will also provide foliage, and hence colour, over winter.

Trees in bioretention pits or vegetated raingardens in urban areas contribute multiple benefits to the community. Photos: M. Dobbie

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Plant layout

Plant layout can be formal or informal, using native plants only or a mix of native and exotic plants. If exotic plants are known to function in improving water quality, it might be possible to use exotic plants only.

Choice of plant layout will be influenced by site context. Potential layouts are:

- Random
- Geometric, e.g. bands, zig zags (chevron)
- Curvilinear, waves, concentric

Different plant layouts for a specific site create quite different aesthetic effects. Left: random; centre, geometric; right, curvilinear. Photos: M. Dobbie; photo manipulation: H. Smillie

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Keeping it green

Green, lush vegetation is preferred by most people to brown, dry vegetation. Thus, it is important to keep the biofilters green.

Design and maintain the biofilter for moisture retention. This can be done by:

- shading the surface,
- including a submerged zone,
- watering the plants as required in dry season spells (particularly during establishment).

Select species with minimal seasonal die-back (or senescence), or use a mixture of species with different timings of senescence. For this reason, it is best to avoid the use of annuals.

Community engagement and landscape design

To further foster community understanding and engagement with the system, designers should consider:

- Public accessibility to the biofilter: Where safety permits, allowing members of the community to get close and peer into the system will foster curiosity and engagement. Consider accessibility in the design of barriers (if any), edges, seating, the proximity of pathways, system shape and crossings, walkways and bridges traversing the system.
- Visibility of the biofilter will help the community to understand biofilter function and add to its appeal. This can be achieved through:
  - The movement of water through the system. Designs may include channels delivering inflow, structures distributing flows across the system, grated coverings on those traversing pedestrian pathways, or the visible movement of flow between biofilter cells. The latter may be best achieved on sites with a sufficient gradient and terraced design.
  - Labels or signage. These can be creatively designed, such as labelling drains with their source (e.g. catchment) or destination (e.g. local creek or bay).

The dynamism of water adds interest to the landscape, as demonstrated in this raingarden in Were Street, Montmorency, and helps to tell a story about the function of the raingarden. Photo: Spiire; http://www.spiire.com.au/case-studies/were-street-raingarden

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Additional resources

Australian Plant Study Group 1980. *Grow what where: over 2300 Australian native plants for every situation, special use and problem area*, West Melbourne, Nelson.

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