10,000 Raingardens for Scotland

A SUDS and Green Infrastructure Technology Initiative

SGIF
Scottish Green Infrastructure Forum
www.sgif.org.uk

CSGN
Central Scotland Green Network

MWH
BUILDING A BETTER WORLD

This study is one of a collection of stakeholder-focused case studies on climate resilience. The authors wish to thank all those who gave their time and expertise to this study, and Heriot Watt University for supporting it and providing feedback.

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10,000 Raingardens Scoping Study
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The Scottish Green Roof Forum, at a committee meeting in December 2013, agreed to support the idea of developing a broad based inclusive initiative to promote green infrastructure which could be described as raingardens in Scotland. The concept was inspired by the Melbourne Water 10,000 raingardens campaign, which included a broad spread of what are known in UK as SUDS techniques (detention areas, biofiltration features, swales etc). This study aimed to clarify the needs for such an initiative in Scotland, and to identify barriers to and opportunities for achievements.

Sustainable Urban Drainage Systems (SUDS) and Green Infrastructure (GI) technologies such as swales, rain gardens, constructed wetlands, and living roofs and walls, provide multiple ecosystems services, including climate change adaptation. Increasing the amount of SUDS and other types of GI in urban areas is considered a key climate adaptation strategy, primarily though delivering increased resilience to flooding and higher temperatures, and by enabling other species to adapt by providing a more vegetated and permeable landscape through which they can migrate.

Despite the recognised importance of SUDS/GI technology in Scotland, efforts to promote the benefits to the general public and key sectors have been relatively limited. Consequently, implementation is not currently at the pace needed to make a significant contribution to climate change adaptation and address other issues such as urban diffuse pollution and biodiversity loss. Further, many of the SUDS installed to date have been lacking in the amenity aspect of the SUDS philosophy.

This study sought to explore the likely benefits of a 'Raingardens' education and awareness raising initiative in Scotland to help drive forward implementation of SUDS and GI technologies, and to scope the nature of such an initiative, identifying focus and opportunities, participants, leaders, key component elements and actions, and anticipated benefits. A review of existing SUDS data was carried out, and e-surveys, semi-structured interviews and workshops were used to gather opinions and information on developing and running an initiative from key potential stakeholder groups.

The use of Raingardens as an inclusive term for SUDS and GI technology was, on the whole, considered a favorable approach to engaging the public, potential funders, higher management, and a diverse group of stakeholders. There was an overall consensus that an initiative should be nationally-led with delivery at the local authority level. Interviews and workshops suggested that a two-pronged approach to delivery was needed:

1 National Level, targeting Scottish Government, SEPA, Scottish Water and others via the SUDS Working Party;
2 Local Level, targeting local authorities, and local delivery bodies and communities for delivery.

All participants in the study thought that the initiative should start as soon as possible, with the aim for a public launch in Spring 2015. Primary reasons for this were that a rapid increase in the implementation of SUDS is needed to address growing environmental problems such as increased flooding and; that there is an excellent opportunity to team up with Local Authorities on current and planned work on Flood Risk Management Plans (FRMP).

First steps towards establishing a SUDS / GI technology / Raingardens initiative should be taken as soon as practical. Key policy opportunities that may be able to strengthen the initiative and should be explored promptly (e.g. update to the SPP and Scottish Water's Surface Water Strategy). Research needs and recommendations should be communicated to those responsible for setting research agendas and research funders. Universities and other research organisations must also work collaboratively through existing agendas and/or the Scottish Universities Green Infrastructure Research (SUGIR) group.

1. Introduction

The Scottish Green Roof Forum, at a committee meeting in December 2013, agreed to support the idea of developing a broad based inclusive initiative to promote green infrastructure which could be described as raingardens in Scotland. The concept was inspired by the Melbourne Water 10,000 raingardens campaign, which included a broad spread of what are known in UK as SUDS techniques (detention areas, biofiltration features, swales etc). This study aimed to clarify the needs for such an initiative in Scotland, and to identify barriers to and opportunities for achievements.

1.1 Purpose of the Study

This study aimed to explore the likely benefits of a 'Raingardens' education and awareness raising initiative in Scotland similar to the Melbourne Water 10,000 Raingardens programme, to help drive forward implementation of SUDS and GI technologies, and to scope the nature of such an initiative, identifying focus and opportunities, participants, leaders, key component elements and actions, and anticipated benefits.

Objectives of the research were:

1. Identify Local Authorities who have made progress developing an inventory of storm-water attenuation assets (sites including SUDS) for flood risk management (ideally GIS based).
2. Identify Local Authorities interested in leading a campaign in their area.
3. Identify opportunities and barriers to running a 10,000 Raingardens campaign/s.
4. Review existing databases, for example SUDS in Scotland, documented in 2001, by local authority area, and identify where most sites were at that time.
5. Identify pilot candidate local authorities for whom it should be a practical task to up-date SUDS records, including green roofs and walls, and integrate with flood management database development.
6. Determine whether a set of pilot projects (for example with a degree of competition between a few local authorities) or one nationally led pilot project is likely to be the best way forward.
7. Explore possible gardening champions for a local or national campaign.
8. Identify possible partner organisations.
9. Identify possible host sites for modular Raingarden box units
10. Identify new guidance needs and types.
11. Propose a way forward including necessary pre-requisite actions and then the key steps in a 2-3 year campaign.

1.2 An introduction to Raingardens

Raingardens are a concept developed in the USA and have been adopted widely in Australia and are beginning to be used more widely in Europe. They provide a diverse range of multi-functional green infrastructure features based on attenuation of rainfall for both flood and drought mitigation. Figures 1.1, 1.2 and 1.3 show some established Raingardens in the USA, Australia and Europe respectively. They demonstrate the diverse range of SUDS/GI technologies that can be included under the term Raingarden, but are in no way inclusive of all the options.

Figure 1.1 Raingardens from the USA (All photos BJ D'Arcy).

Community Raingarden, an array of unit plot Raingardens, and a kerbside Raingarden, all in Portland, USA.

Biodiverse community Raingarden, Portland; and permeable pavement feeding rainwater into a lawn, Seattle.

Figure 1.2 Raingardens from Australia (All photos BJ D'Arcy).

Community Raingardens in Melbourne (left) and Hobart (right).


Coastal protection Raingardens, Melbourne, and regional Raingarden Hobart.


House plot and street traffic calming Raingardens (Melbourne).

Figure 1.3 Examples of European raingardens features.


Bio-filtration feature, Stroud (Neil McLean) and Green wall with filter drain, Barcelona (BJ D'Arcy)


Biodiverse roof, London (Buglife) and detention basin, Berlin (BJ D'Arcy).

Increasing the amount of GI in urban areas is considered a key climate adaptation strategy, primarily through delivering increased resilience to flooding and higher temperatures, and by enabling other species to adapt by providing a more vegetated and permeable landscape through which they can migrate (European Commission, 2013; Briar, R (2010); Hughes & Brookes, 2009). Raingardens will play a significant role in increasing GI since they are a requirement under SUDS legislation in Scotland and will become so in the rest of the UK under flood risk management requirements.

As it is generally not feasible to create large new green spaces in existing urban areas, large-scale retrofitting of SUDS/GI, such as swales, constructed wetlands, and living roofs and walls is necessary to fully embrace the potential of GI as a climate adaptation strategy (Gill *et al*., 2007). This also applies to other growing environmental pressures such as urban diffuse pollution.

SUDS have been referred to as 'Green Infrastructure technologies' (e.g. City of Lancaster, 2011). The use of 'Raingardens' as an inclusive term for SUDS/GI technology has been used in America and Australia for many years. After a recent survey of more than 20 UK SUDS academics and practitioners (Duffy *et al*, 2013), and consultation with international leaders including Melbourne Water, the following definition was suggested:

"A Raingarden is a vegetated area designed to attenuate rainfall"

Such an inclusive term encompasses all of the green or soft SUDS approaches. It is appealing as it allows simple messages to be put forward for effective sectoral and public engagement, as has been demonstrated by the great success of Melbourne Water's '10,000 Raingardens programme'. This definition includes some 'grey' (non-vegetated) features, such as permeable paving which, when associated with landscaping features will help surface water drainage, and thus reduce localised flooding.

1.3 Raingardens in Scotland

From 1996, SUDS technology in Scotland has been driven by regulation (1974 Control of Pollution Act; Water Environment and Water Services (Scotland) Act 2003). To achieve the wider benefits to which the technology aspires, SUDS requirements are also specified in local authority planning conditions and strategies, for example to achieve good landscaping and structural integrity (D'Arcy 2013). In parallel with development of SUDS technology, has been the growth of interest in urban greening for multiple benefits and the emergence of the Green Infrastructure sector, with many overlapping interests and aspirations. Green Infrastructure technologies (i.e. Raingardens) include all the source control SUDS techniques involving vegetation, plus other infrastructure features such as green walls, swales, buffer strips and green roofs of all kinds.

Implementation of SUDS, or GI technology, in Scotland is currently not at the pace necessary to address growing environmental pressures (McLean, 2014). This is because the significant regulatory legislation, policy and technical guidance already in place has been focused on requirements for new developments, with the primary aim of preventing existing problems from getting worse, thereby limiting the pace of implementation to that of new development. The provisions of the Water and Water Services Act (2003) however, gave a remit for public SUDS to Scottish Water, thereby allowing the expenditure of public funds by Scottish Water on retrofit SUDS, including taking on retrofit features as Scottish Water assets in perpetuity. But to date, the pace of retrofit action by Scottish Water has been almost negligible. Figure 1.4 shows some example of SUDS & GI in Scotland which would be classed as Raingardens under the definition in section 1.2.

Figure 1.4 Examples of SUDS/GI technologies in Scotland.


Naturally colonised swale, Burngrange, West Calder (Graeme Hedger); Community Raingarden (detention basin), Dunfermline (Brian D'Arcy)


Sedum roof at Kinnaird Primary School, Falkirk ; Green Roof on Small Mammal Hospital, Edinburgh (Both Bauder Ltd)


Caw Burn wetland, Pumpherston, West Lothian; Linear wetland at J4M8 (both Neil McLean);

Although progress has been made in implementing SUDS particularly in the south east of central Scotland (Wild *et al*., 2002), certain aspects of SUDS technology are under-represented, especially source control techniques for example, in streets, and on a plot by plot basis in industrial and housing developments. 'Hard' or 'grey' SUDS such as permeable paving and filter trenches far outnumber 'softer' or 'green' SUDS (Wild *et al*., 2002; McLean, 2014), which offer additional environmental benefits, including habitats for wildlife, carbon sequestration, and greater aesthetic appeal.

Educational initiatives and campaigns to promote the benefits of SUDS /GI to the general public and key sectors have been relatively limited in Scotland. Such actions are necessary to drive up standards and ensure that both professionals and the general public have a sufficient understanding of the technology and its associated issues in relation to design, implementation, and maintenance.

2.0 Methods

There were four main parts to the approach used, all designed to gather opinions on the need for and benefit of a 10,000 Raingardens Initiative, and how to develop and deliver such an initiative:

1. A review of the existing SUDS/Green Roof data to establish a minimal baseline.
2. Online surveys and discussion forums
3. Semi-structured telephone interviews
4. Workshops

The surveys were used to gauge interest and identify opinions on a limited set of questions, whilst interviews and workshops focused on gathering ideas and knowledge on developing and running of an initiative. Two workshops were held: a mini workshop at Glasgow City Council, and a second with a number of key potential stakeholders in Edinburgh.

2.1 Review of existing SUDS/Green Roof data

Two existing datasets were obtained: (i) The SUDS 'Database', documented in 2001 by Wild *et al*. (2002); and (ii) the Central Scotland Green Network (CSGN) 2011 green roof dataset. Scotland's Greenspace Map was also considered as a source of SUDS data, however, although some larger SUDS features will be recognizable on this map, the broad typology of the map means it is not possible to readily identify specific SUDS features.

2.2 Surveys

As part of the Flood Risk Management (Scotland) Act (2009), all Local Authorities are required to map SUDS and other flood attenuation features by 2015. To gauge interest in a SUDS / 'Raingardens' initiative and gather information on the current state and practice of SUDS and flood risk feature mapping, a short survey was developed via surveymonkey for flood risk management staff working in local authorities (Appendix 1). The survey was sent to a distribution list of flood risk management contacts from SGRF members.

Polls and discussion forums on specialist LinkedIn Groups were used to gauge opinion on the value of a Raingardens initiative across a number of key sectors. They focused on the ideal scale of an initiative, and the use of 'Raingardens' as an inclusive term for different types of SUDS / GI technology.

The questions were tailored to the expertise within the groups, so that the three Sustainable Drainage related groups (table 2.1.) were asked about the scale on an initiative, whilst the others were asked about the merits of using the term "Raingarden".

Table 2.1 LinkedIn groups polled[1]

Sector	Group name	N, (members 6/04/14)	n, (poll votes)
Sustainable Drainage	Sustainable Drainage Systems (SuDS)	717	5
	Urban Diffuse Water Pollution	216	4
	Water Sensitive Urban Design (WSUD)	1678	10
Green Infrastructure	Green Cities	7190	2
	Green Infrastructure	423	0
	Green Infrastructure Partnership UK	264	0
	Green Roofs for Healthy Cities	2657	1
	Greenroofs.com Network	1396	2
	RESET (Ecological Adaptation of the Built Environment)	106	0
Environment	Chartered Institution of Water & Environmental Management	5466	3
Ecology	Chartered Institution of Ecology & Environmental Management	3170	25
	Chartered Institution of Ecology & Environmental Management – Scotland Section	166	0
Built Environment (Architecture, Landscape Architecture, Planning)	Built Environment Forum Scotland	51	2
	Environmental Design Research Association	2018	0
	Landscape Architecture Design + Urbanism at Greenwich	65	0
	Landscape Ecology and Planning	5577	1
	The Landscape Institute	2840	4
	Urban Design Network	28577	9

2.3 Interviews

Twenty-one individuals with known interest and expertise in SUDS/GI technologies, or appropriately placed positions in key organisations were chosen to invite to take part in semi-structured interviews. To date, 14 have responded (see table 2.2).

Interviewees were asked the following questions:

1. Do you think a SUDS and Green Infrastructure technology education and awareness initiative would be beneficial to help drive forward implementation of technologies such as swales, rain gardens, constructed wetlands, and living roofs and walls? (Please explain why)

2. How do you feel about the use of 'Raingardens' as an inclusive term for green infrastructure technologies such as swales, rain gardens, constructed wetlands, and living roofs and walls, for the purpose of such an initiative?

3. What are your ideas on how to develop an initiative, specifically:
    a. **Where** should the focus be for the public and sectors; catchment or river basin scale? Town/city or Local Authority? National?
    b. **Who** should be involved and who should lead (different levels of leadership and differing remits within a lead organisation)? Who are the key sectors? Who should the target audience(s) be?

[1] In a number of cases the poll was posted automatically to the 'Promotions' board, or moved from the Discussion board to the Promotions board by a group administrator. In this case the poll was promoted with a second post on the discussion board, and this allowed further explanatory information on the study to be added, which could not be included in the poll post because of limited space. In some cases this second post was successful in drawing more responses, however in some cases it too was moved to the promotion board.

i. **When** would be a good time to run an initiative?

c. **What** resources and budgets are required? What activities and actions required?

d. **How** should it be put together? How should Raingarden / SUDS features be recorded and records validated? How should the work be funded? How best to engage with the general public and key sectors? How many Raingardens as a target, and over what timescale?

Table 2.2 Individuals who took part in a semi-structured interview

No.	Participant	Position	Organisation
1	David Harley	Water & Land Manager, National Operations	Scottish Environment Protection Agency (SEPA)
2	Scott Mathieson	Principal Conservation Policy Officer	SEPA
3	Emilie Wadsworth	Heritage & Biodiversity Officer	Central Scotland green network, Support unit
4	Lucy Van der Ven	Flood Prevention Officer	City of Edinburgh Council
5	Kerry Smith	Senior Project Manager	Scottish Water
6	Neil McLean	Senior Environmental Scientist	MWH
7	Tony Barrett	Principal Consultant	AECOM
9	Neil Campbell	Director (Scotland)	Sir Frederick Snow & Partners
10	Julie Waldron	Landscape Architect	City of Edinburgh Council
11	Jude Barber	Architect	Collective Architecture
12	Chris Baines	Landscape Architect, urban wildlife writer & broadcaster	Freelance
13	Max Hislop	Programme manager	Glasgow Clyde Valley Green Network Partnership
14	Ian Speirs		Scottish Govt.
15	Neil Berwick		University of Abertay Dundee
16	Katy Hunter		BRE
17	James Travers		Taylor Wimpey
18	Zorica Todorovic	Principal Consultant Engineer	Atkins Global

2.4 Workshops

In addition to the polls, surveys and semi-structured interviews, two workshops were held with a range of stakeholders, including members of Local Authorities, Scottish Water, Scottish Government and NGOs. The aim of these were to gain more information on the needs, barriers and opportunities of a Raingarden initiative, and to start identifying partner organisations, pilot projects and determine a way forward. The structure of the workshops were based around the same questions as the interviews – identifying opportunities and barriers, discussing the scale of delivery, participation and stakeholders, timescales, resources and suggestions for implementation.

One workshop was help in Glasgow City Council with members of various interested departments, including Urban Regeneration, Flood Risk Management and City Design. The second workshop was held in Edinburgh with representatives from Scottish Water, Local Authorities, Scottish Wildlife Trust and Scottish Government and Lothian & Fife Green Network Partnership. A full attendance list can be found in table 2.3

Table 2.3: Participants at the two workshops

Participant	Position	Organisation
Derek Dunsire	Principal Officer, Urban Regeneration Team	Glasgow City Council
Matthew Finkel	Project Officer, City Design Team (Landscape Architect)	Glasgow City Council
Chun Cheung	Engineer / Modeller, Flood Risk Management Team	Glasgow City Council
David Hay	Group Manager Environmental Services	Glasgow City Council
Emilie Wadsworth	Heritage & Biodiversity Officer	Central Scotland Green Network Trust / SGRF
Brian D'Arcy	Environment Consultant, Chair SGRF	Independent / SGRF
Maggie Keegan	Head of Policy	Scottish Wildlife Trust
Graeme Hedger	Team Leader, Flood Risk Management	West Lothian Council
John Millar	Flood Risk Engineer	West Lothian Council
David Winter	Asset Strategy Technical Team Leader	Scottish Water
Simon Pallant	Principle Planning Officer	Scottish Government
Gaye McKay	Principle Environmental Scientist	MWH
Alison Chisholm	Development Officer	Lothian and Fife Green Network Partnership
Emilie Wadsworth	Heritage & Biodiversity Officer	Central Scotland Green Network Support Unit / SGRF
Brian D'Arcy	Environment Consultant, Chair SGRF	Independent / SGRF
Lynette Robertson	Research Consultant	Independent / SGRF

3.0 Results

3.1 SUDS database

The SUDS database contains details of 767 SUDS sites in Scotland, incorporating nearly 4000 individual systems. The data were obtained from numerous sources, but primarily from plans and correspondence contained within SEPA's planning and working files (Wild *et al*., 2002; SNIFFER Project SR, 2009). The information was collated between September and December 2001, and the database is thought to be reasonably accurate up to 1 January 2002. It splits the SUDS up geographically, but Local Authority area, so provides a baseline for each LA in Scotland.

The total number of each type of SUDS by site and by individual systems is shown in Figure 3.1. Filter drains, infiltration trenches, soakaways and permeable paving made up the majority of SUDS at these sites, but a considerable numbers of swales, detention basins and retention ponds were also recorded. Most sites were residential, with a concentration in the South East of Scotland.

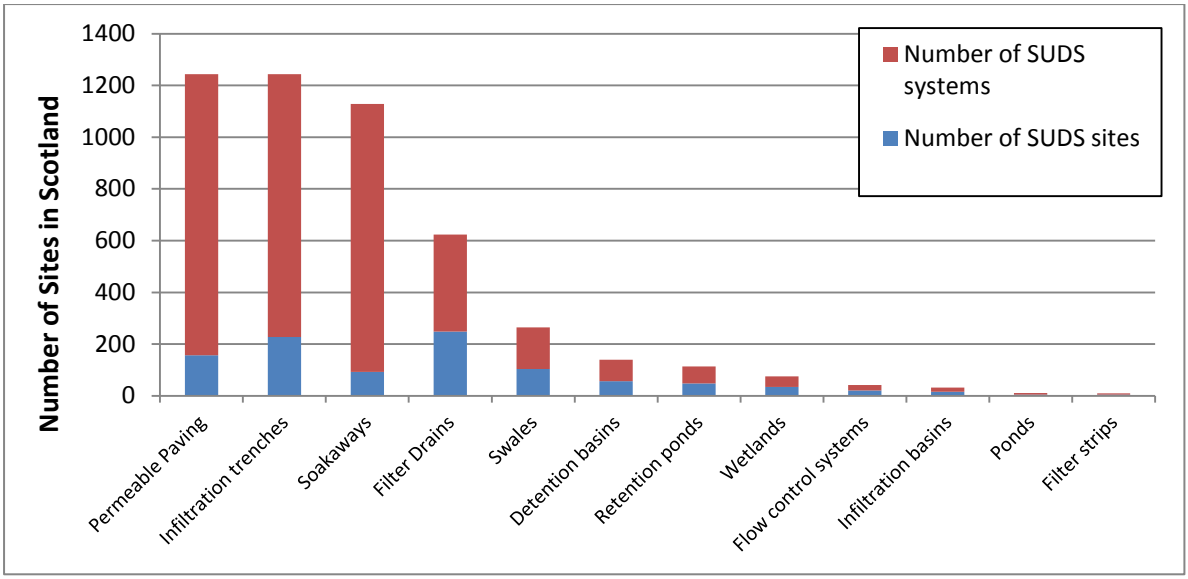


Figure 3.1 Total SUDS sites and individual system in Scotland by type, 2001 (data from Wild *et al.,* 2002).

3.2 CSGN Green Roofs

The data held in the Central Scotland Green Network (CSGN) database were collected from a survey undertaken by the CSGN Support Unit in 2011. Thirteen of the nineteen CSGN local authorities responded (68%), and responses were also received from Dumfries and Galloway, and Highland. The survey recorded a total of 64 green roofs, 61 of which were within the CSGN boundary, and more than half (54%) of which were in Edinburgh (Table 3.1). The three green roofs that were outside the CSGN boundary were in Highland (1), Fife (1), and Dumfries and Galloway (1). Due to unknown accuracy of knowledge on green roofs of each local authority, these values should be taken to represent an absolute minimum.

Table 3.1 Green roofs in each local authority within the CSGN boundary, 2011.

Local Authority	Green roofs (n)	% of total
City of Edinburgh Council	33	54.10
Midlothian	6	9.84
Glasgow City	5	8.20
Falkirk	4	6.56
West Lothian	3	4.92
East Dunbartonshire	2	3.28
Fife	1	3.28
East Lothian	1	1.64
Inverclyde	1	1.64
North Ayrshire	1	1.64
North Lanarkshire	1	1.64
South Ayrshire	1	1.64
South Lanarkshire	1	1.64
TOTAL	*61*	*100*

3.3 Surveys

The online survey was sent to 58 individuals, covering 22 local authorities, on 25 March 2014[2]. Recipients were sent a summary of the scoping study as an attachment with the survey invitation email, and were asked to inform colleagues working in both flood risk management and other units/sections of the study. A reminder message was sent on 3 April 2014, and the survey was closed on 5 April 2014. The total number of respondents was 16, from a minimum of 12 different local authorities: Highland, Perth & Kinross, Angus, Aberdeenshire, Moray, Dundee, Scottish Borders, East Dunbartonshire, Falkirk, Edinburgh, Glasgow, and Stirling (for 1 respondent the LA was unknown). Responses for each question are summarised in turn below. Selected responses are detailed in Appendix 1).

Q1: Are SUDS included in the flood attenuation features being recorded in your area?

Approximately two-thirds of respondents (63%) reported that SUDS were included in the flood attenuation features being recorded in their area. Local authorities that were already recording SUDS to some level were: Highland, Perth& Kinross, Dundee, Scottish Borders, East Dunbartonshire, Falkirk, Glasgow, and Stirling. City of Edinburgh plan to start mapping their SUDS in summer 2014, but Angus, Aberdeenshire and Moray had no known plans. For the Highland region it was reported that only SUDS features in known flood risk areas are recoded.

Q2. Are you currently recording a cumulative total number of such features?

Four respondents reported that a cumulative total of SUDS are being recorded in their local authority area, namely Aberdeenshire, East Dunbartonshire, Stirling, and Scottish Borders. It was noted that City of Edinburgh and Glasgow City are planning to record a cumulative total of SUDS in the near future.

The local authorities for which it was reported that a cumulative count of all flood attenuation features was already being recorded were: Highland, East Dunbartonshire, and Stirling (and one unknown/anonymous).

Q3. At which of the following levels do you think an awareness raising campaign should be focused? (Please select all that you think are relevant).

Most respondents chose National (n = 11) and/or Local authority (n =11) as the preferred scales of choice, representing 38% of total votes (n=29) (Figure 3.2). River basin scale was the least popular choice with only 3 votes (10%), but catchment scale was only marginally preferred with a total of 4 votes (14%).

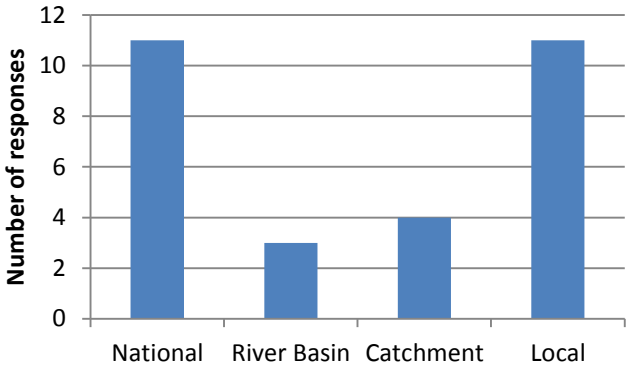


Figure 3.2 Preferred scale for a SUDS /GI technology initiative (LA Survey).

[2] Local Authorities there were not captured as part of the survey were: Argyll & Bute, East Ayrshire, East Renfrewshire, Na-h-Eilenanan Siar, North Ayrshire, North Lanarkshire, Renfrewshire, Shetland, South Ayrshire, West Dunbartonshire)

Q4. Do you think the following definition of a 'Raingarden' is useful for raising awareness of SUDS and other flood attenuation features: "A vegetated area designed to attenuate rainwater"?

Approximately half of respondents were in favour of the definition (n = 9), one-third were not in favour (n = 5), and two respondents were unsure (Figure 3.3). Comments received included that 'attenuate' was perhaps too technical; that it would be best not to confuse terminology; and that the definition may help promote a more positive impression of SUDS technology.

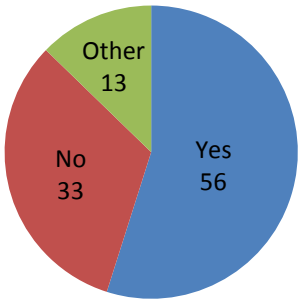


Figure 3.3 Response to the proposed definition of Raingarden (LA survey)

Q5. Will SUDS and other flood attenuation features be included in any flooding awareness raising campaigns run by your local authority?

Approximately two thirds of respondents reported that SUDS and other flood attenuation features would be included in flooding awareness raising campaigns run by their local authority (69%, n = 11). One respondent suggested that this might be done "*through targeted developer briefings run through Planning service*", and another that "*SUDS will be promoted wherever possible either through the Local Flood Risk Management Plan or the development control process*". Another insightful comment was "*Currently awareness raising for flood risk is focused on making people aware of the risk and protecting their properties. It would be hoped that in the future, following SWMP studies that campaigns also look at educating people in terms of development and how to minimise increased risk (e.g. not paving driveway, using SUDS such as water butts etc.)*".

3.4 LinkedIn Polls

Responses from the three SUDS/water groups polled on the scale of an initiative are summarised in Figure 3.4[3]. The strongest response received was from the Water Sensitive Urban Design (WSUD) group, the largest of the three groups, with a total of 10 responses. A national scale campaign was most favoured by the Sustainable Drainage Systems (SuDS) and WSUD groups (60% in both cases), but the catchment scale was the most popular choice for the Urban Diffuse Water Pollution group (Figure 3.4), perhaps indicating the need for catchment-wide implementation of SUDS to address diffuse water pollution (however, response numbers here are very small so must be treated with caution). In contrast to the local authority e-survey, there were no votes for the river basin scale from any of the participants.

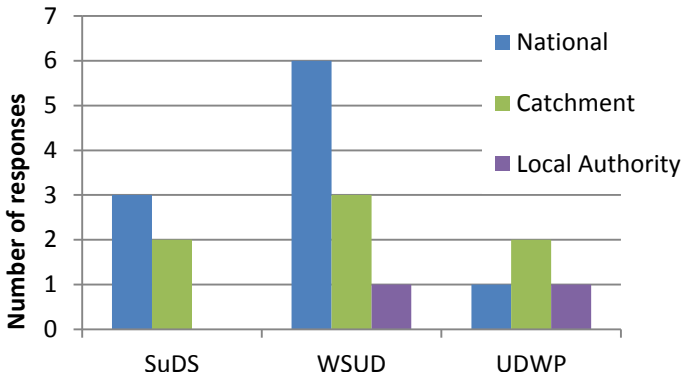


Figure 3.4 Preferred scales for a SUDS /GI technology initiative from the LinkedIn Polls

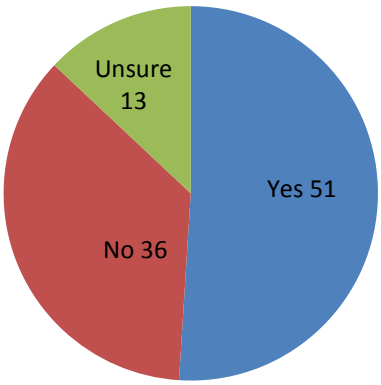


Figure 3.5 Opinions of the use of the term "raingarden".

[3] In contrast to the Local Authority Flood Risk Survey, for LinkedIn poll answers were as restricted to one option only

Pooled responses for the LinkedIn groups from which there was a response on the question of the definition of the term "Raingarden" are shown in Figure 3.5. The strongest response was from the Chartered Institution of Ecology & Environmental Management (CIEEM), and Urban Design Network. For five of the groups there was no activity (Green Infrastructure Partnership UK; RESET; CIEEM Scotland Section; Environmental Design Research Association; Landscape Architecture Design + Urbanism at Greenwich).

A total of 10 additional comments were received and are detailed in Table 3.2.

Table 3.2: comments to the question on the use of the term "raingarden" for an initiative

No	Type	Additional comments
1	Positive	Simplicity of term, attractive to engaging with the public, easy to visualise.
2	Positive	
3	Positive	
4	Positive	
5	Negative	Confusing for professionals as "raingarden" is already used as a specific type of SUDS/GI. GI is already an inclusive term, alternatives suggested are "rainscapes" "waterscales" and "organics drainage"
6	Negative	
7	Negative	
8	Negative	
9	Balanced	
10	Generally positive	Would be good if the rest of the UK followed suite

3.5 Interviews

All interviewees felt that a SUDS/GI technology education and awareness initiative would be valuable, with most being highly supportive of the use of 'raingardens' as a generic term for SUDS and GI technologies.

All felt that the initiative should be a nationally-led project and delivered on a local scale by local authorities, communities, and other stakeholder organisations; and all indicated that they thought the initiative should start as soon as possible, with several specific suggestions of a public launch in Spring 2015. Several key sectors, organisations and champions were identified, and these are listed in Table 3.3. A wide range of resources, budgets and activities were suggested, and these have been summarised in table 3.4. A copy of all the interview responses can be found in Appendix 2.

Table 3.3: Key sectors, organisations and champions identified via the interviews

Sectors	Organisations / Groups / Networks
Householders	Scottish Government
Housing developers	Scottish Water
Landscape architects	Local Authorities
Architects	SEPA
Academia	SNH
Research organisations	Forestry Commission
Gardening	Scottish Wildlife Trust (SWT)
Proprietary suppliers of modular raingarden options	Universities: Heriot-Watt, Abertay, ESALA (Edinburgh)
Schools (esp. Ecoschools)	Sustainable Urban Drainage Scottish Working Party (SUDSWP)
Public	Community councils
Commercial	Community groups
	Gardening clubs e.g. Scottish Garden Society
	Gardening centres/HTA/RHS
	Water utilities/companies

	NGOs e.g. Keep Scotland Beautiful
	Transport Scotland
	Homes for Scotland & NHBC

Table 3.4: Resources, Actions and Activities identified by interviewees

Resources and Budgets
• Funding for project team to coordinate national campaign • Funding to re-distribute locally for delivery (grant scheme) • ID lead organisation to secure funding and manage above • Suggested funding opportunities- Heritage Lottery Fund, Scottish Water, Scottish Natural Heritage, Corporate sponsorship or Business PR budgets, existing budgets within Local Authorities and Agencies, Scottish Government etc.
Early Actions
• Approach and engage SUD S Working Party • Deliver demonstration sites, prototypes etc. • Buy-in from key organisations (CEO & officer level) • Feed in to Scottish Planning Policy reviews • Develop guidance • Develop key research needs • Develop signage/interpretation for existing sites to start promotion and dissemination • Demonstrate cost benefits savings for Scottish Water (how much they would save if x homes/businesses were disconnected from mains)
Activities
• Planning – clear vision, agreed name and structure, identify lead, champions, stakeholders, secure funding, deliver demonstration sites • Delivery – target a wide range of stakeholders (including but not limited to all relevant departments in Local Authorities, high end developers for more exotic SUDS such as green roofs, businesses, householders), demonstration sites and pilot projects, develop media campaign (including website, events, competitions etc.), increase availability of materials, look at accreditation schemes, skills/time bank for volunteers • Recording and monitoring numbers – utilise Flood Risk Management Act requirements for LAs to records SUDS, encourage online registration for community schemes (e.g. empty homes project), monitoring through grant schemes, photo records are key. Need inspection teams and maintenance teams • Engage the public – high profile demonstration sites, website, open days, competitions, target areas who's been affected by flooding • Vision – needs to be ambitious enough to have an impact (e.g. 10,000), interim or local targets (e.g. 2015 by 2015; LA specific targets; 100 new one in first year; install in 10% of all new properties each year (c. 1500 units per year).

3.6 Workshops

Both workshops provided a great deal of information on the potential delivery and format of a raingardens initiative, with differences in focus due to the very different stakeholders present and their individual experience, expectations and work environment. The comments and suggestions from both workshops have been collated into tables 3.6, 3.7 and 3.8, with full notes from both workshops available in Appendix 3. Table 3.5 lists the key sectors, organisations and champions that were identified through the workshops.

In the Glasgow workshop, there was a great deal of enthusiasm for the idea of a raingardens campaign, as the proposal fits well with a range of well-funded current and planned initiatives for the city, and also Greater Glasgow and Clyde Valley. The key challenge for GCC is implementation,

but there is much interest in retrofitting green infrastructure in the urban landscape, and in particular Portland-style retrofit (e.g. South West Montgomery Green St).

In the Edinburgh workshop, a discussion around the general benefits of a SUDS/GI initiative recognised that in addition to the ecosystem services benefits, other benefits of an initiative were:

- Engaging the public on environmental issues
- Enhancing communication between and within organisations – multiple benefits / efficiency
- Creating a common understanding of SUDS / GI terms and benefits
- Catalysing a culture change in relation to SUDS, Green Infrastructure, Ecosystem Services

Table 3.5 Key sectors, organisations and champions identified during the workshops. Please note that there is no read across the rows.

Sectors	Organisations / Networks / Groups	Champions
Housing associations	Scottish Government	Minister for Environment and Climate Change
Housing developers	Scottish Water	SWT gardening champion
Schools (esp. Ecoschools)	SEPA	
Gardening	SNH	
Community groups	Local Authorities – multiple departments (e.g. planning, flooding, roads, education, conservation/environment)	
Commercial	SCOTS Flood Group	
	Forestry Commission	
	Scottish Wildlife Trust	
	Landscape Institute	
	Architecture & Design Scotland	
	Homes for Scotland	
	Royal Botanic Garden Edinburgh	

Table 3.6 Opportunities and barriers to running a raingardens initiative from the Glasgow workshop. Highlighted opportunities are thought to be key to the successful development and implementation of a raingardens initiative

Opportunities	Barriers
Flood management plans	Community engagement – GCC currently not well connected ('Healthy Sustainable Me' initiative trying to rectify this)
George St proposals (green infrastructure)	Roads engineers often tied to traditional technology
Ingram St car park	Clay soils
Sauchiehall St West project	Funding
Regular maintenance of streets	Securing cultural change within GCC depts
'Healthy Sustainable Me' initiative (engaging LA officers with communities)	
Five Streets Project (with greenspace scotland)	
'MUG'(Modular Urban Greening) Project	
MGSDP 60 year vision and associated GI work	
Green Glasgow 2015	
Getting ahead of change	
Landscape Architects are keen	
Public and sectorial education initiatives are needed elsewhere e.g. to support MGSDP	
SNH Green Infrastructure Fund	
Climate Change Fund	
Planning policies have been changed to accommodate green infrastructure features	
Contaminated land – landscape approach to remediation and redevelopment (need for appropriate SUDS and parkland features)	
GI plan has just been developed for a Business Improvement Districts in Glasgow	
CIRIA reports	
Green Roofs now mentioned in Glasgow Local Development Plan	
Tax Incremental Funding (TIF) proposals are being developed for GI in Glasgow	
City Deal	

Table 3.7 Opportunities and barriers to running a raingardens initiative from the Edinburgh workshop. There is no connection between the barriers and opportunities in each line in the table. Highlighted opportunities/barriers are thought to be key to the successful development and implementation of a raingardens initiative

Opportunities		Barriers
Local Authority Flood Risk Management Plans		Conflicting legislation (e.g. public Health & Safety) can work against SUDS best practice being used by developers or landowners more often because of perceived risks (financial and otherwise) .
Surface Water Management Plans		Getting agreement from other local authorities can be difficult
Scottish Wildlife Trust (SWT) Living Landscapes Programme (Edinburgh and Cumbernauld projects)		Overcoming 'silo thinking' in large organisations (not everyone will think it's relevant to them/engage – easier to work with partners outside).
SNH work programmes		Length of time to coordinate and create cultural change within organisations
Local Authority Biodiversity Objectives – reporting on how meeting in 2015		Maintenance issues/cost if not adopted by Scottish Water, and once the developer passes control to the householders
Scottish Biodiversity Strategy - currently being updated. Chapter on Green Infrastructure.		Lack of financial incentive to install
SEPA diffuse pollution priority catchments – SEPA has funding to implement improvement measures in specific catchments with diffuse pollution issues		Difficult to demonstrate cost/benefit as urban watercourses & impact of surface water drainage are not given sufficient priority under WFD.
Climate Change Adaptation Framework		SUDS are not monitored (functionality - SEPA)
Tay Strategic Plan – have 'raingardens' included? (Scottish Gov).		Use of 'raingarden' – is it suitable for Scotland? Ability of organisations and professionals to agree on usage
European Green Infrastructure Strategy and associated funding (e.g. Life +, European Regional Development Fund, European Agricultural Fund for Rural Development etc.)		Health and Safety (e.g. Ponds – fencing)
Non-domestic buildings are metered so they could be used as pilot project to collect before and after data of water usage (cost benefit analysis).		Public indifference
Cost savings examples demonstrated e.g. SWT grass mowing		Perceived lack of top quality demonstration sites.
Rainscapes in Wales – good practice, lessons to learn?		'Eco-bling' perceptions i.e. they can look great, but do they actually solve any of the issues?
Flooding is increasing and has had much media attention (leverage and public awareness/likelihood to engage greater)		Public expectation versus reality of a raingarden on the ground? Could also be an opportunity
Climate Challenge Funds		National buy-in needed as well as local
Urban creep control – potential for S. Gov to introduce a raingardens planning requirement for house extensions?		Funding – at every level
Livingston South Blue/Green network project		

Table 3.8 Summary responses to the Where, Who, When, What and How questions from both workshops. Full details can be found in Appendix 3.

Glasgow	Edinburgh
Where should the focus be for the public and sectors; catchment or river basin scale? Town/city or Local Authority? National?	
A catchment scale	LA level seems most appropriate
Who should be involved and who should lead (different levels of leadership and differing remits within a lead organisation)? Who are the key sectors?	
• Universities • Forest Research • Schools	• Housing associations • Housing developers • Schools (esp. Eco-schools) • Gardening • Community groups • Commercial interest • Scottish Government • Scottish Water • SEPA • SNH • Local Authorities – multiple departments (e.g. planning, flooding, roads, education, conservation/environment) • SCOTS Flood Group • Forestry Commission • Scottish Wildlife Trust • Landscape Institute • Architecture & Design Scotland • Homes for Scotland & NHBC • Champion – Minister for Environment; SWT gardening champion
When would be a good time to run an initiative?	
Glasgow 2015 (green city year)	• Launch in 2015 to tie in with consultation on the Flood Risk Management Act (to be completed by end 2015) • Start as soon as possible
What resources and budgets are required?	

• Funding
  ○ Glasgow Housing Association
  ○ Landfill tax (may now include GI and natural flood management options -
	• Working groups
	• Publicity, communications and marketing
	• Competitions

<table>
<tr><td>allowing landfill tax for Natural Flood Risk Management)
○ Scottish Government Active Travel funding
○ SNH GI bid to Europe: SNH administering green infrastructure fund – but need 60% match funding.
○ Climate Change Fund – also needs 60% match funding
○ LEAF – have a budget of £5M over 5 years (I.e. average of £1M p.a. but not allocated that way)</td><td>• Build on the counting exercise underway
• Quality measurements - need to encourage quality raingardens, not just any old thing!
• Need to identify lead organisation/group/people and set out timetables/work-plan on next steps and responsibilities.
• Implementation of suitable raingardens to actually solve, or contribute towards the solving of a problem
• Work with competent authorities (SEPA, SW, FCS, SNH)
• Materials specifications
• Identify research priorities and retrofit potential
• Funding</td></tr>
<tr><td colspan="2">How should it be put together? How should raingarden / SUDS features be recorded and records validated? How should the work be funded? How best to engage with the general public and key sectors? How many raingardens as a target, and over what timescale?</td></tr>
<tr><td>Councils need to generate a green expectation amongst the public for green streets – find ways to stimulate interest and understanding why changes are to happen and the benefits of them.

Modular Urban Green (MUG) – could be useful demonstration features</td><td>(i) Developing an initiative
• Engage with all potential stakeholders ASAP
• Plan scale/level and timings of campaign
• Target corporate buy in
• Get things on the ground
• Exemplars
• Project team hosted within a trust/NGO
• Focus on maintenance-free / low maintenance options
• Financial incentives
• Target community groups with community gardens and schools for site to install raingardens.
(ii) Recording and validating records of ‘raingardens’
• Local Authority Flood Risk Mapping
• All LA data to go into one database (GIS) perhaps managed by Scots Flood Group?
• Consistency in counting individual features or sites
(iii) Funding
• Climate Challenge Fund
• Scottish Government
• Volume house builders - funding available for sustainability projects
(iv) Engaging general public and sectors
• Need to explain why raingardens are necessary and what’s in it for them or</td></tr>
</table>

	their community • Focus on potential to solve environmental problems . • Need different educational/promotional materials for different groups • Attractive logo • Strapline • Infographics • Animation • Social media • Website • Choose three simple messages. • Awards for best design • Promote at gardening related events: • Financial incentives • Schools • Community groups - inclusion of raingardens in community projects • Commerce – e.g. businesses who's supply chain is at risk from flooding

4. Discussion

The idea of a SUDS/GI technology initiative in Scotland has been met with enthusiastic response from the majority of those informed through this study, including professionals from industry, public bodies, and academia, across a range of sectors. This study was not able to be a comprehensive assessment of opinion from all sectors, but on the basis of interviews and consultation with a number of key potential stakeholders it is clear that a SUDS/GI technology initiative is very much needed to catalyse a culture change in relation to SUDS and GI technology in Scotland. Without this to complement the existing regulatory and policy framework that is in place, Scotland's efforts to adapt to climate change and address growing environmental pressures through GI as part of the Ecosystems Services approach are likely to remain nascent and unable to reach their full potential for a considerable time.

The success of Melbourne Water's '10,000 Raingardens' programme is inspiring and it offers an appealing model for an awareness raising and public engagement initiative, however, it is necessary to consider the transferability of a Raingardens initiative to Scotland. On the whole, the use of 'Raingardens' was considered favourably as an approach to engaging the public. Its simplicity, self-descriptive nature and ease of visualisation were reasons given for its appeal. It was also suggested that a simple approach such as this would be useful for engaging potential funders, higher management, and diverse stakeholders.

The Melbourne project was a result of years of drought and a need to start collecting and saving water. In Scotland, drought is not an issue at the moment, however, flooding is. Raingardens can help to reduce flooding by attenuating and slowing down the flow of water across our urban landscapes. Many of the elements of the Melbourne campaign are transferable to Scotland, for example, the public awareness raising and education; engagement with housebuilders and developers; engagement of the public sector.

The research undertaken as part of this study has identified Needs, Barriers and Opportunities associated with a 10,000 Raingardens for Scotland initiative, which will be discussed below. These have led to the identification of Requirements, Recommendations and Next steps in order to start the development of a successful 10,000 Raingardens for Scotland Initiative.

4.1 Needs

Two types of "needs" were identified during the scoping study: strategic environmental needs which could be addressed by a Raingarden initiative; and the specific needs required by the initiative in order for it to be a success (table 4.1). These specific needs were often identified as a solution to a perceived barrier.

Table 4.1 Needs identified by participants in the workshops and interviewees

Strategic environmental needs	Initiative needs
The management of flood risk and surface water run off	Coordinated approach, led by a single organisation and project team, agreed by range of stakeholders. Nationally led, with local delivery and catchment scale coordination if appropriate (e.g. riparian habitat creation upstream of Glasgow)
Climate change mitigation and adaptations	Cross sector and multi-organisational agreement on involvement
Solutions to the temporary storage of storm water	Agreement on terminology, key messages etc.

Education and awareness raising of GI multiple benefits	Corporate and commercial buy in – implementation of range of GI measures in areas of high footfall; provision of funding/ sponsorship;
Understanding of the additional financial savings GI can provide	Demonstration of the cost/benefits of different types of Raingardens
Supportive and enabling legislation and policy for the delivery of GI at a landscape scale	Improved legislation and policy through the engagement of national and local government
Guidance and advice of the delivery of quality GI measures and interventions	Range of different Raingarden designs suitable for different sites, scenarios and budgets. Specifications of materials, designs etc. as well as "off the shelf" solutions. Raingardens must solve, or contribute to the solution of a problem or potential future problem (e.g. flooding)
Financial incentives (or other) for the incorporation of good quality and innovative measures into new developments.	Publicity and communications strategy.
Buy-in needed from all sectors including National and Local Government; NOGs; Communities; Academics; Individuals, as well as all levers from officer to CEO.	Demonstration sites and exemplars of quality Raingardens.
Raising interest beyond statutory minima	Champions from a range of key sectors.
Need to know where features are in each LA area, need better assessment and validation.	Methods for monitoring and measuring (counting) raingardens.

4.2 Barriers

Many barriers were identified during both the interviews, and the workshops. Some of these focused on barriers to the development of the initiative, whilst some were relevant to the delivery of the initiative. During discussions, solutions were often identified, and these are listed with the barriers in table 4.2 below.

Table 4.2 Barriers and solutions identified by participants in the workshops and interviewees.

Barriers	Solution
Limited awareness of stormwater problems	Incorporate into awareness raising campaign, more of an issue in Scotland that the droughts that made the Melbourne project a success.
Limited awareness of the wide range of GI options/Raingarden types	Incorporate into awareness raising campaign with developers, planners, architects etc.
Poor quality (and application) of technologies available for "adoptable" SUDS in new developments. SUDS vesting policies can also work against best practice	Encourage Scottish Water to increase the range of systems that are adoptable; provide guidance of what's suitable for different sites ad situations, material specifications/designs etc. Encourage policy changes within National Government to create a more supportive and enabling legislative framework
Agreements on what a Raingardens is in terms of this study/initiative	Agreement between all stakeholders, what is included as a Raingarden for the purpose of this initiative
Lack of industry knowledge on options for residential areas	Promotion of residential Raingarden designs – individual household plots, housing estate community raingardens. Develop guidance,

	material specs, designs etc.
Limited knowledge/awareness of benefits of retro-fitting Raingardens.	Incorporate appropriate retro-fit options into awareness raising campaign, guidance etc.
Limited knowledge of local drainage by individual householders.	Address in campaign publicity, engage with DIY suppliers, builders and garden centres
Funding and staff resources.	Lead organisation to develop funding bid for the employment of a project team/national coordinator. All organisations involved to commit staff time to the development and delivery of the initiative as appropriate to them
Lack of financial incentives for the implementation of more than the legal requirements.	Financial incentives (or other) for the incorporation of good quality and innovative measures into new developments, production of better guidance on options available, demonstration/exemplar sites.
Securing a cultural change within organisations or teams.	Secure the support and engagement of Management level staff to instigate the cultural change from top level down. Identify supportive staff to become internal "champions" and encourage the change from the bottom up.
Public indifference to the issues of flooding and expectation versus reality of a raingarden on the ground.	Awareness raising to focus initially on areas with existing drainage problems or have experienced flooding. Public campaign to include a wide range of raingarden types and situations.
Partnership working – securing national and local buy-in from all organisations to work together rather than just being supportive of the idea.	Demonstrate multiple benefit of raingardens, for example, contribution to climate change mitigation/adaptation; financial savings; amenity and biodiversity; flood mitigation etc.
The term 'raingardens' could cause some confusion amongst certain groups of professionals as it can be used as a technical term	Initiative aimed more at general public than professional, but this can be addressed through the campaign publicity, online info and in meetings.

4.3 Opportunities

The study has identified many existing initiatives, projects, programmes and policies which a Raingarden initiative would benefit from linking with. These are listed in the Development section of table 4.3. Additionally, a range of Delivery opportunities were suggested by the workshops and interviews, which are also captured in table 4.3.

It appears that there should be different "roles" for a Raingarden initiative in different areas too, for example, an over-arching coordination role in areas with active SUDS/GI projects already, such as Glasgow Clyde Valley area, whilst a physical delivery of raingardens on the ground would be more beneficial in others areas to encourage the take up by Local Authorities, developers etc.

Table 4.3 Opportunities

Development	Delivery
Link to existing work plans, programmes and initiatives, such as Flood Risk Management Plans, Surface Water Management Plans, LBAPs and Scottish Biodiversity Strategy, Climate Challenge	Develop low maintenance systems to be more attractive to landowners, businesses etc.

Fund, Glasgow Green City 2015, Glasgow MGSDP vision, Five Streets, SNH Green Infrastructure EU Bid, SWT Living Landscapes, Livingston Blue-Green network, EU research programmes	
Tap into Climate Change message, temporary flood storage, financial savings	Focus on school grounds, active community groups with land/community gardens. Riparian flood meadows in urban greenspaces
	Target green businesses, especially with a high foot fall for demonstration sites, sponsorship etc.
	Garden centres may be interested in hosting a raingarden, selling plants and other materials badged as suitable for raingardens etc. They may also be interested in hosting or sponsoring a stand or model raingarden at horticultural and agricultural shows such as Royal Highland Show and Gardening Scotland
	Look at developing training and associated accreditation for raingarden construction
	Coordination of data collection – consistency of data collection and measures, central database

Figure 4.1 Small scale raingarden units that could be retrofitted at garden centres, commercial and industrial premises, at show-houses on new housing schemes, schools etc. Also, mobile display version could be built for use at traveling roadshows, display gardens or stands at public events.

5. Conclusions & Recommendations

1. There are a number of current and planned work programmes that provide excellent opportunities for the **launch of a Raingardens initiative in Spring 2015**. These must be investigated and their lead partners involved in the development of the initiative.
2. First steps (see below) towards establishing a Raingardens initiative should be taken as soon as practical, focusing on the **engagement of key national stakeholders** to agree aims and objectives, and **funding**.
3. All **policy and guidance opportunities** of relevance to the initiative, as outlined in Appendix 4, should be explored promptly, but most notably the update to the Scottish Planning Policy; and the development of Scottish Water's Surface Water Strategy.
4. **Research needs** and recommendations (below) should be communicated to those responsible for setting research agendas for Universities and research organisations as soon as possible. Monitoring and investigations could be facilitated by a Scottish Universities Green Infrastructure Research (SUGIR) group.

A provisional timetabled scenario for establishing a 10,000 Raingardens for Scotland initiative has been drawn up and can be seen in Figure 5.1.

5.1 Next Steps

These next steps should be taken by the Scoping study steering group and members of the SGRF as appropriate, and as soon as possible to achieve a project launch in Spring 2015 (Fig 5.1).

Engagement of key stakeholders:

- Presentation to SUDS Working Party to gain high level organisational buy-in and as potential co-partners in a national endeavour (Scoping study steering group members)
- Meetings with senior representatives of organisations to gain ideas and buy-in for the initiative. Early targets should be representatives involved in urban diffuse pollution, flooding, climate change & resilience, and green networks and from within the Scottish Government. Also approach housebuilders, garden centres; nature conservation and industry leaders and media campaigners (SGRF members)
- Seek permissions to install raingardens from parties already (notionally or otherwise) engaged; BRE, CSGNT, universities, RBGE, GCC, CEC, Scot Gov't, Scot Water, SEPA, MWH (SGRF members)
- Engagement of SUGIR group to develop research needs and contacts within research institutes and universities (SGRF members)
- Input into the update of the Scottish Planning Policy and development of the new Surface Water Management Plans (SGRF).

Establishing an initiative:

- Seek funding for a campaign co-ordinator/project team hosted at lead organisation (CSGNT/SWT). There's a need for the initiative to be nationally led, but locally delivered.
- Plan a national campaign launch at high profile conference in Glasgow in 2015, and at public events such as Gardening Scotland, Royal Highland Show (SGRF sub group).
- Start developing campaign elements, including the Vision, timescales, national and local targets, counting and monitoring procedures, engaging all relevant stakeholders, research strategy, pilot project locations etc (SGRF sub group).
- Pilot projects – identify suitable pilot projects for a range of different Raingardens as demonstrations or promotional tools and deliver in time for a launch. E.g. Modular units at

several businesses and domestic properties, city scape raingardens in Glasgow (SGRF sub group)

Research needs:

Priority research includes monitoring and modeling studies at test plot sites, and cost benefit analysis, with the aim to demonstrating a case for introducing an incentive scheme. Some of this research is already underway (e.g. Modular units), but needs to be collated to produce an informed campaign. Other research needs should be communicated to universities and research bodies by SGRF as soon as possible to identify opportunities for taking them forward.

1. Modular 'SUDS-in-a-box' Raingardens
    - Surface runoff and water quality – sewer and catchment modeling studies
    - Biodiversity assessments
    - Cost benefit analysis
    - Design guide for SUDS-in-a-box
2. Retrofitting Green Infrastructure technologies / Raingardens at the urban scale
    - GIS and street audit assessments for suitable locations
    - GI technology / Raingardens design (for flood attenuation, not just water quality (e.g. Edinburgh School of Architecture and Landscape Architecture)
    - Ecosystem services modelling studies: flood resilience, water quality, habitats/ecology, air quality, urban heat island
    - Cost benefit analysis
3. GI technology / Raingardens materials
    - Bioremediation performance (e.g. Scottish Environmental Technology Network)
    - Sustainable design – construction materials, including planting design (e.g. Edinburgh College of Art Landscape Architecture, Edinburgh Royal Botanic Garden, Scottish Agricultural College, Heriot Watt School Built Environment)
4. Creating an enabling environment
    - Cost benefit analysis into changing legislation and guidance to be more supportive of SUDS/GI implementation

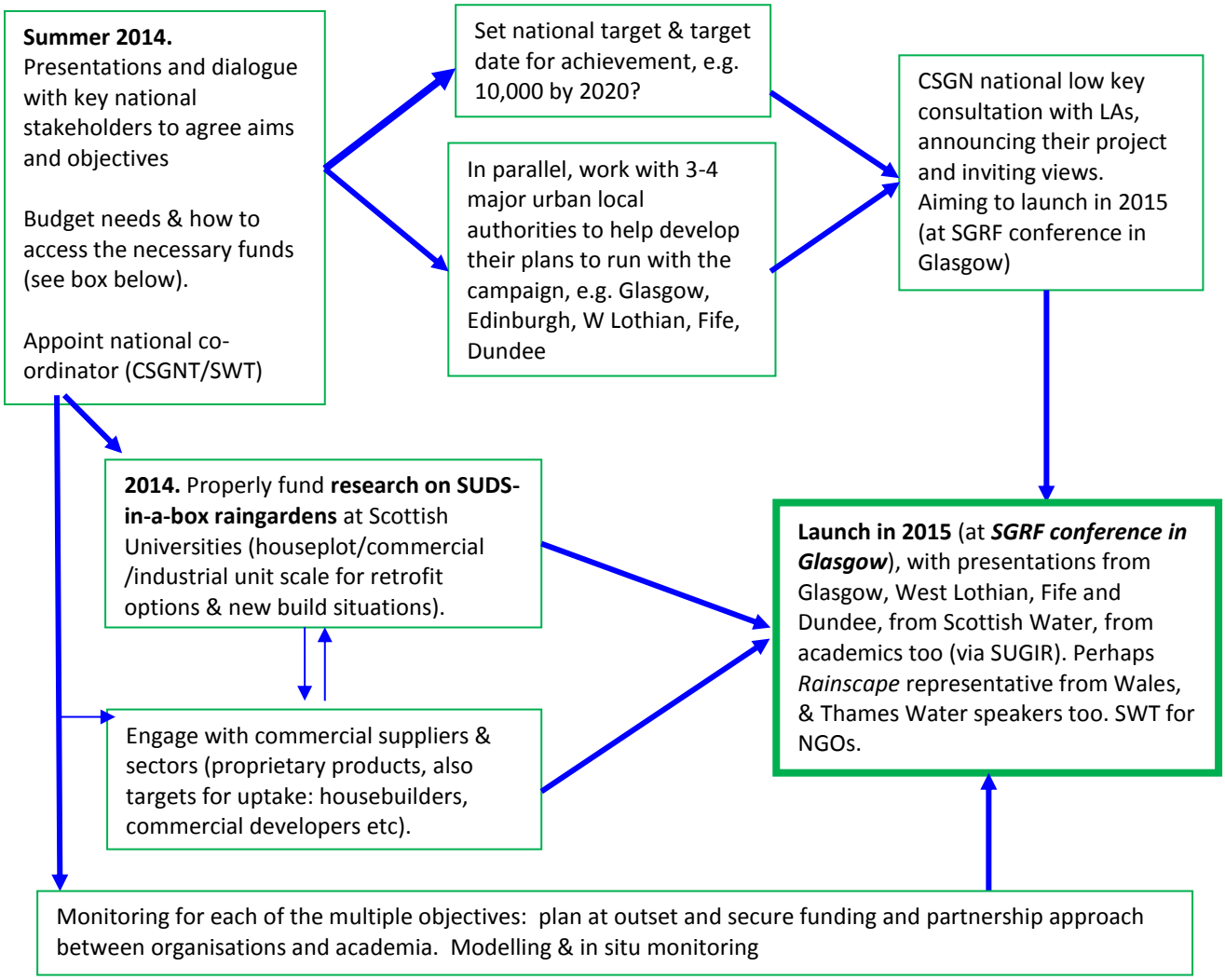
5.2 Potential Resources

1. These are in place for some key aspects, most importantly the work to count and map assets in relation to flood risk.
2. Can landfill tax rules allow budget sources to be tapped for aspects of this project? When are the rules reviewed and by whom?
3. All the larger stakeholder organisations already have a PR budget, can some of this be utilised, in kind support etc?
4. Publicity at a high profile might be possible if the idea can be sold to gardening programmes and their continuous search for new themes and ideas.
5. Capital programmes for addressing flooding problems, and also for Scottish Water/SEPA for addressing urban diffuse pollution issues by SUDS retrofits. A selection of demonstration projects will be important, and could be funded through these mechanisms.
6. Application of SUDS technology is a statutory requirement for new developments – this project doesn't add to costs or require new money for that, but it does provide higher levels of public and institutional interest in whether proposed features are fit for purpose and maximise value. Securing buy-in from planning teams in local authorities would enable them to drive this forward through the planning process.
7. Through universities/ SUGIR, target the Scottish Funding Council for raingarden technology research. Try to use political influence on other sources of academic funds to specify

raingardens research and catchment scale modelling of the diverse impacts anticipated would channel the necessary research funds.

8. Seek candidate or donor sites through interested stakeholders and use their funds for introducing their own facility.

Fig 5.1 Scenario for establishing a *10,000 raingardens for Scotland* campaign



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