Using green infrastructure to add value and assist place-making in public realm developments

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Green Infrastructure (GI), such as rain gardens, trees or permeable pavement, can provide several ecosystem services, protect biodiversity and mitigate the impacts of climate change in urban settings. Using a combination of public surveys and interviews with experts, this research evaluates opportunities and constraints for GI to add value and assist place-making in public realm developments, which is of relevance to impact assessment. The research uses the unique Woodside area in Glasgow as a case study. The project, ‘Connecting Woodside’, is a first of its kind in Scotland and lessons learned can be applied elsewhere. The study found that, to effectively utilise GI to assist place-making and add value in public realm developments, community engagement is a key aspect in developing public spaces. One of the main reasons identified for this was that GI was highly location specific. Therefore, it is important to understand the needs and wants of a place and its communities. The study demonstrated that community ownership of certain project aspects relating to GI could be beneficial for all stakeholders.

Keywords: green infrastructure; place-making; community engagement; public realm developments; maintenance of GI.
1. Introduction

Climate change is increasingly impacting on the world around us, not least in urban areas (EEA, 2012 and 2016). As the population grows and more people live in towns and cities, predicted to be 75% by 2030 (Pobiner, 2014), it is crucial that we investigate how we can manage the impacts of climate in urban areas. We should evaluate how we utilise public urban spaces, through place-making, for a multitude of human and natural benefits. The role that Green Infrastructure (GI) can play in this process has received increasing attention recently (e.g. Derkzen et al., 2017; Kopperoinen et al., 2014; Mell, 2013) and therefore it is key that research is carried out regarding how GI might be utilised in urban spaces, and perhaps most importantly, how we might engage with the people and communities that rely on these spaces to provide physical and emotional well-being.

This paper investigates how GI might be utilised to add value and assist place-making, specifically within public realm developments. It sets out some of the key issues, ideas and opinions surrounding GI within the public realm. It draws on the expertise of those within the field as well as the opinions of members of the public to inform the discussion. It approaches key topics surrounding GI and asks questions such as: What do the public know and think about GI? What are the benefits and constraints of utilising GI? What role does GI play within place-making? And to what extent should the public be engaged in the process?

The study focusses on public realm developments within Glasgow, the largest city in Scotland, in particular the ‘Connecting Woodside’ development. It is hoped that the findings will be relevant to public realm developments in both the UK and elsewhere. It will assist planners, developers and other relevant bodies to effectively incorporate GI in the public realm, particularly in densely populated urban settings, and with public engagement and place-making at its centre. The aim of this paper is to look at how best to define and measure
the value of GI within public realm developments, and how GI might assist the concept of place-making.

1.1 What is Green, Green-Blue and Green-Grey Infrastructure?

Although the term Green (Green-Blue) infrastructure is a broad concept, there is some agreement within the various definitions. Davies et al. (2006, p.2) provide a useful definition developed through stakeholder engagement. They describe GI as:

“Green infrastructure… is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, street trees and open countryside. It comprises all environmental resources, and thus a green infrastructure approach also contributes towards sustainable resource management.”

GI can also be used to support a range of ecosystem services – i.e. benefits people obtain from ecosystems, such as clean air and flood control (see Phillips and João, 2017). GI is multifunctional in nature, meaning it can provide a range of functions in a given spatial area, something that sets it apart from traditional Grey Infrastructure (Science for Environment Policy, 2012). However, there is now research looking at how to develop Green-Grey Infrastructure, where green elements are incorporated into hard infrastructure that is more difficult to replace, such as sea walls (Naylor et al., 2017). Naylor et al. (2017) refers to work by Davis et al. (2006) on the ‘green-grey continuum’, where grey infrastructure should be incorporated into the green infrastructure network and the two not regarded as distinct entities. Further to this, Mell (2013) points out that ambiguity is present in the understanding of GI’s uses and benefits in urban development, particularly between different stakeholders, and that this could impact on the way that GI is evaluated and delivered. Research has been carried out in an attempt to resolve this issue and focus on a place-based approach to GI and urban spatial planning (see Kopperoinen et al., 2014).
1.2 What is Place-making?

One broad definition of place-making comes from cultural geography, where it is seen as “how a culture group imprints its values, perceptions, memories, and traditions on a landscape and gives meaning to geographic space” (Lew, 2017, p449). This definition focuses on people and culture rather than any physical aspects. In relation to GI, physical aspects can also be incorporated, and place-making can be described as “a collaborative process by which we can shape our public realm in order to maximize shared value” (Project for Public Places, 2018). For the purposes of the study, the latter definition will be adopted to frame the discussion. Generating new GI can increase a sense of place and one of the benefits could be social value (Alzahrani et al., 2017).

In Scotland, the Scottish Government has a drive to create more sustainable communities and places (Scottish Government, 2011). GI has a major role in this place-making approach as it can provide multifunctional benefits such as mitigating flood risk, enhancing urban ecosystems and improving human well-being (CIRIA, 2014). The latter in particular is of high importance to densely populated urban areas and has been highlighted by Wolch et al. (2014). They also argue that access to public green space is an environmental justice issue, often disproportionally affecting minority or low-income groups and that specific factors for this will vary from place to place. It is therefore important that both the views of communities and place-making are considered when implementing GI in urban developments.

1.3 Relevance of GI for Impact Assessment and of Impact Assessment for GI

Given that strategic environmental assessment (SEA) of policies, plans and programmes and environmental impact assessment (EIA) of projects support decision making (by law) worldwide, they can be a useful framework to promote GI. This could be, for example, by
suggesting that GI can be used as a mitigation measure for climate change (Matthews et al. 2015). While the enhancement potential provided by GI could enrich the impact assessment process if we aim to emphasise enhancement in all forms of impact assessment (see João et al., 2011).

How GI is currently being used in impact assessment is therefore of interest. Fischer et al. (2018) studied how GI was used in three types of impact assessments (health impact assessment (HIA), SEA and EIA) in order to evaluate health aspects associated with the planning of urban green space. They evaluated the impacts on human health related to green spaces with regards to both biophysical (climate function, air quality, noise, water/flooding and fauna/flora) and social and economic aspects (social cohesion/exclusion/support, physical activity, mental well-being, neighbourhood environment/attractiveness, crime and anti-social behaviour, improved environmental and ‘healthy’ access to services/amenities). Fischer et al. (2018) found that green spaces, and their associated impacts on human health, were considered in HIA, EIA and SEA in different ways and formats, but there was potential to develop further the value of GI for impact assessment.

2. Methods and Data

This section introduces the study area and then describes the methods carried out: a public survey and semi-structured interviews with experts.

2.1 Glasgow and the Woodside Area

Glasgow is Scotland’s largest city, both in population and area, and the UK’s third largest after London and Birmingham. This makes it useful for comparison purposes to other major cities around the world. Glasgow is known locally as ‘The Dear Green Place’ (People Make Glasgow, 2018) due to the high proportion of publicly accessible green space in the city,
which makes up 30% of its land area (Greenspace Scotland, 2012, p18). However, around six in 10 people in Glasgow also live within 500 metres of derelict land. Glasgow’s air quality is also an issue, where traffic related air pollutants exceed UK air quality targets (Understanding Glasgow, 2018).

In September 2017 Glasgow City Council (GCC) secured £8 million match-funding from Sustrans, a UK sustainable transport charity, to develop cycling and walking infrastructure within the Woodside area of Glasgow. The development is set to include 3km of segregated cycling tracks, increased permeability and connectivity and have a focus on place-making (GCC, 2018a). A map of Glasgow outlining the project area and survey locations can be seen in Figure 1.

[Figure 1 Near Here]

The project, known as ‘Connecting Woodside’ is a first of its kind in Scotland. GCC has many similar developments in the pipeline as part of its Glasgow City Centre Strategy, specifically its Glasgow City Avenues projects. GCC are investing £115 million to deliver its Enabling Infrastructure – Integrated Public Realm (EIIPR) programme. The various projects under EIIPR have a strong focus on the public realm and place-making, with GI forming part of the concept (GCC, 2018b). Therefore, there is scope to investigate the role urban Green Infrastructure can play within these types of public realm projects.

2.2 Public Survey
A public survey with a total of 48 questions was carried out during June and July 2018 and 51 responses were obtained. Although the number of survey responses was lower than anticipated, the surveys completed were very detailed and provided a rich set of data used in this paper. Data was collected through a combination of face to face and online surveys.
Online surveys were distributed through several local channels (see Table 1). Face to face surveys were carried out at various locations (see Figure 1).

[Table 1 Near Here]

The survey questionnaire was structured into six main sections. The first section focussed on demographic information. Next, several awareness questions were asked in relation to key terms, such as GI and place-making. The next section provided examples of GI measures using pictures and a short description. The pictures of GI used can be seen in Figure 2.

The questionnaire asked respondents to rate each GI measure on a scale. A 10-point rating scale was chosen based on work by Preston and Colman (2000), where 10-point scales were found to be relatively easy to use and allowed for respondents to express their feelings to a much greater extent than narrower scales. Respondents were also asked for any specific reasons for the rating given for each measure.

[Figure 2 Near Here]

The next section of the survey used a matrix style rating scale based around the theme of place. This was adapted from an online tool called ‘Place Standard: How good is your place?’ (Place Standard, 2018). Respondents were asked to rate different aspects of their area. Although Place Standard uses 14 aspects, only eight of these were selected as relevant to this study because they dealt with key themes such as public space, green areas and community. A full list and description of the aspects of place included can be seen in Table 2. Finally, there was a matrix question using a 5-point Likert Scale ranging from ‘Strongly Agree’ to ‘Strongly Disagree’.
2.3 Interviews with GI Experts and ‘Connecting Woodside’ Stakeholders

Semi-structured interviews were carried out with four key experts and practitioners. Respondents were from Scottish Natural Heritage, Glasgow City Council, Sustrans and the University of Glasgow. Table 3 provides further information about the interview respondents. This was important to allow for data to be gathered from differing viewpoints, relating to various topics surrounding GI, such as the type of GI considered and the role of place-making.

Semi-structured interviews were chosen to ensure that key topics and ideas surrounding GI and place-making were covered, whilst allowing a degree of flexibility for the interviewer and respondent to explore ideas. Also, given the scale of the research, it was deemed more appropriate to use this type of interview (Drever, 1995).

Interview questions were set out into five main sections, covering opening questions, GI and place-making, GI measures, GI policy and public involvement (see Table 4). The topics and questions in the interview were chosen to cover key themes from the GI literature, be relevant to the case study, gather specific information that would relate to public realm development, and use ratings based on equivalent work by Preston and Colman (2000) and Place Standard (2018) so findings could be comparable. Throughout the interviews, other questions were asked, and ideas explored where they presented themselves. Interviews were carried out face to face, audio recorded and lasted between 30-40 minutes.
3. Utilising GI to Add Value and Assist Place-making in the Public Realm

Of the 51 responses to the survey questionnaire, 19 were Woodside residents and 32 non-Woodside residents. Of the non-Woodside residents, 26 lived in Glasgow and six lived elsewhere in Scotland. This section explores the data collected in seven themes: 3.1 public awareness of ‘Connecting Woodside’, GI and place-making; 3.2 using GI in the public realm; 3.3 benefits and constraints of using GI in the public realm; 3.4 maintenance and litter in public spaces, 3.5 measuring the value of GI; 3.6 using GI to assist place-making; and 3.7 using public engagement for better GI and public realms.

3.1 Public Awareness of ‘Connecting Woodside’, GI and Place-making

Survey respondents’ awareness of key projects and terms, split by Woodside and non-Woodside residents, can be seen in Table 5.

[Table 5 Near Here]

Out of the 24 text responses, 11 mentioned the themes of cycling or active travel, which is the focus of ‘Connecting Woodside’. Only three responses mentioned the theme of greenspace, two mentioned infrastructure, and five respondents had heard of the project but did not know what it was about (see Figure 3). This does suggest that the key message of active travel in the project is getting across to the public. However, other elements, such as greenspace, are less apparent. In this regard, IA could help support a better public understanding of various project elements and how they might be utilised within the public realm. Open green space is something that CH1, the ‘Connecting Woodside’ Project Coordinator at Sustrans, indicated there was a lot of potential for within the Woodside area.

[Figure 3 Near Here]
A higher percentage of Woodside residents were aware of the term Green Infrastructure than non-Woodside residents, with 53% and 48% aware of it, respectively (see Table 5). Amongst these respondents there was a general understanding that GI related to greenspace or nature with 13 instances of this theme from 18 responses. The main themes that were evident are shown in Figure 4. Another theme apparent, but to a lesser extent, was the understanding that GI is multifunctional, providing a range of services. One respondent wrote:

‘Areas of green space e.g. lawns, trees etc. Put in place to help with clean air, and to encourage natural biodiversity. Also, potentially for wellbeing and happiness of people in the area, as provides space for leisure, relaxation and looks nice etc’.

Four respondents also linked GI to place-making with one respondent writing that GI was partially ‘the creation of liveable places with tree and plants’. This is one indication that including GI within public realm developments can assist in place-making.

It was apparent from the responses that the term GI can mean several different things to different people and this was also reflected in the interviews, with LA1, CH1 and AC1 all referring to this.

This idea that GI constitutes several different things must be considered when looking at how we can utilise it within public realm developments. It might be that the use of GI in the public realm will depend on the location or site itself and therefore the needs and views of residents will be of high importance.

Most of the survey respondents were not aware of the term ‘place-making’, with only 21% of Woodside and 35% of non-Woodside residents indicating they were aware of the
term (see Table 5). Amongst those that were aware of place-making, there were a few key themes within their understanding of the term which are shown in Figure 5.

Interestingly, given the low awareness of the term, one of the main themes was that of community engagement. One respondent described place-making as ‘stakeholder centred urban design’, whilst another thought of it as ‘empowering local communities to take an active role/have a voice in making a site more beautiful and user friendly for that local community’. Place-making is another key part of ‘Connecting Woodside’ and these responses highlight that community engagement regarding the public realm must be considered. These findings relate well with the definition of place-making as a collaborative process to maximise shared value. When taken against the themes discussed shown in Figure 4 it can be argued that GI can play a key role in assisting place-making within public realm developments. This is reflected in the interview responses of experts. PB1 provided an example of place-making at Colquhoun Square, Helensburgh (Scotland), where better use of GI added value and increased functionality making areas look ‘striking’ (PB1, pers. comm., 25 June 2018), but did not provide other functions, such as shading or habitat. In contrast, PB1 spoke of similar spaces in Minorca (Spain), where GI has been used to create shade and simultaneously increase attractiveness and biodiversity. The view that GI could be better utilised to add value and function in the public realm was also expressed and discussed in detail by LA1 and CH1.

These responses, both from the public and experts, indicate that by using elements of GI to provide additional benefits within the public realm, GI can assist in place-making. Further to this, IA can assist this process by supporting a better public understanding of the concepts involved, facilitate active public involvement in how GI is implemented and inform
developments as they move forward, as part of a collaborative process. The next section will consider different types of GI and how they might be utilised to add value and assist place-making within public realm developments.

3.2 Utilising Green Infrastructure in the Public Realm

Derkzen et al. (2017) have previously pointed out that it can be difficult to gauge the public’s preference for GI in the public realm. Survey respondents were asked to rate several different examples of GI, shown in Figure 2, and provide any explanation for the rating given. The ratings given to each example can be seen in Figure 6.

[Figure 6 Near Here]

As can be observed, ratings of value 7 or above constitute over 60% of the responses for most of the examples, except green screens, which was slightly below 60% and bee benches, which was slightly below 50%. This indicates that there is a general public appetite for the use of GI within the public realm.

Based on ratings of value 7 or above, flower meadows proved to be the most popular, alongside urban rain gardens, living walls, city street trees and greened benches. Flower meadows generally received higher ratings as they were thought to be attractive and they provide high biodiversity benefits. Urban rain gardens were popular due to the flood mitigation benefits, which aligns itself with the issues of flooding in Glasgow. One respondent said, ‘flood risk is becoming a more prevalent issue so green spaces are needed for water to drain naturally’. Respondents gave several reasons for liking green walls, such as biodiversity, aesthetics, noise reduction and positive impacts on mental health. City street trees were also popular as people liked how they looked on the street and that they provided habitat and shade. However, this was one measure that also flagged up the issue of
maintenance. Finally, greened benches were also popular as they would provide a nice place to sit. It should also be noted that litter was cited as an issue here (see also section 3.3).

GI measures that received slightly lower ratings, although popular overall, included green screens, green traffic islands and roadside planting. Bee benches received mixed ratings from the public. Lower ratings for bee benches generally related to the proximity of the bees to people using the benches. Others who gave higher ratings for bee benches liked the fact they provided habitat for the bees and that would be good for biodiversity. This suggests that these types of benches would be better used in less built up areas within the public realm. In relation to these public ratings, IA could provide valuable data regarding the possible benefits and/or constraints of GI measures, which could in turn be disseminated to the public for a more informed result. Likewise, this type of data gathering could also be incorporated as part of an IA process, seeking to improve projects or public realm developments.

The study identified several benefits and constraints of utilising GI. An overview of these can be seen in Figure 7. One of the main benefits that came across is that GI is multi-beneficial. LA1 stated, ‘the main benefits are that its multi-beneficial to put GI into cities’ (LA1, pers. comm., 4 July 2018) and AC1 said, ‘they’re [GI measures] seen as the magic fix for a lot of urban problems’ (AC1, pers. comm., 20 July 2018). This was also recognised several times in the public responses to GI measures.

[Figure 7 Near Here]

The benefits of GI on health and well-being also came across strongly and has been previously highlighted (e.g. Ernststson, 2012; Fischer et al., 2018; Wolch et al., 2014). AC1 provided in-depth insight into GI’s positive impact on ‘well-being, mental health, life expectancy and child’s play’ (AC1, pers. comm., 20 July 2018). Interestingly, this concept was backed up during a face to face survey with a member of the public when talking about a
local community garden. They said it is ‘really nice for kids, engaging them first thing in the morning, therapeutic use of space’. Such findings could be incorporated into, and supported by emerging forms of IA such HIA and Social Impact Assessment (SIA), to improve and enhance project outcomes.

The use of GI in surface water management was also apparent and of importance to Glasgow, which has issues of flooding. This aspect was discussed by both LA1 and PB1. PB1 cited the biggest benefit as GI’s impact on climate change, issues of flooding and surface water management. LA1 elaborated on this aspect stating:

‘surface water management, rather than putting in hard engineering, say for instance pipes, which have a capacity, if you put in GI, areas can flood and let water flow, it has benefits in terms of reducing the impact of flooding and managing surface water’ (LA1, pers. comm., 4 July 2018).

LA1 also alluded to further benefits that this has had within Glasgow, such as freeing up new sites for regeneration which have previously been unsuitable or providing drainage for sites that are already at drainage capacity. This shows that including GI within public realm developments can not only have benefits for that development but also wider benefits for development and regeneration. The benefit of surface water management was also well supported by the public and reflected by their ratings of urban rain gardens, shown in Figure 6. One respondent said, ‘anything that prevents flooding is a good thing and again it’s nice to look at’.

Visual and aesthetic benefits were also apparent from the study as well as increasing biodiversity through measures such as roadside planting or flower meadows over traditional ‘Grey Infrastructure’. Biodiversity regularly featured within all the interviews.

There were also several constraints that were apparent and that could impact on how GI is used within the public realm. Maintenance was highlighted as a constraint and is
discussed in section 3.3. Another constraint that came through strongly from the interviews was that stakeholders, such as planners and developers, might be quite risk averse when it comes to implementing GI. It was suggested that it was often difficult to convince decision makers to include GI as it was often too innovative, untested or certain elements of it were not working to the desired level. It was suggested that developers may choose ‘business as usual’ to avoid any extra burden. This indicates that there may be issues with policy in this area.

Other constraints included the funding of GI measures or projects and the initial cost of implementation. AC1 mentioned that the cost of GI is often more expensive, ‘certainly in the short term’ (AC1, pers. comm., 20 July 2018) but if you were able to evaluate the benefits of GI beforehand, this might make persuading decision makers easier. LA1 discussed how it can often be difficult to fund a ‘suite of GI’ (LA1, pers. comm., 4 July 2018), making specific reference to green walls as being quite difficult as they do not fit with the drivers of the developers. Mell (2013, p163) points out that practitioners could benefit from an ‘additional awareness of the end value of investments’. Therefore, this is certainly an area where impact assessment can assist the successful implementation of GI.

PB1 cited obtaining match funding as an issue. There were also constraints relating to the complexity of implementing GI such as placing natural elements within an urban environment and dealing with contaminated land. The study highlighted several benefits and several constraints to implementing GI in the public realm. By gaining a better understanding of these, ways in which GI can be better implemented in the public realm can be developed.

For all of the benefits and constraints identified here, in particular GI’s impact on mitigating climate and increasing biodiversity, IA could help support these findings by providing further data to inform decision making and encourage the use of GI in public realm developments.
3.3 Maintenance and Litter in Public Spaces – is GI a Help or Hinderance?

As discussed, the issues of maintenance surrounding GI were apparent in both the interviews and the survey. The issue of litter was also highlighted by survey respondents. When asked to provide explanations for their ratings of GI measures, respondents often cited issues surrounding maintenance. A summary of the survey responses collected can be seen in Table 6.

[Table 6 Near Here]

Some comments were directly in relation to the GI measure in question and some were more general in their scope. Several survey respondents said that maintenance would be an issue generally, whilst others were concerned about GI measures causing specific maintenance issues. For example, when responding to flower meadows, which rated very highly (see Figure 6), some expressed concerns regarding weeds. While LA1 pointed out that maintenance costs may increase if GI is replacing traditional grey infrastructure such as concrete. However, Naylor et al. (2017) have shown that switching road verges from mowed to meadow flowers can reduce mowing and litter picking maintenance costs for the local authority, whilst providing increased biodiversity and public amenity. While Sikorski et al. (2018), found that low-maintenance GI was an economically feasible and socially acceptable solution to greening a city and Mekala et al. (2015) assigned value to GI’s service provision which could potentially offset maintenance costs.

Similarly, in relation to street trees, one respondent wrote ‘Provides shade, relaxing, free to use for everyone, not just for shopping. If big trees, can cause problems if not maintained’, and another that ‘root management [is] important’. Therefore, it is important to note here that there is a clear desire for GI measures to be implemented and that the public do recognise some of the benefits, but there is also a real concern from residents about how they
are selected, installed and maintained. It can be argued that more information regarding maintenance of GI measures needs to be made available to the public so that a more informed decision can be made. Again, this is another area that that could be supported by IA.

Several responses also related to litter and how certain GI measures could increase or cause this problem. This was particularly apparent when asked about their ratings for greened benches. Again, this GI measure received good ratings (see Figure 6) and the respondents recognised the benefits while at the same time pointing out possible litter issues. This certainly suggests that the public like this idea but, if it was implemented, reasonable provisions would need to be made, such as bins to gather litter. However, it does also indicate that there is a problem with litter generally, regardless of whether GI is present, and that actions need to be taken to tackle problem litter.

3.4 Measuring the Value of GI

It is generally accepted that there are multiple values of green infrastructure (e.g. Wild et al., 2017). The interviews corroborated this by indicating that there was not one single measure that could be used to assess the value of GI. This seems to stem from the fact that GI is multifunctional in nature and provides a range of benefits, which might be financial, ecological or social, as pointed out by Demuzere et al. (2017). This was reflected within the interview responses with all respondents pointing out the difficulty of incorporating these different ‘values’ into a value assessment of GI. This might be assisted by IA relating to specific projects. It was much easier to assess the initial cost of implementing GI than assessing a value harder to quantify, such as social benefits or long-term gains which take time to manifest themselves, such as health improvements. AC1 suggested several ways to measure GI’s value, such as cost or biodiversity, and that clear goals must be set to implement GI effectively. Interviewees also suggested that opportunities are often missed in
terms of monitoring of projects, often because there is little resource to do this, indicating there is often a lack of information informing the next project. IA could be beneficial here, if set up in such a way as to continue monitoring the impacts after project completion.

CH1 discussed that it is often difficult to measure social benefits in a meaningful way. These benefits tend to come after and are difficult to account for before they happen. Therefore, it could be argued that engaging the public at an early stage, for example as part of IA, can help gauge how beneficial certain GI measures might be in this respect. There were several examples of social benefits in the survey responses to GI measures. One respondent simply wrote ‘happiness’, in relation to street trees. Another wrote, ‘I love looking out my window and seeing green areas… I can see the swans from my window’. As CH1 outlined, this type of value is quite difficult to quantify when it comes to developers implementing GI. Therefore, this furthers the importance of GI monitoring for public realm projects, which could be incorporated into the IA approach of developers.

To enable effective monitoring within public realm developments, it is important that baseline data is available so that any improvements, or otherwise, can be assessed properly against this baseline. This is something that is generally difficult to do due to financial constraints. However, CH1 explained that this is an area Sustrans is beginning to develop. This aspect of monitoring is particularly crucial when considering long term benefits, such as health. Therefore, it can be argued that gathering baseline data and monitoring is key to utilising GI in future public realm projects.

3.5 How Can We Utilise GI to Assist Place-making?

The questionnaire asked respondents to rate, on a scale of one to seven, certain aspects of place, based on the descriptions detailed in Table 1, for their area. The ratings were based on how residents felt their area currently met these place aspects. The results of how Woodside
residents responded to these questions are shown in Figure 8. This showed varying ratings from residents across the various aspects.

As can be seen in Figure 8, the aspects that rated quite highly amongst Woodside residents were ‘feeling safe’, ‘social contact’ and ‘moving around’, which over half of the respondents gave a rating of 6 or above. Perhaps more relevant, aspects which related more closely to GI, such as ‘care and maintenance’, ‘streets and spaces’, ‘play and recreation’ and ‘natural space’, did not receive such a high proportion of ratings 6 or above and shifted slightly towards the middle of the scale. This suggests that some Woodside residents feel that improvements could be made in these aspects of place that GI can have a significant impact on. For example, for ‘play and recreation’, around 35% of respondents gave this aspect a rating of 3 or below. For all the aspects of place included, there was a clear variation in the ratings that Woodside residents provided. This suggests that issues surrounding this can be very localised depending on where you live or how you interact with these places.

Respondents were also asked to what extent they agreed or disagreed with several statements that related to GI and place-making. This question was asked near the end of the questionnaire so that respondents had a better understanding of different GI measures and the concept of place-making. As can be seen (Figure 9), most respondents either strongly agreed or agreed with all the statements, and only a very low proportion strongly disagreed.

It was strongly felt that community opinions and ideas should always be considered in public realm developments, with around 95% of respondents strongly agreeing or agreeing. This is another aspect that could be supported by IA. Agreement was also high with
statements that related to GI or greens spaces. Again, around 95% of respondents would welcome GI being implemented within public spaces in their area and around 90% that GI would improve public places. Around 90% of respondents agreed that more use could be made of open spaces in their area and around 85% that more green space would make their area a nicer place to spend time in. All of this suggests that there is strong public support for both implementing GI in the public realm but also that this would improve the quality and social functions of a given area.

As ‘Connecting Woodside’ is mainly a cycling infrastructure project, a statement was given about improving cycling infrastructure. In relation to this, over 60% of respondents agreed that if this was improved, they would cycle more often. It could be argued that combining cycling and green infrastructure within this type of project could have wide ranging social and environmental benefits which would assist a place-making model. One survey respondent suggested that cycling projects should not just be about the cycling infrastructure and should also include other elements.

The study demonstrated strong public support for utilising GI within the public realm. So, how can GI be best utilised within the public realm to assist place-making? Place-making is one of Glasgow’s core policies within its City Development Plan (GCC, 2017), and therefore how this is achieved is important.

Experts indicated that the use of GI within the public realm needed to be specific to the location(s) involved in any project. Both LA1 and CH1 discussed this in detail describing how consideration of which GI to use would depend the specific nature and constraints of an area. For example, this would be different for an historical city centre or a busy main road junction. Therefore, given the site-specific nature of designing and utilising GI within the public realm, it can be argued that community involvement is even more important, and that effective and focused IA is essential. Further to this, PB1 outlined that they thought GI could
help make an area or space more liveable and easier for people to interact with. GI can not only be utilised to add several benefits but also make it easier and more attractive for people to move in and around certain spaces.

3.6 Utilising Public Engagement for Better GI and Public Realms

It has been shown that community engagement has an important role regarding GI and public realm developments. This includes gauging preferences for GI measures, identifying key barriers or concerns surrounding GI, and in evaluating the social and health benefits of GI. The study has shown evidence that there is an appetite from the community to be involved in developing the public realm.

The importance of public engagement was also reflected in the interviews. LA1 felt that more public involvement was generally important in planning, specifically across different stages of the process. Interviewees added that it was often difficult to involve communities at a strategic policy level. AC1 also acknowledged that it was important but did point out that there are ‘complexities in how you do that, who you choose to engage with, and at what level’ (AC1, pers. comm., 20 July 2018). CH1 felt it was important to simply make sure communities got what they wanted. This way any concerns could be assessed within specific public realm projects, while in contrast not involving the public would be counterproductive to creating places for the people that use them. Finally, PB1 explained that SNH have recognised community engagement within their project assessment for funding from the Green Infrastructure Fund. It is clear then, that community engagement is an important element both from the point of view of the public, and of practitioners in the field.

Within the interviews, it was apparent that giving a community a stake or some ownership within a project, that this could be beneficial and provide better outcomes for all stakeholders. This topic was discussed on some level by all interviewees. LA1 discussed it
terms of what features GI might deliver and linking those to community stewardship and management. To do this, it would be key that communities are involved from an early stage so that an active community role can be developed. AC1 pointed out that it is not always about implementing new GI but also making the public aware of what is already there. AC1 also suggested that by simply involving the community in the process, that community can gain a better understanding of the process, even if they do not get their desired outcomes. Therefore, this aspect of community engagement is an area that could certainly be developed to provide benefits to the community, but also developers, planners and other stakeholders. It can be argued that all of these aspects can be facilitated through effective and timely IA.

Another aspect highlighted by the study was the communication or dissemination of information and knowledge regarding GI and its features. LA1 explained that it was often difficult to relay the benefits of GI on a wider scale, where the benefits might be felt elsewhere in a network or involve more technical aspects. They suggested that some community engagement might be more about creating a better understanding of what GI is, what it does and why investment is needed. Other interviewees discussed the importance of developing public engagement that offered an informed choice regarding GI. This has been carried out to some extent regarding ‘Connecting Woodside’. However, information about GI made up a very small proportion of the overall material presented at a drop-in public consultation held at Woodside Library in June 2018 and via the GCC’s website (GCC, 2018). This is an area of community engagement that may need to be developed specifically for GI. In addition, ways of effectively communicating information and knowledge of GI to the public needs to be investigated and possible implemented through various forms of IA.

4. Conclusions
To effectively utilise GI to assist place-making and add value in public realm developments, this paper has shown that community engagement is very important, with both the public and
practitioners agreeing that it was a key aspect in developing public spaces. One of the main reasons identified for this was that GI was found to be very location specific. Therefore, it was important to understand the needs and wants of a place and its communities. It has also been demonstrated that community ownership of certain project aspects relating to GI could be beneficial for all stakeholders, particularly in relation to ongoing maintenance and a sense of community control. Impact assessment could play a role in this, both at project and strategic level. Söderman and Saarela (2010), for example, suggested that GI planning should be used in SEAs of spatial planning.

This paper has also discussed how IA, in various forms such as EIA, HIA or SIA, has a key role to play in supporting many of the findings of this paper. IA could be utilised to support a better public understanding of GI and its implementation in public realm developments. Also, IA’s role monitoring the social and health benefits of GI could be very beneficial and enhance long term project outcomes. IA could also provide valuable data regarding certain aspects of GI, such as its effects on climate impacts and biodiversity. IA has the potential to be a vehicle to enhance and improve public engagement and active involvement in public realm developments, specifically when considering GI. In relation to place-making, IA can help facilitate a collaborative process between those who live, work, study or spend time in a place and those that are involved developing those places, such as local authorities and developers. Through this process, IA can help shape places to provide more shared value within that place and assist place-making.

The multi-functionality of GI was recognised by both the public and practitioners, in particular GI’s ability to improve the aesthetics of an area, increase biodiversity and mitigate flooding. One key benefit, recognised both by the public and practitioners, was the positive impacts on health and well-being that GI can have (similarly to the findings by Fischer et al., 2018). However, it was also found that these benefits were often difficult to measure and
assign value to in relation to GI, as they either happen over long time periods, in the case of physical health, or are often difficult to quantify, in the case of the mental health benefits. So, work needs to be done to incorporate this into planning and implementation of GI. The aesthetic appeal that GI can bring to an area was also strongly identified by the public. However, it should be noted that this can lead to ‘ecological gentrification’ that lowers opportunities for the existing community (Wolch et al., 2014).

There were also constraints identified in utilising GI within the public realm. Most of these were apparent from the point of view of practitioners. The risk aversion of planners and developers to implement GI was a major barrier identified. It was suggested that GI was often seen as an extra burden for developers and that there was not significant buy-in to the benefits of GI from those involved in projects. Another key constraint was the up-front cost and funding of GI. It was suggested that implementing GI is often costlier initially and that it was difficult to relate this to cost savings or social benefits further down the line. Securing adequate funding for the implementation of GI is therefore critical. This is certainly an area where IA can assist the successful implementation of GI, as discussed by Mell (2013).

Maintenance of GI was an issue that was often apparent and crossed between both benefits and constraints, and ties in with the importance of monitoring in IA. The public was generally concerned with the maintenance of green features as opposed to traditional grey infrastructure, some suggesting that current features were not maintained or concerned that they might not be maintained in the future. For example, GI being more susceptible to gathering litter or looking untidy. However, the benefits that certain GI can have for maintenance, such as reduced maintenance costs were also recognised by both the public and practitioners. The importance of maintenance means that there should be a cost associated with maintenance, but this cost does not need to be a barrier for GI development. For example, Mekala et al. (2015) made a case for public investment in urban GI in the City of
Brimbank (Australia) by quantifying the values of cultural and regulating ecosystem services, which were found to potentially offset annual maintenance costs.

If GI is to assist place-making it needs to “generate places that can improve the relationship between users and space” (Alzahrani et al., 2017, p. 752). Regarding future practice, this study has found that baseline data collection and monitoring of projects that include GI need to be improved and developed. The way this information is effectively communicated also needs to be developed and incorporated so that it is more understandable to the non-technical public. Finally, public engagement for public realm projects could be enhanced to allow for a better understanding of the needs and wants of the areas and communities involved and allow for a smoother process overall.

References


Mell, I.C. (2013), Can you tell a green field from a cols steel rail? Examining the ‘‘green’’ of Green Infrastructure development, Local Environment 18(2), 152-166.


Place Standard (2018), Place Standard: How Good is Our Place, [online] Available at: https://www.placestandard.scot/ Accessed 20 October 2018.


Tables:

Table 1 - List of organisations and type of distribution for online surveys.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Distribution Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodside Community Council; University of Glasgow Bicycle Users Group</td>
<td>Description and link shared social media</td>
</tr>
<tr>
<td>Queens Cross Housing Association</td>
<td></td>
</tr>
<tr>
<td>Woodside Library; Woodside Gym; In Bloom Café; Maryhill Community Halls</td>
<td>Posters and flyers with link and QR code</td>
</tr>
<tr>
<td>Queens Cross Housing; The Mackintosh Church; Woodside Health Centre</td>
<td></td>
</tr>
<tr>
<td>City Cycling Glasgow Forum</td>
<td>Description and link posted in Connecting Woodside</td>
</tr>
<tr>
<td>Forum and dedicated forum post</td>
<td></td>
</tr>
<tr>
<td>Glasgow Triathlon Club</td>
<td>Link provided to contact at club</td>
</tr>
<tr>
<td>Agile City</td>
<td>Link provided to contact at organisation</td>
</tr>
</tbody>
</table>

Table 2 - Place aspects and descriptions included in the survey (Source: Place Standard, 2018).

<table>
<thead>
<tr>
<th>Place Aspect</th>
<th>Description in Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural space</td>
<td>Natural space includes parks and woodlands, fields, streams and rivers, green space alongside</td>
</tr>
<tr>
<td></td>
<td>paths and roads, and tree-lined streets. These can be good for wildlife, improve air quality</td>
</tr>
<tr>
<td></td>
<td>and benefit our health and well-being.</td>
</tr>
<tr>
<td>Play and recreation</td>
<td>Good places encourage children to play and allow adults to enjoy leisure and sporting activities. Opportunities for play and recreation can improve the quality of our lives and our health.</td>
</tr>
<tr>
<td>Streets and spaces</td>
<td>Buildings, landmarks, greenery, views and natural landscape can all help to create an attractive, distinctive place that people enjoy. These features can also help people to find their way around.</td>
</tr>
<tr>
<td>Moving around</td>
<td>Walking and cycling are good for our health and the environment. Pleasant and safe routes can encourage walking and cycling.</td>
</tr>
<tr>
<td>Social contact</td>
<td>Feeling isolated can be damaging to our health and well-being. Good places provide a variety of spaces to meet and spend time with others.</td>
</tr>
<tr>
<td>Feeling safe</td>
<td>How safe a place feels can affect people’s well-being and how they spend their time in the place. Well-designed places can help make places feel safer and reduce crime and antisocial behaviour.</td>
</tr>
<tr>
<td>Care and maintenance</td>
<td>Places that are well cared for can make us feel positive, while those that are not looked after properly can have the opposite effect. Proper maintenance arrangements allow people to feel supported and more positive about where they live.</td>
</tr>
<tr>
<td>Influence and sense of control</td>
<td>People’s views about their local area should be heard. Having a voice in decision making and feeling able to make changes can help to build stronger communities and better places.</td>
</tr>
</tbody>
</table>
Table 3 - Interview respondents.

<table>
<thead>
<tr>
<th>Interview Respondent</th>
<th>Organisation and Description</th>
<th>Job Title</th>
<th>Interview Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic 1 (AC1)</td>
<td>University of Glasgow</td>
<td>Green Infrastructure Research Assistant</td>
<td>20/07/28</td>
</tr>
<tr>
<td>Public Body 1 (PB1)</td>
<td>Scottish Natural Heritage – Promotes and cares for Scotland’s natural environment.</td>
<td>Green Infrastructure Funding and Project Officer</td>
<td>25/06/18</td>
</tr>
<tr>
<td>Charity 1 (CH1)</td>
<td>Sustrans – Active travel charity.</td>
<td>Project Coordinator, Community Links Plus Senior Project Officer</td>
<td>05/07/18</td>
</tr>
<tr>
<td>Local Authority 1 (LA1)</td>
<td>Glasgow City Council – Scotland’s largest local authority in terms of population.</td>
<td>Senior Project Officer</td>
<td>04/07/18</td>
</tr>
</tbody>
</table>
Table 4 – Interview schedule

<table>
<thead>
<tr>
<th>Interview Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opening Questions</strong></td>
</tr>
<tr>
<td>Q1. Could you explain your current role and what relation it might have to Green Infrastructure?</td>
</tr>
<tr>
<td>Q2. Are you aware of Glasgow City Council’s ‘Connecting Woodside’, formerly ‘Woodside Mini Holland’ development? If yes, what do you know about it?</td>
</tr>
<tr>
<td><strong>GI and Place-making</strong></td>
</tr>
<tr>
<td>Q3. What is your understanding of Green Infrastructure?</td>
</tr>
<tr>
<td>Q4. What do you feel are the main benefits and/or constraints to utilising green infrastructure?</td>
</tr>
<tr>
<td>Q5. Are you aware of the term ‘Place-making’? If yes, what is your understanding of it?</td>
</tr>
<tr>
<td>Q6. In your opinion, do you think green infrastructure has a role to play in ‘Place-making’? Please explain your answer.</td>
</tr>
<tr>
<td>Q7. How do you think Green Infrastructure can be utilised in public realm developments to assist Place-making?</td>
</tr>
<tr>
<td><strong>GI Measures</strong></td>
</tr>
<tr>
<td>Q8. In your opinion, what are the most effective green infrastructure measures in relation to public realm projects or spaces and why?</td>
</tr>
<tr>
<td>Q9. Do you have any personal preference of green infrastructure measures that are used in public realm developments? Please explain your choices.</td>
</tr>
<tr>
<td>Q10. How can the value of green infrastructure best be measured?</td>
</tr>
<tr>
<td>Q11. What are the main considerations in selecting green infrastructure measures for development projects?</td>
</tr>
<tr>
<td>Q12. Currently, do you think that green infrastructure is used effectively by planners and developers? Please explain your answer.</td>
</tr>
<tr>
<td><strong>GI Policy</strong></td>
</tr>
<tr>
<td>Q13. Do you have any involvement in policy surrounding green infrastructure? If yes, what does this involve?</td>
</tr>
<tr>
<td>Q14. In your opinion, do you think that current Green Infrastructure policy in Scotland and the UK is adequate? Please explain your answer.</td>
</tr>
<tr>
<td>Q15. Are there any areas of green infrastructure policy that need to be improved or developed? If yes, what are they and how could they be improved/developed?</td>
</tr>
<tr>
<td><strong>Public Involvement</strong></td>
</tr>
<tr>
<td>Q16. Do you think it is important that communities are involved in the planning process for public realm developments? Please explain your answer. If yes, do you think this currently happens to a satisfactory level? Please explain your answer.</td>
</tr>
<tr>
<td>Q17. Do you think that communities should have input on which green infrastructure measures are considered? If yes, how could this element be incorporated into the planning of public realm developments?</td>
</tr>
<tr>
<td>Q18. Are there any other considerations or factors that you feel are important to note regarding green infrastructure or anything else discussed?</td>
</tr>
<tr>
<td>Q19. Do you have any other comments or points you would like to add?</td>
</tr>
</tbody>
</table>
Table 5 - Respondent awareness of public realm developments, Green Infrastructure and Place-making split by Woodside and non-Woodside residents.

<table>
<thead>
<tr>
<th>Woodside Resident</th>
<th>Aware of 'Connecting Woodside' or similar public realm developments</th>
<th>Aware of the term Green Infrastructure</th>
<th>Aware of the term Place-making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
<td>No (%)</td>
</tr>
<tr>
<td>68</td>
<td>32</td>
<td>53</td>
<td>47</td>
</tr>
<tr>
<td>59</td>
<td>41</td>
<td>48</td>
<td>52</td>
</tr>
<tr>
<td>No (%)</td>
<td></td>
<td>21</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>GI Measure</td>
<td>Responses Related to Maintenance and Litter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Green Screen        | • Maintenance could be an issue.  
                    • In this situation, this is a reasonably easy to maintain plants and provide habitat and food for birds and other species.  
                    • Good idea but needs maintenance. Is ivy the best choice of species? The real problem is screened out but not removed.                                                                                                        |
| Roadside Planting   | • It looks lovely as long as it’s maintained properly.     
                    • Carefully chosen, well maintained roadside planting would have all the benefits above.                                                                                                             |
| Green Traffic Island| • Maintenance important.  
                    • How easy is it to maintain this? Would it become a rubbish trap, or overwhelmed by road pollution?  
                    • Again, as long as they were maintained and not scratching cars in the summer when they overgrow.                                                                                                                  |
| Green Street Divider| • Needs to be maintained.  
                    • As long as it’s not too high.                                                                                                                                             |
| City Street Trees   | • Provides shade, relaxing, free to use for everyone, not just for shopping. If big trees, can cause problems if not maintained.                                                                                                              |
| CityTree            | • A great idea if well maintained. I have seen [good] examples and neglected examples.                                                                                                                                                    |
| Living Wall         | • Nice aesthetically if maintained but can become dilapidated and unused over time.                                                                                                                                                    |
| Urban Rain Garden   | • Might need maintenance.                                                                                              |
| Green Arches        | • This can look good and provide links for wildlife to cross over roads safely. Maintenance problems?                                                                                                                                     |
| Flower Meadows      | • These are taking over parks and look terrible most of the time. Like waste ground, Just a cost saving measure.                                                                                                                          |
| Greened Benches     | • Sceptical – issues with litter.                                                                                                                                          |
| Bee Benches         | • Again, risks being used for rubbish.  
                    • Glasgow is a fantastic city with many green spaces where we live in the Southside, but a lack of maintenance and green urban spaces is an issue as well as litter.                                                                                        |
| Other Comments      | • Nice, however needs to have something to prevent littering there.                                                                                                           |
|                     | • Again, pleasant but risks being used as rubbish bins.                                                                                                                       |
|                     | • Again great, provided they’re maintained and where people want to sit.                                                                                                       |
|                     | • May get littered.                                                                                                                                                            |
|                     | • Cost and implementation of maintenance is a concern. Community involvement is essential.                                                                                  |
|                     | • Maintain green amenity spaces already in existence.                                                                                                                           |
Figures:

Figure 1 - Map depicting the ‘Connecting Woodside’ project area, its surrounding areas in Glasgow and the five face to face survey locations, dates and times (Map data source: Digimap, 2018).
Figure 2 - Pictures of GI measures used in survey questionnaire (Sources of figures: Naylor et al., 2017).
Figure 3 – Respondents’ knowledge of ‘Connecting Woodside’ showing common themes within text responses.

Figure 4 – Respondents’ knowledge of GI showing common themes within responses.
Figure 5 – Respondents’ knowledge of place-making showing common themes within responses.

Figure 6 - Public preference ratings for various GI measures.
Note: Rating scale based on work by Preston and Colman (2000).
Figure 7 - Benefits and constraints of utilising GI gathered from interviews and survey data.
Key: Light grey: survey data; Dark Grey: interview data; Black: survey and interview data.

Figure 8 - Woodside resident’s ratings for aspects of place, based on how residents felt Woodside currently met these aspects of place.
Note: Aspects of place adapted from Place Standard (2018).
Figure 9 – Survey respondents scale responses to statements regarding GI and place-making.