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**University of Glasgow**  
**School of Social and Political Sciences**  
**Urban Studies**

**Towards strong sustainability in Glasgow's regeneration, a case-study of Dalmarnock  
and Sighthill**

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## Abstract

Many European cities are changing as processes of regeneration aim to transform areas of dereliction and neglect into places where people want to work, play and live again. Simultaneously, cities are creating policies to become more sustainable in the wake of climate change. Regeneration provides a unique opportunity to restructure urban environments in an environmentally sustainable way.

Through studying two unique regeneration projects in Glasgow, Dalmarnock and Sighthill, this study aims to examine to what extent Glasgow has been successful in regenerating its city in an environmentally sustainable way. Additionally, it aims to define motivators and barriers to successful sustainable regeneration. An environmental assessment framework was designed to assess the environmental sustainability of the event-led regeneration projects in Dalmarnock and Sighthill. An additional framework including social, environmental and economic indicators was used to examine the attitudes of stakeholders to sustainability. It was found that while both developments featured elements of environmental sustainability, their incorporation could generally be attributed to the unique circumstances of the event-led developments rather than to a systematic commitment to environmental sustainability. Social, economic and environmental sustainability were often considered as substitutable and stakeholders often emphasized social sustainability. The two cases made a clear start on environmentally sustainable regeneration. However, for a future of sustainable regeneration, environmental sustainability needs to become a goal in itself rather than an incorporated aspect of social and economic sustainability.

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## Introduction

Many European cities are changing as processes of regeneration aim to transform areas of dereliction and neglect into places where people want to work, play and live again (Francese, 2016). The term sustainability is often connected to this process of place-making, as is evident from the title of the Scottish Regeneration Strategy: “*Achieving a Sustainable Future*” (Scottish Government, 2011). This document defines regeneration as “the holistic process of reversing the *economic, physical and social* decline of places where market forces alone won’t suffice” (Scottish Government, 2011, p. 2).

Environmental sustainability is high on the urban agenda all around the world. In the wake of international agreements and national policy commitments, sustainable urban alternatives spring up everywhere, and Glasgow is no exception. The Athletes’ Village of the 2014 Commonwealth was designed to be a benchmark of urban sustainability and the area of Sighthill aims to follow its example. With large quantities of derelict land still to be developed, Glasgow provides a rich testing ground for urban sustainability initiatives.

However, there are many definitions for sustainability, the most well-known of which can be found in the Brundtland report that stated that “sustainable development meets the needs of the present without comprising the ability of future generations to meet their own needs” (Brundtland, 1987). This broad definition is popular because it has the potential to be holistic, but it risks a lack of specificity because it allows for different points of emphasis in its interpretation. Moreover, later definitions have come to include three pillars of sustainability of natural, human and economic capital that need to be nurtured and balanced to get to a sustainable system (Blanco and Mazmanian, 2014). This conceptualization has also been criticized. Each pillar is based on different values that often end up competing, such as biodiversity, economic cost, cultural values and health. Additionally, there are often multiple interests that need to be balanced within a single pillar. The emphasis for sustainable development might hence be on finding a balance between interests within the pillar rather than finding a balance between the pillars (Hansmann, Mieg and Frischknecht, 2012).

Within the complex nature of regeneration, it is therefore important to not only examine how environmentally sustainable the development is, but also how sustainability is defined. The definition of sustainability used by those involved in a regeneration project can be of influence on the way environmental sustainability is included.



This paper will discuss the developments in Dalmarnock and Sighthill to evaluate the inclusion of environmental sustainability in urban regeneration within Glasgow. It examines how environmental sustainability relates to the other pillars of sustainability in Glasgow, and how this affects its success. By studying perceptions of sustainability and barriers and motivators for its success as experienced by stakeholders, I aim to understand the processes that might assist the advancement of sustainable regeneration in Glasgow.

## Chapter 1 – Defining Sustainability

The distinction between different definitions of sustainability becomes important once one starts differentiating between weak and strong sustainability. In the case of weak sustainability there is a focus on maintaining a combined stock of the capital of the three pillars of sustainability intact (Mori and Christodoulou, 2012, p. 97). Strong sustainability however means that natural capital is essentially non-substitutable to the other forms of capital (Mori and Christodoulou, 2012, p. 97). In assessing strong sustainability, a higher score for social capital does not cancel out a lower score for natural capital. It is not the average amount of capital that counts in the final assessment but the individual sustainability of each pillar, and the balance between them. That this non-substitutability is essential becomes clear when we define natural capital not just as natural resources, but as those processes “whose organizational integrity is essential for the continuous self-production of the system itself” (Mori and Christodoulou, 2012, p.97).

When we see each pillar as non-substitutable, that makes each pillar of equal value and importance. A higher degree of sustainability in one, cannot compensate for a lack of sustainability in another. This observation carries implications for the way we assess the success of regeneration projects and urban areas.

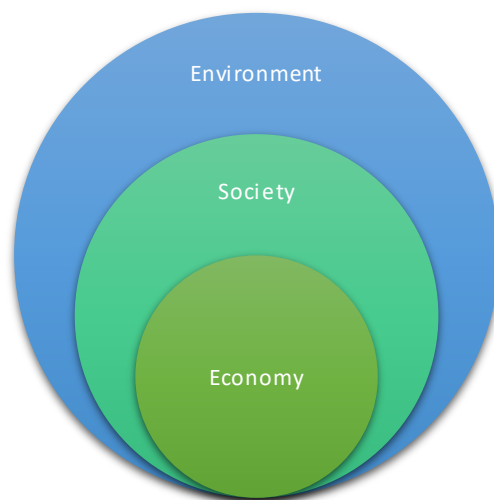
### Environmental Sustainability

But before any assessment can take place, we must examine what constitutes a sustainable city. We have previously determined that this requires a balance of the three pillars of sustainability. However, as it is essential to have a view of each pillar separately to truly value the sustainability of an area, this study will focus on the environmental sustainability of urban areas.

Many definitions of environmental sustainability are grounded in a concept developed in the 1960s by Lovelock. The Gaia Hypothesis was developed in the same time as Darwin's *Origin of Species* and similarly is based on the theory that the earth functions as one coherent ecosystem. Lovelock proposed the idea that “species whose effects on the environment are life-enhancing will prosper, while others will not: ... those organisms which made their environment more comfortable for life left a better world for their progeny, and those which worsened their environment spoiled the survival chances of theirs” (Moody, 2012). He assumes that the ecological system of the earth sustains itself. Intervention in this system is only sustainable if it does not disrupt the earth's capacity to self-sustain. In the case of resource extraction, for example, this means that resources are only extracted at a rate at

which the earth can replenish them. It is these principles that also underlie concepts such as the circular economy. The definition of environmental sustainability that will be used in this study is therefore that “sustainable development is the development that is likely to achieve lasting satisfaction of human needs and improvement of the quality of life under condition that ecosystems and/or species are utilized at levels and in ways that allow them to keep renewing themselves” (Mori and Christodoulou, 2012).

A further justification for a focus on the pillar of environmental sustainability can be found in the representation of the pillars as nested entities. Figure 1 shows how there is an interdependency between the pillars that rests most heavily on the environment. People depend on the natural environment for resources to sustain both themselves and economic production. Additionally our economies as social systems function around this utilisation of resources (Blanco and Mazmanian, 2014). This observation emphasises a need for the conceptualization of an environmentally sustainable city especially.



*Figure 1: The nested relationship among the three dimensions of sustainability (Blanco and Mazmanian, 2014).*

## Chapter 2- Sustainable Cities

Cities can be categorized on their sustainability based on a variety of indicators. One such distinction is based on a city's physical structure and associated commuter culture. So far, three types of cities have been identified. *Walking Cities* are characterized by mixed-use areas and narrow streets that facilitate a dense, walkable city (Newman, 2014). *Transit Cities* originated in the mid-19<sup>th</sup> century and are based on extensive public transport systems. The urban fabric is less dense but has nodal denser centres that are connected by public services. *Automobile Cities* from the 1950s onwards are marked by a low density and are accompanied by urban sprawl. Because of the flexibility of cars they are often more divided into functional zones that people travel between for different activities (Newman, 2014). The link between these urban forms and sustainability is self-evident. Reductions in fuel use reduce the carbon footprint of a city. Although there is a complex set of factors that interact with the movement patterns in a city, the physical layout as described in these three types has been found to have a substantial impact on the commuting patterns of the area (Newman, 2014). Even transitioning from automobile cities to transit cities can have a significant impact, as car use and public transport use are exponentially linked. The more public transport facilities are developed, and the more they are used, the more private car use decreases (Newman, 2014). Transport infrastructure and mixed-use design are therefore essential elements to pay attention to in any assessment of urban sustainability.

Green infrastructure is another element that matters for sustainability. Green areas can provide “a complementary green matrix of spaces that offer multi-level benefits for human populations. Green infrastructure can also be viewed as simultaneously providing natural resource sinks to assist urban climate control, water management and provide important green networks” (Mell, 2009, p.23). There are several key elements of successful green infrastructure that support environmental and social sustainability, such as promoting landscape connectivity, creating multi-functional environments and supporting strategic urban planning (Mell, 2009). The Countryside Agency adequately defined the aims of green infrastructure as comprising:

*“the provision of planned networks of linked multifunctional green spaces that contribute to protecting natural habitats and biodiversity, enable response to climate change and other biosphere changes, enable more sustainable and healthy lifestyles, enhance urban*

*liveability and wellbeing, improve the accessibility of key recreational and green assets, support the urban and rural economy and assist in the better long-term planning and management of green spaces and corridors”*

(The Centre for Urban Development & Environmental Management, 2006).

It seems that most angles of sustainability are covered by green infrastructure thinking. However, sustainability is too complex to be solved within a singular framework or discipline. Stroud *et al.* (2018) argue that effective sustainable transition policies are more likely to emerge when spanning all three pillars of environmental, social and economic sustainability. Moreover, they find that policies are more likely to be effective when emerging from a relationship between the state and civil society. This is particularly the case where large-scale changes are planned through urban regeneration, signalling an importance of governance arrangements. It is therefore key that this study assesses not only the environmental pillar of sustainability, but also its place in the governance arrangements of each project that influences its effectiveness.

A full consideration of different indicators and assessment frameworks can be found in Chapter 3.

## Sustainability and Regeneration

Green solutions aim to decouple economic growth, potentially in areas of deprivation, from environmental depletion. These efforts are often linked to local regeneration of areas that suffer from industrial decline and are focussed on technological innovation and green energy. Both aim to create a more sustainable infrastructure in these areas of decline. However, often these regeneration projects are seen as inherently ‘green’ because they convert a formerly industrial area into a less carbon-intensive one. However, Stroud *et al.* (2018) remark that attention for sustainability needs to move beyond carbon. Transitioning to a greener economy requires changes in employment and therefore in skills. This consequently means that investments for a green transition need to focus on transforming the behaviours and skills of people as well on transforming infrastructure. Policies for effective sustainable transitions therefore need to incorporate a sustainability of use as well as a sustainability of production. Investing in cycling lanes for example does not guarantee their use.

Next to infrastructure development, housing development is especially salient in urban regeneration. Housing can have a negative impact on the environment through its production, placement, management, demolition and maintenance. The housing system requires the input of materials and creates an output in waste. So far, assessing the nature of sustainable housing has remained under researched (Winston, 2010). Additionally, management and maintenance after the instalment of the infrastructure can have an equally large impact on sustainable practices. Table 1 shows the analytical framework for assessing sustainable housing as proposed by Winston (2010).

Location has an impact on sustainability through use of natural resources and commuting behaviour. Dense, mixed-use development reduces the need for individual transport by car and increases use of cycling and pedestrian infrastructure. Additionally, the higher density favours brown-field over green-field development and reduces the impact of the city on the surrounding environment. These environmental aspects are easily combined with social objectives such as a sustainable tenure mix that ensures affordable housing as well as private properties that are sold at a profit. The behavioural elements mentioned previously, be it for either or social or environmental sustainability, can be stimulated through participation of the residents through a partnership. These examples from Table 1 demonstrate the importance of the combination of investment in infrastructure and a sustainable built environment, combined with attention for the appropriate governance structure to stimulate the development of green skills and stimulate sustainable behaviour.

<b>Aspects of Housing</b>	<b>Sustainable Housing Characteristics</b>
<b>Location</b>	<ul style="list-style-type: none"> <li>- Sustainable land-use planning <ul style="list-style-type: none"> <li>▪ Resisting scattered settlements</li> <li>▪ Within mixed used developments</li> <li>▪ Close to good public transport</li> </ul> </li> </ul>
<b>Construction and Design</b>	<ul style="list-style-type: none"> <li>- Higher residential densities</li> <li>- Sustainable construction (e.g. energy efficiency, local renewable materials)</li> <li>- Design for sustainable use (e.g. energy use, water recycling and treatment, waste recycling)</li> <li>- Housing quality</li> <li>- Access to green space</li> <li>- Attractive, clean and safe residential environment</li> <li>- Housing affordability</li> <li>- Tenure mix &amp; social mix</li> <li>- Social resources</li> </ul>
<b>Use</b>	<ul style="list-style-type: none"> <li>- High standards of energy efficiency in use of dwellings</li> <li>- Waste recycling</li> <li>- Sustainable management and maintenance</li> </ul>
<b>Regeneration</b>	<ul style="list-style-type: none"> <li>- All of the above &amp;</li> <li>- Emphasis on renovation rather than demolition</li> <li>- Partnership with residents</li> <li>- Social support vulnerable households</li> </ul>

*Table 1: Analytical framework for assessing sustainable housing (Winston, 2010).*

Additionally, the institutional context of urban development and regeneration has an important impact on the degree to which environmental sustainability is achieved (Stroud *et al.*, 2018), in line with the importance of an interdisciplinary approach to urban planning for sustainability, mentioned earlier. This has led to the inclusion of a multitude of actors from different (governmental) agencies, local organisations and other parties in regeneration projects. This extensive set of stakeholders is meant to cover the multitude of issues related to the complexity of regeneration and sustainability. The incorporation of a multitude of (local) actors in policy and a therefore more decentralized policy process is the core element of theories of governance (Shand, 2013). However, despite its apparent importance, the involvement of different actors and stakeholders in a policy network can, especially in the case of urban renewal, lead to competition rather than cooperation. It might blur the lines of responsibility, and facilitate certain agendas over others (Shand, 2013). For this study, we must therefore examine the governance structures of the environmental pillar of sustainability, to determine the extent to which governance arrangements influence the success of this pillar, or of its effective combination with other pillars. The importance of these governance structures relates back to the idea of strong sustainability. A key issue is whether environmental sustainability is separately represented in the governance structure or included as a sub-element of another organisation. Additionally, it is important to ask who is responsible and accountable for success in environmental sustainability and who drives that success. How for example, do private and public entities perceive their responsibilities for environmental sustainability in regeneration projects and how does this influence the extent to which environmental sustainability is incorporated?

Especially in Glasgow elements of urban planning are often intertwined with regeneration. The city was hit hard by industrial decline and has worked assiduously on urban renaissance policies for the past decades. Unlike other cities, this initially did not take place under a city-wide strategy but happened sporadically on a project basis. Because of this flexible approach, the city has gained back its stable economic position, even though the social and environmental results have lagged behind (Organisation for Economic Co-operation and Development, 2003). Recently, Glasgow has developed several strategic long-term frameworks to oversee the further regeneration of its neighbourhoods. Additionally, the city and Scotland find themselves at a critical point in environmental policy. With a new Climate Bill introduced in national parliament, Scotland is getting ready to make its commitments for a more sustainable future. The Bill, that is currently still being discussed in



Parliament, sets targets for greenhouse gas emissions and details how these targets will be attained and evaluated. The old target of 80% reduction by 2050, set in 2009, has been replaced by a 90% target. Additionally, interim targets have been set for 56% reduction by 2020, 66% by 2030 and 78% by 2040 (Scottish Parliament, 2018). Moreover, the language of sustainability is very present in the most recent regeneration strategy of the Scottish Government, dating back to 2011 and called “*Achieving a Sustainable Future*”. In the foreword Alex Neil, then Cabinet Secretary for Infrastructure and Capital Investment, states that

*“Together we must ensure that all of Scotland’s communities are sustainable and promote well-being and that, in the pursuit of sustainable economic growth for Scotland, no-one is left behind”* (Scottish Government, 2011).

The economic and social pillars of sustainability are clearly present in this statement; however, the environmental aspect seems to be lacking. Additionally, throughout the report the word sustainability is generally used in the phrase ‘sustainable communities’, the conceptualization of which is mainly defined along socio-economic lines. Key themes include employability, community cohesion and public health. The main aim is the improvement of the socio-economic position of the regeneration areas. The sustainability narrative of the report is mainly focussed on socio-economic sustainability, without paying equal attention the pillar of environmental sustainability. As the term sustainability is used holistically, each pillar is assumed to be substitutable, therefore resulting in a weak form of sustainability. At the end of the report three bullet-pointed categories are identified: economically sustainable communities, physically sustainable communities and socially sustainable communities. Each category roughly corresponds with one of the pillars of sustainability. It is interesting that the original pillar for natural capital has been turned into ‘physical’ sustainability. Amongst the goals in this category are elements relating to the design quality of places and the accessibility of facilities. The efficient use of resources and respect for the natural environment only receives a brief mention at the end of the section (Scottish Government, 2011, p. 37). Thus, it appears as if the environmental component of sustainability is not at the forefront of Scottish urban regeneration policy, although it merits a mention.

The local level of regeneration is especially valuable to enhancing sustainability and is therefore a suitable level of analysis for this study. As Glasgow and Scotland are now committing to tackling Climate Change through the new Climate Bill, it is key to avoid

neglect of the environmental pillar of sustainability in regeneration projects. Although Scotland's strategy clearly recognises the importance of interdisciplinary policies for sustainability, it seems to have lost a clear approach to tackling environmental sustainability.

Regeneration can take place through different strategies. One particularly relevant to this study is event-led regeneration. Mega-event flagships (MEFs) such as developments associated with multisport event often consist of iconic buildings that are catalysts of urban renewal. However, underused MEFs in Montreal, Sydney, Moscow and Athens after their respective Olympic bids highlight the dichotomy between the MEF's and sustainability (Deng and Poon, 2013). More recently, for example during the Commonwealth Games of 2014 in Glasgow, extensive Legacy plans were developed to ensure a more sustainable form of MEF's. Although still faced with considerable challenges, Glasgow seems to have made an improvement regarding long-term benefits of this MEF (Scottish government, 2018). This fits in a more general trend of increased attention to long-term sustainability plans for MEFs. Additionally, issues of sustainability and legacy are becoming increasingly important in assigning bids for large sporting events. This context is therefore highly relevant to this study.

The context of event-led regeneration is moreover relevant to the governance structures that are involved. Event-led regeneration in the UK, including Glasgow's development, is organised around public-private partnerships that are "thought to provide governance solutions to problems of public policy coordination and to emphasise structural relationships between political institutions" (Christie and Gibb, 2015).

## Research Questions

Considering the context of Scotland's tradition of regeneration and the recent Climate Bill, this study examines recent and ongoing regeneration in the country's largest city to ask:

- To what extent is environmental sustainability explicitly incorporated into regeneration projects, and how does this balance with the incorporation of the other two pillars of sustainability?
- What are the barriers and motivators for environmental sustainability and how are these experienced by the different stakeholders involved in regeneration?

## Chapter 3 - Methods

### Case Studies

To answer the research questions, I have chosen two case studies in Glasgow, in the areas of Dalmarnock and Sighthill. There are several reasons to opt for case studies as a methodology. Cross-sectional indicators, deprived of their context may not be accurate enough (Mason, 2002). As regeneration is highly embedded in its locality, case studies are appropriate as they allow for an in-depth study of both case and context. Especially questions on the issue of governance and its effect on the inclusion of environmental sustainability in regeneration projects are very localized. Choosing two case studies in the same city therefore helps to compare context and isolate relevant indicators. The trade-off generalization-contextualisation is incredibly relevant to the methods selection for this study. To understand how the method of case studies functions in this study, it is useful to look at Tsang's (2013) adapted version of the case study typology developed by Welch *et al.* (2011) This typology framework can be seen in Figure 2. This study has a strong emphasis on contextualization, as it has contextualized sustainability in urban planning in the setting of regeneration, a phenomenon highly particular to place. However, from these observations I hope to be able to define barriers, motivators and attitudes that can be generalized to other contexts. I situate the case studies in Glasgow in the wider theory on sustainable urban planning. Hereby, contextualisation in the study is the pretext for generalisation of the results. The fourth indicator of *contextualized explanation* is therefore a fitting concept to understand the methodology of this study.

Emphasis on contextualization	Strong	3. Interpretive sensemaking	4. Contextualized explanation
	Weak	1. Identification of empirical regularities	2. Theory building & testing
		Weak	Strong
		Emphasis on theory development	

Figure 2: Typology of theorizing of Case Studies (Tsang, 2013)

Case studies, as a research design, are often subject to a mixed methodology of both quantitative and qualitative methods (Tight, 2010). It allows for answering both the *what* and the *why* question on a highly localized and contextualized basis. This reflects the questions of

this study, asking both *what* is present in terms of sustainability and *why* things transpired that way according to stakeholders.

Both case-study sites were initially event-led types of regeneration. Dalmarnock because of the 2014 Commonwealth Games and Sighthill because of their bid for the 2018 Youth Olympic Games. The Commonwealth games eventually took place, which resulted in extensive regeneration and the development of amongst other things the Athletes' Village in Dalmarnock. Sighthill lost the bid for the Youth Olympics but the regeneration is going ahead as planned nevertheless. The development in Dalmarnock is largely finished, however the developments in Sighthill are only in their first phase. This will make for an interesting comparison.

The study comprises of two parts. Firstly, the two case studies in Sighthill and Dalmarnock were assessed on their inclusion of environmental sustainability components. Secondly, I explored the perceptions of stakeholders regarding sustainability and its inclusion in the regeneration projects at these sites. Both these stages used environmental audits as a conceptual framework and investigation tool. For the assessment of the projects itself I focussed solely on environmental aspects of sustainability as presented in these audit frameworks. This was broadened for the second stage, in which stakeholders were asked to respond to indicators from all three pillars of sustainability.

## Environmental Assessments

For the first phase of this study, an accurate assessment needed to be formed about the environmental sustainability of the regeneration in Dalmarnock and Sighthill. Information was gathered through site visits, and a review of development plans. Where insufficient information about an indicator was present in the publicly available development plans, further information was requested during the interviews of phase 2. In the case of Sighthill, there was a heavier reliance on development plans and design sketches, as only a small part of the development has been realised so far. The indicator scores for this site are therefore less certain than those for Dalmarnock, as it remains to be seen to what extent the reality will match the masterplan.

An appropriate evaluation framework needed to be selected, which required answers to a few key questions. The first concerns the type of measurement. Most audit frames fall into one of two categories: indicator-based or single unit measurement (Mori and Christodoulou, 2011). Indicator based indices are comprised of a diverse set of variables that

represent different processes in the evaluated environment. They are especially useful to measure a diversity of elements but are also occasionally criticized for a certain level of subjectivity in the choice of indicators and the weighing of such indicators in the final model (Mori and Christodoulou, 2011). Single unit indices often aim to illustrate the balance in the relationship between the economic activity of an area and its environment. As the results are converted into a single unit, the amount of processes considered is often limited. Several commonly known examples of single unit measurement frameworks include the Carbon Footprint or the Ecological Footprint (Mori and Christodoulou, 2011).

For this study, indicator-based indices are more appropriate. Regeneration projects extend far beyond the economic activity of an area, so that a measurement based on a single unit is likely to miss essential elements. Furthermore, the results of this audit are meant to aide policy makers and planners in planning for environmentally sustainable neighbourhoods. An index that is based on a single unit might not be instructive in determining areas requiring attention, in the same way as a single indicator for the triple bottom line<sup>1</sup> can be deceiving. Not only can environmental sustainability not be substituted for another pillar, within the pillar itself different fields of intervention to attain environmental sustainability should not be interchangeable. An indicator-based index allows for a breakdown of different elements of the urban fabric and is therefore more useful in determining policy intervention points.

This leaves us with the question of how to determine the indicators to be included. Miro and Christodoulou (2011) distinguish between indicators set top-down by researchers, and a bottom-up approach where local stakeholders are responsible for this process. Whereas a bottom-up approach allows for the input of local stakeholders that can later prove valuable to make the framework understandable and useable to these same stakeholders, it is also likely to hamper the generalisability of the results. This study measured the assigned importance of certain indicators through separate interviews with stakeholders, in order to contrast this with a more general, less localized indicator of sustainability. A top-down approach will be chosen to determine the indicators for the audit phase of the study. Both frameworks for the audit of

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<sup>1</sup> The Triple Bottom-Line (TBL) model is based on the idea of the three pillars of sustainability: economic, environmental and social sustainability. Effective solutions for sustainability problems can be found in their combination, especially when there are competing interests and needs at the policy level (Schweikert, Espinet and Chinowsky, 2017).

the sites and for the interviews were combinations of existing frameworks such as BREEAM and the Local Index of Sustainability.

There is a multitude of existing frameworks that assess urban sustainability. However, many of the indices are global, based on the triple bottom line or single-unit indices. As the final measurement often consists of a single value, it is difficult to zoom in on the environmental element of sustainability. Therefore, I took the environmental indicators and systems of several sustainability indices to construct relevant categories and indicators. I reviewed a range of indices and their indicators. Frameworks such as the popular energy/energy index and the ecological footprint are useful in creating generalisable measurements of the environmental burden an area is posing internally and externally (Mori and Christodoulou, 2012). However, they are both single unit indices and are therefore unlikely to represent the complexity of regeneration. Moreover, neither addressed the capability of policy intervention to bring about behaviour change. Additionally, these indices require data that are not obtainable for this study, such as emissions data and energy usage. The latter remained relevant for indicator-based indices. It is essential that the chosen measurement can be adequate for both the developed area in Dalmarnock but also the plans for the development in Sighthill. This requires a more qualitative rather than a quantitative measurement to be appropriate for pending policies as well as finished development.

The first index that provides a useful framework for this study is the Local Sustainability Index (Lo.S.I.). This evaluation model was developed especially for the urban regeneration context and aims for a systematic approach to assessing sustainability. The model is based on 12 classes of sustainability criteria (R – Resource consumption; C – Loadings; I – Indoor environmental quality; S – Quality of service; E – Economics; G – Management; T – Commuting transport; P – Participation; M – Regional marketing and branding; K – Cultural topics; L – Local development; A - Virtuous circles) (Mattia, Oppio and Pandolfi, 2012). By measuring indicators in these categories and the relationships between them, the model tries to account for the impact of the intervention on the built environment and on its context. The system is very elaborate and detailed, and relies on inside information on energy consumption, waste production, transport behaviour and other variables. Applying it directly to Sighthill and Dalmarnock is therefore not possible, but there are several indicators within it that are useful to consider. Resource consumption and the green standards of the actual built environment in terms of energy use, insulation and other

relevant factors, are two of these. The latter is done by frameworks such as the Green Building Challenge (GBC). Their GBtool was developed to advance the standard of evaluation of green building (International Initiative for a Sustainable Built Environment, 2005). The GBtool category of commuting transport for example corresponds with the *walkable city* concept introduced earlier (Mattia, Oppio and Pandolfi, 2012).

Lastly the Lo.S.I scoring of variables according to their level of commitment to sustainability can prove valuable for this study. It allows for the framework to be adapted to a benchmark of what is ‘ordinary’ and what is ‘high-profile’ commitment in that locality, which is especially valuable for Glasgow’s case studies. I have therefore chosen to score items on a scale of five as seen in Figure 3.

<b>-2</b>	<b>-1</b>	<b>0</b>	<b>1</b>	<b>2</b>
Low-profile		Ordinary	High-Profile	

Figure 3: Rating scale for sustainability indicators according to benchmark.

As most of the indicators of the Lo.S.I consist of data that are difficult to obtain and often based on quantitative measures, a second index was examined to provide guiding themes and indicators. The SBTool is based on the triple bottom line principle, but nonetheless has clearly distinguishable indicator categories that prove useful in the context of this study. SBTool is an assessment tool for green construction however, not necessarily for green regeneration, which is important to keep in mind (Mateus and Bragança, 2011). There are four categories of environmental sustainability, derived from the SBTool, that will be used in the framework of this study: site regeneration, urban design, project infrastructure and energy and resource consumption.

Several indicators were added from the BREEAM-UK framework. Originally developed by the Building Research Establishment in 1990 it is currently one of the most well-known international sustainability assessment frameworks. For this study indicators will be drawn from the framework for ‘Achieving Sustainable Masterplans’ specifically developed for regeneration (BREEAM, 2012). The final composition of the environmental indicators for the audit can be found in Appendix A.

For the assessment method explained in Figure 3 it was crucial to ensure that a relevant reference point is chosen, particularly to define what is ‘ordinary’ or what is more or

less than that. An unclear or overly modest reference point can mark systems as sustainable even though the long term trend is not improving more than its natural course would imply (Bell and Morse, 1999, p.14). I therefore used national and international guidelines that the case studies fall under to benchmark their performance. The specific benchmarks and their justifications can be found in Appendix B.

## In-depth Interviews

After assessing the two case studies, I used a second framework for the interviews with the stakeholders of each site. The choice for this method was embedded in the ontology of interpretivism. Interpretivism, according to David Donaldson's interpretation, means that the researcher needs to assume that a participant is largely right about the world. There is no universal reality, alongside which the participant's statement can be measured (Graf, 2003). The current sustainability challenges that we face are more complex than the cases of pollution of the 1970s and 1980s. Those were problems with largely technological solutions, whereas we currently face socio-technical issues that require systems change rather than mere technological solutions (Geels, 2010). Different ontological standpoints have different interpretations of these transition dynamics, between stakeholders, technologies and available data. Interpretivism takes an agency approach to sustainable transitions. Actors use their interpretation of the situation to produce meaning. Each actor creates a reality based on their interaction with other actors, each reality being equally true. These interpretations change continuously because of learning behaviour. This learning behaviour originates in experience or accumulated data. Transitions may initially be slow because of uncertainty but may gain speed when social perceptions and understandings start to converge. Hence, shared visions may further advance sustainable transitions (Geels, 2010).

Regeneration and its governance include a multitude of actors. Each of these actors is involved in, and experiences, regeneration in a different way; it therefore follows that each of these actors might experience sustainability and its role in the regeneration projects differently. Semi-structured, in depth interviews allow me to speak with individual actors to help understand their perception of sustainability and its inclusion in the regeneration projects in Sighthill and Dalrnock. Whereas unstructured interviews allow for more freedom, semi-structured interviews allow for more guidance from the interviewer and are therefore more appropriate when more specific information is required (Gibson, 1998). As the questions of this study are quite particular, semi-structured interviews are preferred.



The participants were part of three different stakeholder groups: developers, civil servants and residents. Developers were chosen because they provide the private side of the public-private partnership common in regeneration. The other side of this partnership was represented by civil servants of the City Council and of involved public partnerships such as Clyde Gateway or Transforming Communities Glasgow. Residents are included because their view link strongly to the behavioural impact of sustainable transitions. Initially it was intended to include interviews with residents of both sites, however, it became evident that because of extensive amounts of research and consultation done in the area, considerable research fatigue was present. It was therefore decided to speak with community organisations instead to get some insight into the views and attitudes in the community. Table 2 shows the number of interviewees for each stakeholder for each case study.

	<b>Dalmarnock</b>	<b>Sighthill</b>
<b>Public Officials</b>	3	2
<b>Developers and Landlords</b>	3 <sup>2</sup>	2
<b>Resident Community (Representatives)</b>	1	1

*Table 2: Participant numbers for site stakeholders*

The framework formed a guideline for the interview as I interviewed stakeholders on their perceptions of sustainability, and their priorities between the three different pillars. I used the same frameworks as I used in the audit phase of the study, now using indicators of all three pillars. Participants were asked to define sustainability and to review the role it played in the project in question. Additionally, they were asked to elaborate on the balance between the three pillars of sustainability, both from their own viewpoint and in light of the project. Lastly, they were asked how the aspects of these pillars were reflected in the regeneration area, and how this could or should have been different. The second framework and its indicators can be found in Appendix C.

Participants were recruited in several ways. Developers and civil servants were approached directly via phone or email, using available contact details from the projects websites and newsletters. The first contact at Clyde Gateway and the City Council were made

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<sup>2</sup> As Glasgow Housing Association was involved in both Dalmarnock and Sighthill, the same officers were interviewed for both projects during one interview.

in similar fashion, after which their professional network was used to be referred to other involved officials in the organisation. Through these same networks contact was sought with community organisations involved on the regeneration sites. Only adults over 18 were interviewed for this study.

## Chapter 4 – Ethical Issues

A project such as this may raise anxieties or expectations among participants. This project involves working with groups of residents from areas that are high on the index of multiple deprivation. Asking questions about sustainability in general might trigger issues that are sensitive. Moreover, there was significant research fatigue among residents. It was therefore chosen to speak with community organisations rather than with residents directly. This also helped manage expectations.

The relationships between stakeholders involved in the projects' governance could have been compromised, since some of their standpoints might be conflicting, and there is a certain level of power relationships and dependencies amongst the stakeholders. It was therefore ensured that participants were anonymous in the paper, and their comments were treated with utmost confidentiality. All participants were aware that the study would include the viewpoints of other stakeholders as well as their own.

## Chapter 5 - The incorporation of sustainability: results

### Dalmarnock - Background

The first site study took place in Dalmarnock, Glasgow. The site is in the East of Glasgow, a few kilometres away from the city centre. The area was an important part of the Clydeside's industrial base with large amounts of steel manufacturing, heavy engineering and textiles. Post-industrial decline impacted all heavy industry in the city, and Glasgow's East end was no exception (Barke and Sim, 1981). Despite earlier regeneration attempts through Glasgow Eastern Area Renewal (GEAR), by 2012 Dalmarnock had a reputation of a 'problem area, with problem people' (Clark, Kearns and Cleland, 2016), with local residents were living amongst vast stretches of derelict and vacant land.

Most regeneration in Dalmarnock took place in the context of the 2014 Commonwealth Games. Figure 4 includes a map of Glasgow, displaying Dalmarnock in light blue, and the Athlete's Village in Green. After bidding and planning for the village since 2006, work commenced in 2009 and was completed shortly before the Games in 2014. The buildings were retrofitted for residential occupation throughout 2015. The development comprised housing, transport infrastructure, an energy centre, and several sports facilities related to the games such as the Velodrome and the Emirates Arena. This study does not cover the entirety of Dalmarnock but focusses on the Athletes' Village site and the adjacent former Power Station site that is currently being developed.

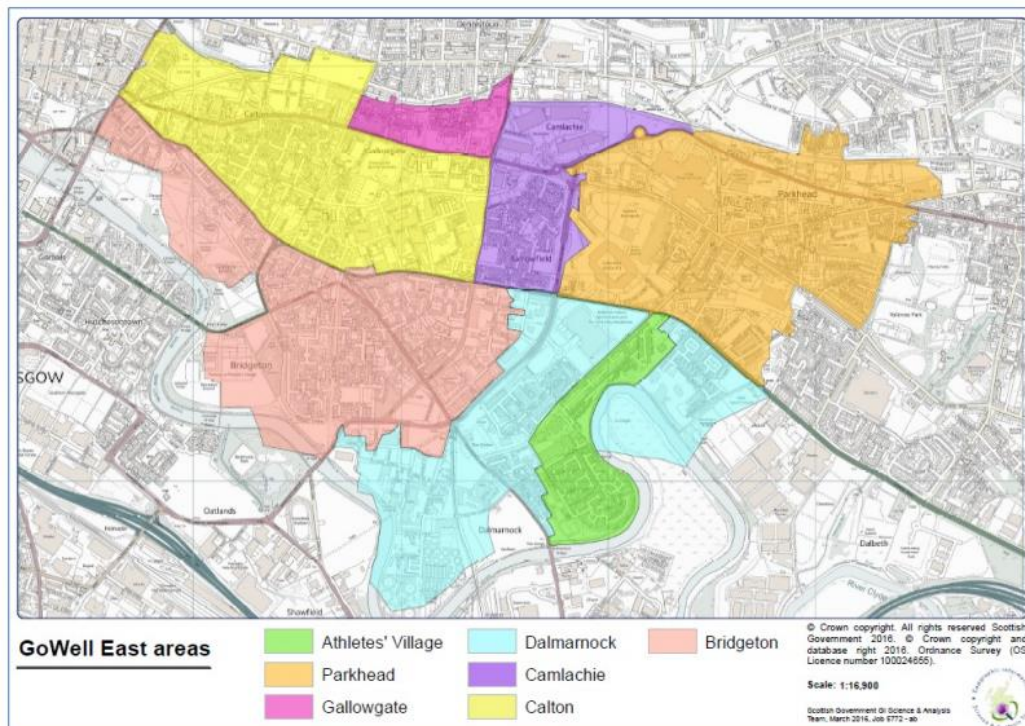


Figure 4: The Athlete's Village as situated in Dalmarnock. (Source: Scottish Government).

The village consists of 700 homes, that were initially used to house athletes during the Commonwealth Games. After the event ended, the houses were retrofitted and occupied by permanent residents between February and December 2015 (Clark and Kearns, 2017). Most properties were destined for social rent, however, 300 were sold privately. Besides clear attempts at achieving a tenure mix, the site includes several eco-friendly features such as the combined heat and power centre (Clark and Kearns, 2017).

Further developments in the area include a large housing development adjacent to the Athletes' Village. The developments in Dalmarnock were largely executed by a special purpose partnership called Clyde Gateway. The partnership was instigated in order to "to achieve the turnaround in terms of creating 21,000 new jobs, constructing 10,000 new homes, increasing the population by 20,000 and delivering £1.5 billion of private sector investment" (Clyde Gateway, 2009). The organisation is a partnership between the Scottish government, Scottish Enterprise, Glasgow City Council and South Lanarkshire Council. Three strategic goals were set:

- Sustainable Place Transformation; focussed on infrastructure and environment to make the area more attractive for investment.
- Increase Economic Activity; to target major employers into the area and maximize growth opportunities.
- Develop Community Capacity; long term investment is to lead to increased community capacity and private investment (Clyde Gateway, 2009).

Many large infrastructure works were delivered through partnerships with additional partners. Scottish' Government 'Smarter Choices, Smarter Places' funding was used to invest 2.4 million pounds in pedestrian and cycling routes as can be seen in Figure 5. As part of this investment a large new road was constructed called the East End Regeneration Route. The 4-lane road links the M74 motorway to the M8/M80 Motorway (Glasgow City Council, 2017).

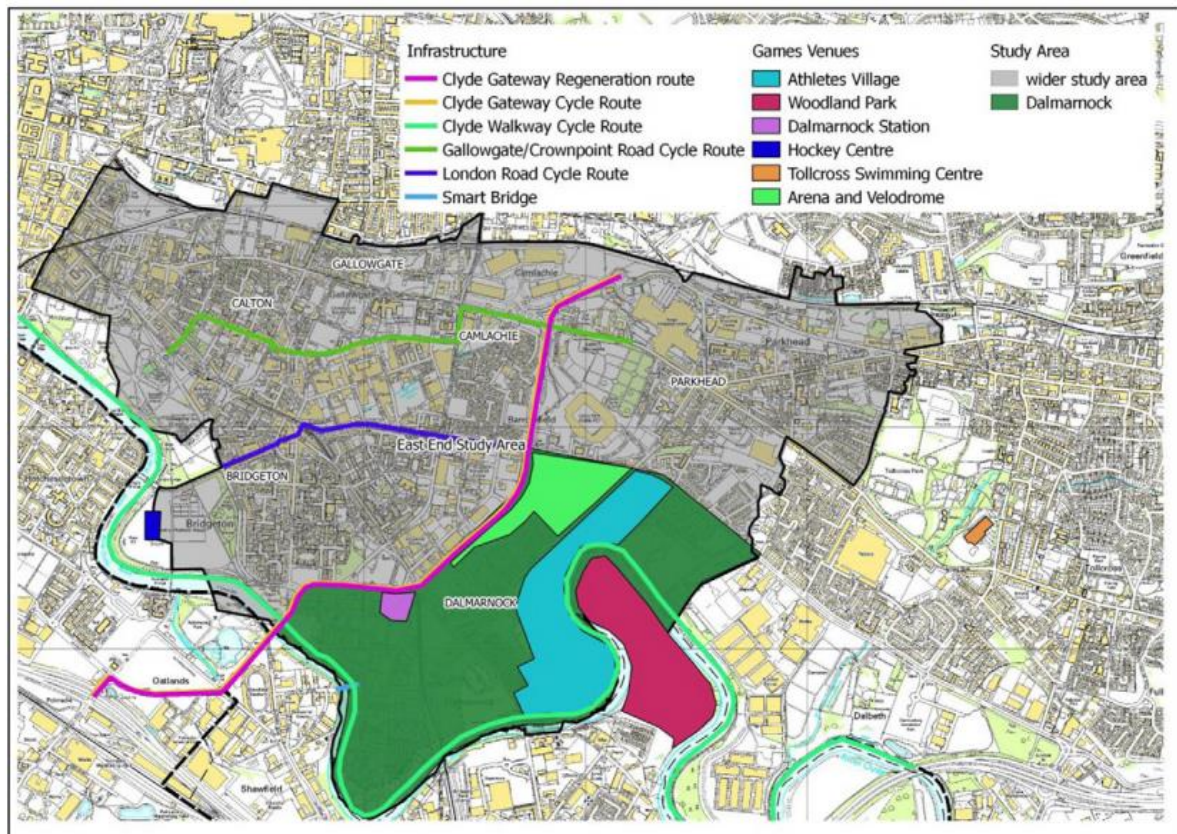


Figure 5: Dalmarnock and Commonwealth Games-related regeneration developments (Clark, Kearns and Cleland, 2016).

Another example of a partnership is the Shawfield Remediation Group that aims to address the extensive contamination heritage of the industrial history of Dalmarnock. One of the largest contaminated sites is the former Dalmarnock Power Station site, adjacent to the village, and location of 550 newly planned homes (Clyde Gateway, 2017).

Figure 7 displays the audit scores of the Dalmarnock developments at the Athletes' Village and the neighbouring Power Station site. Each of the elements of the audit assessment are discussed in turn below.

## Site Regeneration

Dalmarnock used to be the site of substantial industrial activity and therefore had to undertake extensive remediation works before commencing on any construction. This commitment was made through Clyde Gateway and extensive remediation took place through the placement of a soil hospital that treated the soil on site. 140,000 cubic metres of soil were treated and reused, that would have otherwise ended up in landfill (Step Up, 2015). Figure 5 shows the cycling routes that were put into the area. It must be noted that these routes are all substantial, but rarely link up to form a comprehensive network of cycleways. However, the

residential development blocks were designed to prioritize pedestrians and cyclists, as can be seen in Figure 6. Through a new pedestrian bridge, connections were made to the Clyde Walkway and Cuningar Loop. Facilities for small scale food production were not included in the design.



*Figure 6: Architect's impression of the Athletes' Village*

### Urban Design

The nature of the development at the AV ensured a high efficiency of land-use in the area. Because of the required amount of accommodation for the Commonwealth Games, the density is relatively high, especially at the sides where there is easy access to the site (City Legacy Consortium, 2010). However, because of that same nature of the development, the site has less of a mixed-use nature. In recent years this feature has been improved on by the addition of retail and the recent construction of a primary school. The consideration of passive solar potential was hardly applicable, as virtually each unit was equipped with solar panels.

### Project Infrastructure and Water Strategy

Each unit is equipped with the City Council's four recycling bins both inside and outside to encourage recycling. These bins include both solid and organic waste.

In addition, the AV has an extensive network of Sustainable Drainage Systems (SuDS) to prevent flooding in the area. Previously surface water and waste water were combined underground, which resulted in a system that was working at capacity and could easily overflow. By managing surface water through SuDS features above ground the capacity for water management is increased.

## Energy & Resource Consumption

Dalmarnock has made a great commitment to renewable energy and innovative energy projects. The area features a district heating system through an energy centre, responsible for almost half of the village's carbon reduction scheme. All homes and the care home in the area are serviced by this centre, which harbours a capacity to serve a larger area in the future. Moreover, the energy centre is connected to the Emirates Arena and sports facilities (Step Up, 2015). Additionally, all homes are equipped with solar panels and received high quality insulation. Each of the homes includes smart meters that help to reduce energy consumption. The meters should increase energy literacy in residents and stimulate them to reduce their usage, and therefore their energy bills (Step Up, 2015). The energy system contributed to an eventual 95% reduction in carbon emissions (Vital Energy, 2014). Vital Energy, that was commissioned to design and deliver the energy centre also runs a permanent maintenance scheme on site. The adjacent former powerplant site is still to be developed but is aimed to maintain the same standard.

## Ecological Strategy

The site used the Integrated Habitat Network (IHN) model to inform habitat creation projects. Additional features such as woodland were added where possible to improve habitat space for wildlife, which was enhanced by the SUDS ponds. Current species were identified, however scarce they were because of previous contamination, and protected (Glasgow City Council, 2010). Biodiversity was handled in compliance with City Council regulations at the time. Although firmly in adherence with regulations, no additional commitments seem to have been made.

## Transport Strategy

As part of the regeneration project, Dalmarnock got a brand-new train station. This was the most notable investment in public transport infrastructure in the area. Additionally, the site is well serviced with bus-lines. The pedestrian walkways and cycling ways are meant to increase active travel, and the area was a designated Low Emission Zone during the games. Whether this remained to be a Low Emission Zone afterwards is unclear. All residential units are equipped with cycling storage; however, community workspace is not provided.



## Climate Change Adaptation

The main issue for climate change adaptation consisted of flood risks and other weather impacts in the case of more extreme weather because of climate change. Clyde Gateway modelled for these events to prevent disruption to the area. The results were incorporated in strategies for water management and maintenance.

## Green Infrastructure

The AV site is relatively dense because of its initial purpose during the games. In the design brief, green infrastructure was mentioned as an essential element of the development, however, it was allowed to off-set green infrastructure by investing in green infrastructure neighbouring the site. City Legacy Consortium, that eventually won the bid, did exactly that (City Legacy Consortium, 2010). Investments were made to connect the site to a woodland park across the river at the Cuningar Loop, and significant improvements were made to this park. However, green infrastructure was not an integral part of the site's design itself. The amount of green infrastructure within the development was therefore limited. A connection was made to Cuningar Loop by a pedestrian bridge, but this did not include a ramp for bicycles. The question therefore remains to what extent the green infrastructure is an integrated part of the daily lives of the residents and attributes to sustainable awareness and behaviour, as the largest investment in green space is essentially made off-site.

Additionally, it is unclear where the responsibility lies for the maintenance of the green infrastructure. Aspirations for community ownership are mentioned, and after the end of Clyde Gateway's involvement, assets are intended to be transferred to the community. However, simultaneously, awareness and enthusiasm to take ownership of sustainability assets seems low amongst the residents. A lack of future strategy in this respect indicates potential challenges to its sustainability in the future.

## Community Involvement

User manuals have been provided to all residential units, including information on how to operate the smart meters and how to best use the district heating system. Extensive community consultation took place however, most was targeted at social and economic issues. An external organisation provides cycling workshops and assistance, but otherwise interaction to stimulate environmentally friendly behaviour change seems limited as part of the regeneration effort. The lack of community involvement is a serious concern when

considering the remarks by Strout *et al.* (2018) mentioned previously. Regeneration needs to move beyond infrastructure and consider green skills and capital in the community.

## Light Pollution

The interviews executed about the Dalmarnock area revealed that this was not an issue that was particularly considered in the design or execution of the regeneration project, neither did it appear to be discussed in any of the planning documents.

## Sustainable Buildings

All housing of the AV is built according an EcoHomes ‘excellent’ rating, larger properties are all assessed under a BREEAM qualification scheme expecting the same rating. These ratings were requirements of the design brief and commitments made by Glasgow City Council in their bid for the Commonwealth Games. Throughout the development efforts were made to recycle and reuse materials and use low-impact materials to lower the carbon footprint of the development. All these standards were laid higher than the requirements of the Scottish government at the time, also to ensure that the housing would still be innovative and above the required standard once it would become occupied by permanent residents in 2015. Additionally, during the ‘games mode’, the village used 260.000 items of furniture that were obtained from the 2012 London Olympic and Paralympic Games (Glasgow 2014, 2014).

Category	Indicator	-2	-1	0	1	2
<b>Site Regeneration</b>	Remediation					X
	Contaminated Soil					
	Bicycle facilities and pathways				X	
	Pedestrian Walkways				X	
	Facilities for small scale food production			X		
<b>Urban Design</b>	Land-use efficiency				X	
	Mixed use design			X		
	Passive Solar Potential					X
<b>Project Infrastructure</b>	Solid Waste Collection					X

	Organic waste and Composting				X	
	Surface Water Treatment					X
	Water Management/Flood Risk					X
<b>Energy &amp; Resource Consumption</b>	Energy use reduction measures					X
	Inclusion renewable energy sources					X
	Combines Heat and Power systems					X
	Decentralized Energy Systems					X
	Re-use materials				X	
	Ability to repair and sustainable maintenance			X		
<b>Water Strategy</b>	Water use reduction Measures			X		
<b>Ecological Strategy</b>	Preservation/stimulation biodiversity			X		
<b>Transport Strategy</b>	Public Transport Nodes				X	
	Transport Capacity				X	
	Multi-purpose trips facilitation.			X		
	Active travel stimulation			X		
	Reducing the need for commuting – i.e.		X			

	community workspace et al.					
	Adequate cycling storage space				X	
<b>Climate Change Adaptation</b>	Flood risk					X
	Increased temperatures				X	
	Increased weather volatility				X	
	Changes in ground conditions				X	
	Snow build up and Ice			X		
	Impact on water resources			X		
<b>Green infrastructure</b>	Availability Green Space according to best practice guides			X		
	Management and future maintanance			X		
	Green Infrastructure is part of Masterplan				X	
<b>Community Involvement</b>	Masterplan details community involvement in execution sustainability goals		X			
	Training and user manuals for sustainable facilities are provided				X	
<b>Light Pollution</b>	Lighting efficiency			X		
	Upward transmission			X		

<b>Sustainable Buildings</b>	Adherence of new or refurbished building to best practice for sustainability					X
	Commitment to sustainability confirmed through planning authority					X
	Accredited third party sustainability assessment					X
	Use of low impact materials				X	
	Resource efficiency (demolition & material reuse)				X	

Figure 7: Audit results Dalmarnock

## Summary

To conclude, the development in Dalmarnock is particularly strong on matters concerning energy, water and waste infrastructure and the sustainability of the buildings themselves. Especially the energy centre and SuDS make large contributions to the sustainability of the area. However, whereas clear efforts were made on transport and active travel, and infrastructure was installed, an integrated provision seems to be lacking. More concerns arise about green infrastructure, which is largely located off-site. This integration is key, which becomes clear when examining the definition of effective green infrastructure given before, which mentions *linked* green spaces that form a network (Mell, 2009).

Regarding the provisions that are there, there does not seem to have been much investment in the behavioural element of sustainability. Whereas infrastructure is often present, little engagement has taken place or was planned to stimulate environmentally sustainable behaviour or community ownership and maintenance.

## Sighthill - Background

The second site study took place in Sighthill. The area became one of Glasgow's Transformational Regeneration Areas (TRA's) in 2009. Just like Dalmarnock it was a contestant for the location for the Athletes' Village for the Commonwealth Games in 2014, however the village was eventually located in Dalmarnock. In 2011 the site was again selected for an event-led regeneration scheme during a bid for the 2018 Youth Olympic Games. Although the bid was lost, a commitment was made to continue the regeneration in Sighthill regardless of the success of the bid. The area has therefore continued as a TRA since the failed bid in 2013 (Glasgow City Council, 2016).

The main aim of the project is the regeneration of the physical environment of the area, which spans about 50 hectares. It included extensive areas of derelict land that require remediation because of former chemical works plant on site. Before the regeneration, a period of demolition took place of a set of high-rise tower blocks that were originally built in the 1960s. By the 1980s Sighthill had become a 'byword for deprivation' because of high levels of unemployment, fear of crime, drug problems and a declining physical environment (Leslie, 2018). Figure 8 shows the former high-rise blocks in Sighthill as captured by Chris Leslie through the project *Disappearing Glasgow*.



Figure 8: Sighthill high-rise flats (Leslie, 2018).

Sighthill is located only a short distance North of the city centre but is separated from it by the M8 motorway. Enclosed on other sides by Springburn road and the railway line to Edinburgh, the site is currently quite isolated. Connectivity therefore is a key theme in its regeneration. Figure 9 shows the area map of Sighthill indicating its key connectivity points after the regeneration is completed.

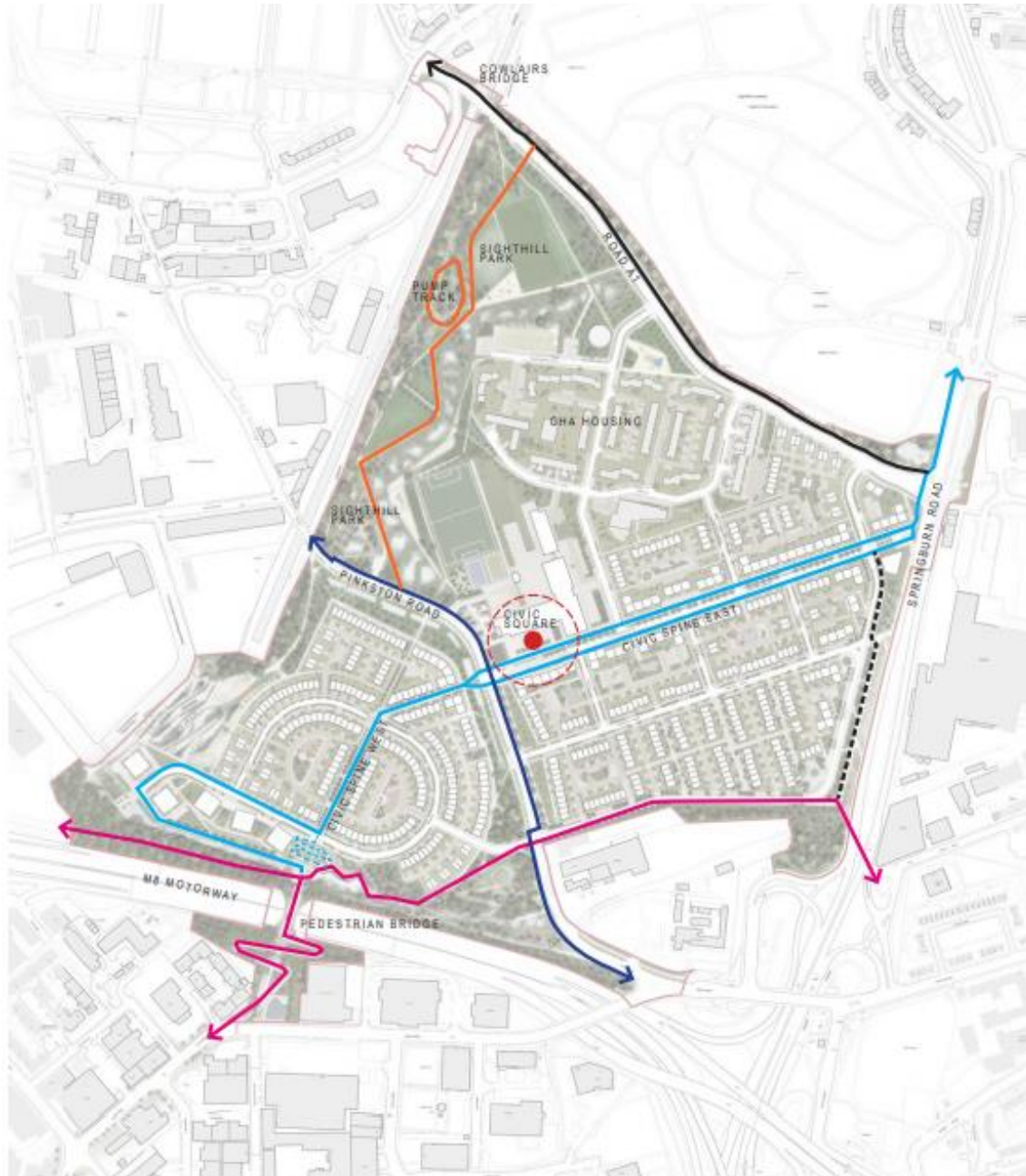


Figure 9: Masterplan Planned Cycling Routes (Transforming Communities Scotland, 2016).

The overall development will take place in several phases of which the first has already been completed. The first section of housing was completed in 2015, followed by the demolition of the last tower blocks. This first phase included 141 units of social rented housing for Glasgow Housing Association (GHA) and extensive site-wide remediation works to prepare for further development (Glasgow City Council, 2018). The future plans include:

- 826 new homes for sale and mid-market rent
- An alternative site for development, with use still to be determined
- Retail and commercial facilities
- A new pedestrian bridge across the M8 motorway
- A new road bridge linking the north and the west of the city (Glasgow City Council, 2018).

The timeframe for the developments is displayed in Figure 10, extending into the 2020s. Additionally, improvements were made to the existing core stock, to make the GHA tenants living there feel included in the effort.

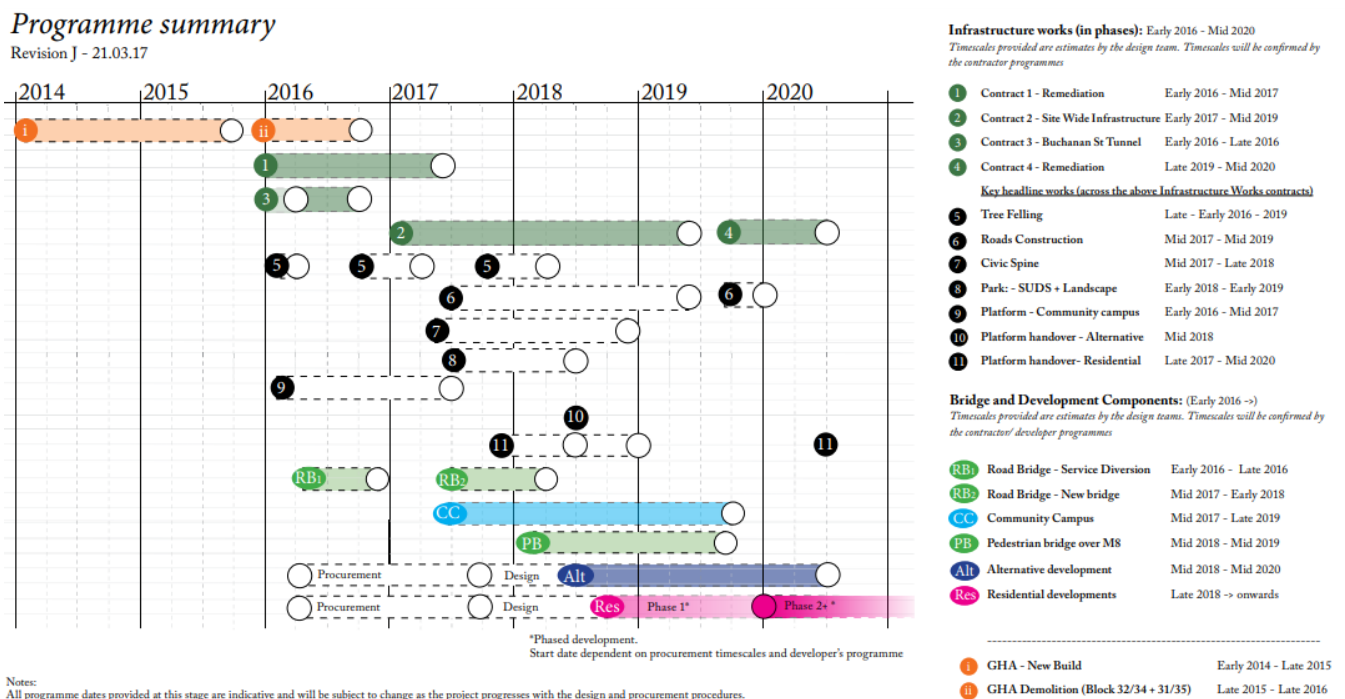


Figure 10: Programme summary timeline (DRS Housing and Regeneration Services, 2017).

These developments are led by the partnership Transforming Communities Glasgow (TCG). The partnership between GHA, Glasgow City Council and Scottish Government is meant to spread development risk for each site across the partners as sites are often contaminated and difficult to develop. Each area has its own Local Delivery Group, made up



out of residents and other community representatives. One of the partners takes the main lead on each of the TRA's, in the case of Sighthill, the main lead for development is in the hands of Glasgow City Council.

Figure 14 displays the audit scores for Sighthill based on the currently established development and the masterplan indications for future development. The scores are based on the site observations as explained below.

## Site Regeneration

Sighthill displays clear environmental considerations for all indicators of this category. In terms of remediation of contaminated soil, Sighthill seems to stick to the guidelines of Scottish Government to remediate until the property is fit for use. An encasement method was chosen to prevent gas formation through reactions between ground water and the contaminated material, which had previously led to unpleasant smells.

Bicycle facilities and pathways feature extensively in the masterplan as indicated in Figure 9. The Cycling Unit of Land & Environmental Services, Glasgow City Council defined a set of desired cycling routes, that were then integrated into the masterplan according to the map in Figure 9. Several of these routes link into the surrounding areas. The pedestrian bridge links into the existing cycling route to Cumbernauld and other routes link into Cowlairs and onto Springburn road. 20 mph speed limits are to be introduced and enforced throughout the development except for Road A1. However, that road will feature segregated foot and cycle ways with a raised curb. These segregated cycle ways are in place along all busier roads in the TRA (Transforming Communities Scotland, 2016). The two civic spines that feature on the map are a good example of these segregated facilities, as can be seen in the design in Figure 11.



*Figure 11: Civic Boulevard East (Transforming Communities Scotland, 2016).*

Facilities for small scale food production are included in the design in the form of allotment plots close the new community campus. It is envisaged that these allotments stimulate gardening by the community. As most inhabitants are not used to having a garden, having previously lived in the high-rise flats, most do not have the knowledge to maintain their garden or grow food. The allotment plots are aimed to come into community ownership to stimulate learning and the growing of food in individual gardens of the new houses as well. However, whether this will be successful, considering the limited engagement with the community, remains to be seen.

## Urban Design

Although not separately highlighted in the masterplan or in the conversations with officials involved in the development of Sighthill, there seems to be some commitment to creating a mixed-use design. The community campus features many essential elements for a community and is flanked by basic retail and healthcare facilities. All these facilities are connected by a ‘civic spine’ that enable them to be reached on foot or by bike. Through the interviews it appeared that careful considerations were made about what facilities to include directly in the development, such a retail and the school campus, and what facilities to leave out as they were easily reachable in neighbouring areas.

## Project Infrastructure and Water Strategy

As part of the project infrastructure developers have had to submit waste strategies. Each house is equipped with Glasgow City Council's 4 bins for food waste, dry recyclables, glass and general waste. The community garden site and the allotments are currently seen as possible locations for composting. The development follows the City Council guidelines but does not have a further commitment to waste reduction or recycling infrastructure. However, collection times are meant to stimulate recycling as not separating waste will lead to an overflowing general waste bin.

There is an elaborate strategy for surface water treatment and management of flood risks at the site. Water management is executed through a series of SuDS (Sustainable Drainage Systems) and ponds running through the park and other sections of the development. Once water reaches the southern part of the site it is piped under the site and through street canals until it reaches the canal that borders the site. This point is monitored by Scottish Canals to control the inflow of water into the canal to avoid flooding. All developers have had to commit to including water treatment facilities in their platforms to ensure that water is filtered before it enters any of these chains. Bio retention cells are incorporated features of the landscape to avoid a sudden downpour flowing straight into the canal and potentially causing a flood. This sustainable urban drainage plan is also referred to as the Blue Spine in the masterplan, as can be seen in Figure 12.



Figure 12: *The Blue Spine* (Transforming Communities Glasgow, 2014).

## Energy and Resource Consumption

Surprisingly Sighthill, developed after Dalmarnock, did not include the district heating or combined heat and power systems that were featured in the latter. Even though it was initially included in the masterplan but it was removed later. The system was meant to be integrated with the City Centre North and North Glasgow district heating network. However, because the development of the overall network lagged behind, there was risk of system islands emerging rather than an integrated system on the medium term. Whilst the provision in Sighthill would have provided carbon savings, it would not have provided lower cost heating as the heat price would be benchmarked against the equivalent cost of heating via a modern gas boiler. Investment were therefore made to upgrade the building stock's insulation as it would reduce fuel poverty more. These considerations are a clear indication that although all three pillars of sustainability are considered. Strong sustainability as defined previously by Mori and Christodoulou (2012) is still lacking as social consideration take precedence over environmental ones.

Moreover, the first batch of houses does not seem to feature solar panels, the retrofitted core stock was fitted with gas central heating. Whereas that is an improvement over the previously used storage heaters that were less efficient, gas is much less sustainable than renewable energy resources. The new developments on the platforms are expected to feature renewable energy, however, it is unclear whether this a requirement and therefore a certainty when handing over the platforms to developers. The interviews about Sighthill revealed a strong emphasis on energy efficiency, based on top-grade insulation. However, the motivation for these measures was mainly social, to reduce fuel poverty and bring the energy bill of tenants down. Whereas gas is still used, extra generators were added to convert waste energy back into useable energy as heat.

Through the design brief and requirements, Sighthill has seen positive amounts of reuse of materials, including the debris of the old highrise flats. Constructors are encouraged to reuse and recycle as much on site as possible, and debris has been used over the years for amongst others the extension of the M74 motorway.

## Ecological Strategy

The Blue and Green spine running through Sighthill in the park and the additional green space is meant to safeguard and aide biodiversity. The masterplan favours the retention

of existing trees, vegetation and rock, irrespective of additional effort and cost attached to this commitment to safeguarding biodiversity (Central Scotland Green Network, 2018)

## Transport Strategy

Connectivity is a keyword in the Sighthill Masterplan. A new bridge over the M8 is meant to improve the connectivity with the city centre. The area is well serviced with an extensive network of bus and rail lines. As of now these do not yet run into the development, but conversations are in progress to ensure this occurs once the area becomes more densely populated again. However, as transport services are in control of these decisions and have been hesitant in the past, it remains to be seen whereas the Council's vision will be realised. There is a public transport hub around the community campus and retail space. An extensive network of pedestrian walkways and cycling paths, both generally segregated from the road, are meant to stimulate active travel. Each dwelling above a certain size will include a home office, which can facilitate community workspace and reduce the amount of commuting. Aside a significant investment in infrastructure for active travel, there seems to be little stimulations of the behavioural element of active travel in the area. It was indicated in the interviews that cycling events and workshop would be stimulated once the area would become more densely populated again, but it is not an integral part of the masterplan.

## Climate Change adaptation

Climate change adaptation mostly takes the form of water management and the management of flood risks, which were covered previously. In the interviews conducted the other elements were indicated to either be found irrelevant or not considered, or no more than up to the usual extent.

## Green infrastructure

Replacing the old and under-used Sighthill park, the regenerated area features the 'Linear Park'. It features the Green and the Blue Spine both key in preserving biodiversity and water management. The Linear Park is displayed in figure 12. Additionally the park features social activities, walkways, children's play areas and an eco-garden. Other locations on site feature green space and green public realm such as the canal terraces displayed in figure 13. Further maintenance of green space might prove challenging based on its complex nature and relatively unique integrated features. However, as the development is still in

progress it is difficult to determine its potential success or challenges (Central Scotland Green Network, 2018).



*Figure 13: Canal Terraces impression (LDA Design, 2018)*

## Community Involvement

A gardening tool shed was opened to familiarize residents with ways to maintain their gardens and green space. After further completion of the project there is the intent to organise workshops to teach residents to build, ride and repair their bikes. User manuals are provided on site. Community involvement is detailed in the masterplan, but hardly so beyond community consultation on the green space. There is a strong commitment to infrastructure, however behaviour change stimulation is not integrated into the masterplan.

## Light Pollution

Both indoors and outdoors Sighthill seems to consider lighting efficiency and pollution. The lighting in the park is sensor-based and therefore is only on when there is movement in the park. Additionally, Glasgow Housing Association actively tries to encourage residents to use efficient lightbulbs in their homes. As in other parts of the city, it is expected that street lighting will be LED powered.

## Sustainable Buildings

All developers are required to develop to at least a Silver technical standard of design according to City Council guidance, including facilities for electrical vehicle charging. This standard is set by Glasgow City Council and lies higher than the required standard by statute from the Scottish Government. However, this standard includes issues such as wheelchair accessibility and fire safety as well. When looking at the policy up close one notes that whereas the sustainability section 7 indeed is required to be up to the Silver Standard for design, sections 1-6 of the document still are only requirement to attain a Bronze Standard (Glasgow Housing and Regeneration Services, 2017). Section 1-6 includes things such as energy efficiency, insulation and carbon dioxide emissions. Section 7 includes a set of indicators specifically targeted to sustainability that can be found in Appendix D (Scottish government, 2017). Whereas significant, it is important to note that they do not include Sections 1-6 that include requirements on the environment, carbon dioxide emissions and energy. In September the Council is heightening the standard to Gold, however, as Sighthill has already received planning permission this does not have to apply to the development. It would be interesting to see if the new developments on the platforms that are currently being prepared will raise their standards alongside the Council. By raising the standard above the Scottish requirements through a holistic label, the Council is pushing the envelope on sustainable development. As mentioned previously, reuse of materials and recycling played an important role in both the demolition and the construction phases of the development.

Additionally, it must be noted that for several features mentioned above, the maintenance of the areas such as the green infrastructure, community garden and allotments have yet to be clearly defined. Whereas most of it is likely to be maintained by Glasgow City Council, there was mention of stimulating community ownership. However, how and in what cases this should take place remains unclear. This signals a potential lack of attention for the future sustainability of the site, beyond the infrastructure.



<b>Category</b>	<b>Indicator</b>	<b>-2</b>	<b>-1</b>	<b>0</b>	<b>1</b>	<b>2</b>
<b>Site Regeneration</b>	Remediation					X
	Contaminated Soil					
	Bicycle facilities and pathways					X
	Pedestrian Walkways					X
	Facilities for small scale food production				X	
<b>Urban Design</b>	Land-use efficiency				X	
	Mixed use design				X	
	Passive Solar Potential			X		
<b>Project Infrastructure</b>	Solid Waste Collection			X		
	Organic waste and Composting				X	
	Surface Water Treatment					X
	Water Management/Flood Risk					X
<b>Energy &amp; Resource Consumption</b>	Energy use reduction measures					X
	Inclusion renewable energy sources			X		
	Combines Heat and Power systems			X		
	Decentralized Energy Systems		X			
	Re-use materials				X	
	Ability to repair and sustainable maintenance			X		

<b>Water Strategy</b>	Water use reduction Measures			X		
<b>Ecological Strategy</b>	Preservation/stimulation biodiversity				X	
<b>Transport Strategy</b>	Public Transport Nodes			X		
	Transport Capacity				X	
	Multi-purpose trips facilitation.			X		
	Active travel stimulation				X	
	Reducing the need for commuting – i.e. community workspace et al.				X	
	Adequate cycling storage space				X	
<b>Climate Change Adaptation</b>	Flood risk					X
	Increased temperatures				X	
	Increased weather volatility			X		
	Changes in ground conditions				X	
	Snow build up and Ice			X		
	Impact on water resources			X		
<b>Green infrastructure</b>	Availability Green Space according to best practice guides					X
	Management and future maintenance			X		

	Green Infrastructure is part of Masterplan					X
<b>Community Involvement</b>	Masterplan details community involvement in execution sustainability goals		X			
	Training and user manuals for sustainable facilities are provided			X		
<b>Light Pollution</b>	Lighting efficiency				X	
	Upward transmission			X		
<b>Sustainable Buildings</b>	Complacency new building or refurbishment best practice for sustainability					X
	Commitment to sustainability confirmed through planning authority					X
	Accredited third party sustainability assessment			X		
	Use of low impact materials			X		
	Resource efficiency (demolition & material reuse)				X	

Figure 14: Audit results Sighthill

## Summary

The planned Sighthill scores exceptionally well on green infrastructure and water management. The two elements are integrated through the extensive network of ponds, the canal terraces and the linear park. However, the developments scores lower than Dalmarnock on the subject of energy, as the use of renewables is limited, and unlike Dalmarnock no district heating system is in place. However, the building standards for the design of the future housing include relatively high levels of insulation and energy efficiency. Sufficient attention was paid to biodiversity and ecology. Yet, similar to Dalmarnock, little to no attention was paid to the engagement of people in sustainable activities. The project remains weak on the stimulation of environmentally sustainable behaviour. Additionally, for Sighthill it must be noted that most of the assessment was based on intentions rather than reality, as the development has not been realised yet. Moreover, it is unclear what parts of the development are funded by TCG and what parts are dependent on private investment.

It is noticeable that while both case studies show clear elements of environmental sustainability, both lack an integrated approach that includes education and the stimulation of environmental behaviours. Dalmarnock has been incredibly successful in securing renewable energy at an affordable price for residents through its district heating system and using solar panels. The energy centre accounts for a large part of its decrease in carbon emissions. However, active travel stimulations through pedestrian and cycling infrastructure are present, but are insufficiently integrated and linked up. Sighthill seems to have learned lessons from Dalmarnock in some respects. Green infrastructure is integrated throughout the entire site and connected to pedestrian and cycling infrastructure. Moreover, it is integrated with an even more innovative drainage system than in Dalmarnock. Yet, Dalmarnock's most successful feature was arguably its energy centre, which was not replicated in Sighthill when a social concern took clear precedence over an environmental one. Additionally, the commitment to the inclusion of renewable energy seems lower in Sighthill than it was in Dalmarnock. Considering the size of the impact these measures had in improving environmental sustainability in Dalmarnock, it is questionable whether Sighthill is a step forward. Especially because the energy centre is a piece of infrastructure that is hard to add a later stage. Dalmarnock was intended to be a benchmark and example for further learning in the city, however, it seems that whereas Sighthill has studied Dalmarnock, elements are copied on a pick-and-choose basis.

## Chapter 6 - Governance of Sustainability: Results

In addition to the data gathered in the audit above, a set of participants was identified for each site to elaborate further on the decision-making process and the governance structure of the project. These interviews helped to define barriers and motivators for the inclusion of environmental sustainability in the regeneration projects. Moreover, they assisted in examining how the event-led context of these two case studies impacted their results on sustainability. The results below will be discussed along common themes that emerged during the interviews for both sites, if differences arose between sites relevant distinctions will be made.

### Defining Sustainability

All interviewees were asked to define sustainability in the context of regeneration projects. Especially the planning officers articulated that a purely environmental definition was quite limited in this context. The term ‘holistic regeneration’ appeared throughout our conversations. Officers at several different institutions explained that they believed that sustainability was traditionally understood in mere environmental terms but that the definition is lacking when it comes to producing a successful regeneration project. As explained by a Clyde Gateway officer:

*“that is a very, very, very limited view of regeneration, in terms of sustainability, so for us sustainability is about building capacity in the community to take full advantage of every opportunity that is brought in. So, sustainability is improving education, improving health to give people better life chances. You could say, I mean what is the definition of economic development? Economic development is supposed to be about improving quality of life for everyone by increasing opportunities for all. So, if you’re increasing opportunities across the board, you want people to benefit from them so that we can sustain the benefits of regeneration.”*

This quote demonstrates the strong socio-economic focus that is added to environmental aspects of sustainability in regeneration. Moreover, the environmental aspect is often defined as the dimension of the physical environment, not necessarily as a behavioural element.

This interpretation translated into the organisation’s Key Performance Indicators (KPIs):

- Remediation of derelict and contaminated land
- Creation of business floor space
- Construction of residential units

When asked to define sustainability, most respondents therefore defined it in the sense of the three pillars discussed earlier in this paper. When applying these definitions to the case studies several themes emerged.

## Sustainability & social benefits

Both planning officers and housing officers strongly articulate sustainability in terms of infrastructure and energy. In both Sighthill and Dalmarnock, housing is designed to meet the requirements of external assessment or accreditation labels. This has led to units that are highly efficient and well insulated. Whereas there are great environmental benefits to this, most participants articulate the successes of this element in socio-economic terms. As fuel poverty is a stringent issue in these areas of multiple deprivation, the high efficiency of the houses will greatly bring down the energy costs down for their occupants.

A similar pattern emerges from our conversations about contamination and remediation. The clean-up of contamination was perhaps one of the largest environmental features of each of the projects and are recognized as such by the stakeholders. The narrative on this aspect of the projects is divided over environmental and socio-economic factors. A Clyde Gateway officer noted when asked about the most important elements of environmental sustainability in the project:

*“Key focus would be infrastructure and remediation, without tackling those issues, the legacy and the issues, the historical issues of Dalmarnock would remain. So, you know arguably you could continue to consult and you could continue to know how you were going to or how you aspire to move the area forward but without actually physically intervening in those areas of infrastructure of remediation of you know works to sites then private sector would never invest in the area. “*

The remediation is seen as socially necessary because of its health risks, the negative impact of living around derelict land and the barrier it forms to outside investment. The benefits or remediation are therefore largely defined in social and economic terms; a healthier environment for residents, higher aspiration for the community because of the decreased amount of derelict land and increased external investment in the community.

## The health agenda

Especially the public health agenda features heavily in our conversations about environmental sustainability. It is a unifier that brings together different purposes and funding

streams that incorporate sustainability through for example green space provision. The areas suffer from health inequalities and unhealthy lifestyles that have dramatic impacts on the local life expectancy. Within the Scottish Government framework of Inclusive Growth (Scottish government, 2016a), health inequalities are high on the agenda. Many initiatives that feature on the environmental agenda, such as active travel and green infrastructure are therefore often promoted under the health agenda. In the case of Dalmarnock the theme of health moreover seems to have emerged from the event-led nature of the development, it being linked to the Commonwealth Games. It was a goal of the games committee to promote a healthier lifestyle through the games, a theme that has remained significant throughout the Legacy phase of the games.

## Event-led regeneration

Both regeneration sites were the result of a bid for an international sports event. The momentum created by these bids, and in the case of Dalmarnock the eventual event, had a significant impact on the incorporation of sustainability in the regeneration projects. Most interviewees emphasized that it was unlikely that any remediation or development would have taken place in the near future if it had not been for the bid.

In the case of Dalmarnock and the Athletes' Village, the environmentally sustainable character of the development was sparked by the need to stand out in the competitive bidding process. A Glasgow City Council officer involved in the bidding process remarks:

*“As part of the bid for the Commonwealth Games we had to make a bid for the Athletes' Village. So, in order to find unique selling points etcetera, we decided that we wanted the village to be as sustainable as possible so that was the first primary thing in terms of the Athletes' Village that we decided when we were at the bid stage.”*

Once this bid was successful, the promises made in the bid became a legally binding agreement, this secured the inclusion of these ambitious sustainable elements in the development. That commitment meant that even as the 2008 credit crisis emerged, few compromises could be made on sustainability. Because of this, Glasgow City Council put out a design brief that had a stringent set of sustainability requirements that influenced the bidding stage for developers. The relevance of this becomes apparent when speaking to the developers involved in the village;

*“If you are in a competitive situation and you are bidding for a site on market, unless you are confident that you can sell your product for more than the next person, then you know*

*what is the incentive to overreach? So, the brief was key, that was set, that was the bid requirement, you must perform to this, so everybody was in an equal scenario of bidding.”*

Without the public initiative to include these requirements, any plans going beyond the statutory requirement would put bidders at a financial disadvantage as compared to other bidders with a cheaper plan that only aimed to reach the statutory requirements.

Also, in the case of Sighthill, interviewees noted how the bid for the YOG created the political will to invest in the area. This political support took away the resource barrier that would have normally impeded the inclusion of sustainability in a regeneration project such as Sighthill and therefore boosted its progress. The event-led nature of the development allowed for the site to be a testing ground for new technologies and ideas on sustainability. This function of the site was recognised by officials at both projects. It therefore seems that the event-led nature of the developments stimulated strong sustainability. Through the bid its inclusion became legally binding, which ensured that environmental sustainability was not substitutable for other elements. However, because Sighthill lost the bid for YOG there was no legally binding commitment to strong sustainability. That this made environmental sustainability a substitutable element again appears from the considerations about the district heating system.

## Public-Private Governance

In both cases the governance of the project took the form of a special purpose vehicle meant to deliver on a set of determined indicators. These boards were comprised of several private and public-sector organisations such as Glasgow City Council, Scottish Government, Glasgow Housing Association, developers and community representatives. This combination allowed for a spread of risks that would have otherwise impeded the progress of projects on site.

Several public-sector officials moreover noted that a public lead on these projects ensured the inclusion of sustainability even during financially straining times. Accounts from interviews in both the private and public sector testify that sustainable features are often the first to get dropped in the face of financial adversity, as they are often seen as costly and the least necessary to the successful completion of the project. This tendency to drop elements of environmental sustainability first in part is made possible by the governance structure as set up in these projects. The KPI's of Clyde Gateway for example explicitly include the pillars of social and economic sustainability. Environmental features are incorporated throughout the



KPI's but do not have their own KPI. A respondent noted that board meetings often include comments on sustainability, but only as secondary agenda points to main discussions about the KPI's. Whereas the other two pillars are hence subjected to separate assessment and performance indicators, benchmarks for environmental sustainability may remain unclear. Moreover, the final assessment is for sustainability as a whole rather than for each pillar separately. As noted by an employee of Clyde Gateway:

*“We probably would look at it, or we do look at it on individual sustainability themes if you like, but then there would be an overall assessment of that.”*

In the cases of event-led regeneration the commitment to the inclusion of environmental sustainability may have been consolidated through the legally binding bid, however the potential consequences of this structure become clear later on.

## Funding Structures

I briefly touched on the different agendas that incorporate features of environmental sustainability or rather, that are being used to get environmental sustainability on the policy agenda. Alongside the KPI's, the funding of projects related to environmental sustainability come from different sources. One civil servant indicates how, when attention for active travel increases, the funding available through SusTrans increases, which increases possibilities for its inclusion in (regeneration) projects. But it was also indicated that this is “how it is at the moment”, signalling that these policy windows change throughout the running of the project.

Additionally, funding for the projects was assigned based on two-year or sometimes even just 1-year terms. According to interviewees this impeded the ability of project staff to plan ahead in the long-term. As sustainability is often mainly a long-term consideration, rather than a short term one, these funding structures might impact the inclusion of environmental sustainability. Without the inclusion of environmental sustainability as a separate KPI, or sustained long-term funding for its inclusion, changes in funding in the short term might allow for its objectives to be dropped.

## Sustainable Behaviour

Throughout the interviews with all stakeholders it was notable how all definitions of and references to sustainability were about the technological, measurable aspects of sustainability such as renewable energy and infrastructure improvement. There so far has been little attention to the awareness of environmental sustainability or sustainable behaviours by

the residents of the respective areas. In Sighthill, examples were given regarding gardening that were illustrative of the need of investment in sustainable behaviour. As most residents came from multi-storey flats, none of them had ever had a garden. Even on beautiful days, gardens remained empty, and little gardening was done. Only after some investment was made in the provision of gardening equipment and residents were encouraged more to start using their gardens did activity start to emerge. However, when speaking about active travel, little integrated activity takes place beyond the placement of infrastructure. External organisations organise biking workshops, however, these interactive elements are rarely integrated aspects of the masterplan. When asked about stimulating behaviour change, an interviewee in Dalmarnock notes:

*“I mean we have provided a number of cycle provisions, cycle routes, we provide active travel support to inward investors, but that is I suppose for us it is a sort of a next tier up for some of the nitty gritty things that you need to get right, it’s a bit like the icing on the cake.”*

That the mere provision of infrastructure is lacking when attempting sustainable behaviour change appears from data from GoWell studies in the area. Several indicators for sustainable behaviour change saw no significant positive change over time. The main positive indicator was on recycling, showing an overall increase in recycling over time, yet a slight decline in frequency. However, in the categories of understanding environmental responsibilities, a fall in concern was measured for both energy usage and waste production (Gannon, Kearns and Clark, 2018).

Moreover, a community officer in Sighthill indicates that there is little consistent engagement with the community on issues such as behaviour change and ownership. As the community currently does not have the social capital or knowledge to bring about environmental change or take ownership of it, this can only be achieved by investing in their skills and knowledge long-term. Infrastructure alone does not provide enough encouragement or enough sense of agency to change behaviour.

Whereas environmental sustainability is integrated in several different policy agendas and indicators, it therefore remains questionable if there is a truly integrated strategy for all aspects of environmental sustainability.

## Summary

Throughout the interviews the importance of the event-led nature of the regeneration projects in stimulating environmental sustainability became evident. It made sustainability an independent agenda point during the bidding process, which secured its incorporation in the design brief. Otherwise, environmental sustainability was incorporated under the headers of other agendas or KPIs. That contributed to a largely socio-economic definition of sustainability. Whereas environmental sustainability did receive attention, the motivations behind the initiative were often described in socio-economic terms. It therefore remains questionable to what extent the inclusion of environmental sustainability is safeguarded in projects where it is not secured by an event-led background.

Moreover, it became evident that private partners in the partnership experienced more significant barriers to including environmental sustainability than public partners. The design briefs provided by the City Council proved crucial in eliminating sustainability as a negative competitive element and turning its inclusion into a strength. These partnerships within their special purpose vehicles therefore were crucial to the sustainability of the project.

Environmental sustainability was mainly seen as a matter of infrastructure and design quality. Rather than seeing behavioural aspects as unimportant, they are separate elements that can be considered at a later stage of the development. It can therefore be concluded that they are not seen as an integrated part of sustainability, or as a priority.

## Chapter 7 - Conclusion

Several conclusions can be drawn from this study, that pose questions about the future of environmentally sustainable regeneration in Glasgow. Each of the case studies displays a keen awareness of the three pillars of sustainability across all involved actors. Moreover, most respondents particularly articulate the importance of using a 'holistic' definition of sustainability rather than an environmental one. In each of the two case studies there was a clear narrative of sustainability that spanned all three pillars.

However, it is not a narrative that encourages strong sustainability (Mori and Christodoulou, 2012). Elements of environmental sustainability are included through policy agendas of the other two pillars. Assessment of sustainability takes place through a single indicator, incorporating all three pillars. This makes environmental sustainability a substitutable attribute of the project, as it is not an indicator that officials are held accountable for in itself. There is therefore little to guarantee the inclusion of environmental sustainability as the context of the project changes. Moreover, as it is not a separate indicator, environmental sustainability is not evaluated as such, which leaves limited policy lessons for future projects.

However, both case studies did have successful elements of environmental sustainability. These features, like the district heating system in Dalmarnock and the SuDS in Sighthill were stimulated, if not made possible, by the event-led nature of the development. The events created political commitment and financial support, but also created the wish to create innovative, sustainable areas to stand out in the bidding process. In the case of Dalmarnock this generated legally binding commitments to environmental sustainability. These commitments guaranteed that environmental sustainability was a goal in itself. Sighthill however did not win the event bid, and the significance of that fact is seen in the district heating issue. Whereas its inclusion had become a commitment in Dalmarnock, it was substitutable for concerns of social sustainability in Sighthill. Rather than substituting environmental goals for social ones, a combination of a district heating system with highly effective insulation would have both reduced carbon emissions long-term and brought energy cost down for residents. Had environmental sustainability had its own indicator, both may have been included.

The need for a firm commitment to environmental sustainability in the public sector becomes evident from the conversations with private partners on the developments. Environmental sustainability is still not seen as a competitive advantage in the private sector, and recent regeneration projects do not seem to have assisted in overcoming that barrier. On

the contrary, the public lead within the partnership seemed a condition for inclusion. One may therefore conclude that it is essential that the public sector leads as firmly and effectively as possible on environmental sustainability. Regeneration, because of its strong involvement with the public planning departments, therefore provides a unique opportunity for the public sector to influence sustainable building practice in its city.

Dalmarnock was intended to be an example and new benchmark for other developments in the city. Whereas some policy learning has taken place in the public sector, and public officials reported seeing the sites as testing ground for future projects, learning seems to be on a pick and choose basis. Additionally, overall the regeneration case studies are heavily based on the infrastructure aspects of sustainability, and there is little attention for the behavioural aspects such as environmental awareness, ownership and behaviour. As reported by a community officer in Sighthill, behaviour or a sense of ownership by the community will not change unless the council actively and consistently integrates policy for behaviour change and empowerment with infrastructure investment, especially for a topic relatively new and strange to the community such as environmental sustainability.

Glasgow needs to future proof its way of doing environmental sustainability. These two unique projects have set interesting benchmarks and hold promise for sustainable regeneration in the future. But without event-led regeneration areas that include binding bid commitments, the city will need to find other ways of securing the inclusion of environmental sustainability in regeneration projects both in times of prosperity and in times of financial hardship. An important first step in that direction lies in the area of assessment. Assigning environmental sustainability its own KPI provides it with its own agenda, resources and ensures commitment to its inclusion. Moreover, to become a truly sustainable city, Glasgow needs to invest in the skills and the sustainable behaviour of its residents. Sustainable infrastructure is not enough, as its use needs to be equally sustainable as its production. It is therefore key that behavioural aspects of sustainability are integrated into the master plans. This ensures that these areas become sustainable spaces, with a sustainably acting community, rather than just sustainable spaces. Glasgow has got the sustainability; the next step is to make it strong. A building is made stronger by adding another pillar to support its roof, not by adding additionally building blocks to its two existing pillars.

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## Appendix A: Environmental Audit Framework

Category	Indicator	-2	-1	0	1	2
<b>Site Regeneration</b>	Remediation					
	Contaminated Soil					
	Bicycle facilities and pathways					
	Pedestrian Walkways					
	Facilities for small scale food production					
<b>Urban Design</b>	Land-use efficiency					
	Mixed use design					
	Passive Solar Potential					
<b>Project Infrastructure</b>	Solid Waste Collection					
	Organic waste and Composting					
	Surface Water Treatment					
	Water Management/Flood Risk					
<b>Energy &amp; Resource Consumption</b>	Energy use reduction measures					
	Inclusion renewable energy sources					
	Combines Heat and Power systems					
	Decentralized Energy Systems					
	Re-use materials					

	Ability to repair and sustainable maintenance					
<b>Water Strategy</b>	Water use reduction Measures					
<b>Ecological Strategy</b>	Preservation/stimulation biodiversity					
<b>Transport Strategy</b>	Public Transport Nodes					
	Transport Capacity					
	Multi-purpose trips facilitation.					
	Active travel stimulation					
	Reducing the need for commuting – i.e. community workspace et al.					
	Adequate cycling storage space					
<b>Climate Change Adaptation</b>	Flood risk					
	Increased temperatures					
	Increased weather volatility					
	Changes in ground conditions					
	Snow build up and Ice					
	Impact on water resources					
<b>Green infrastructure</b>	Availability Green Space according to best practice guides					

	Management and future maintenance					
	Green Infrastructure is part of Masterplan					
<b>Community Involvement</b>	Masterplan details community involvement in execution sustainability goals					
	Training and user manuals for sustainable facilities are provided					
<b>Light Pollution</b>	Lighting efficiency					
	Upward transmission					
<b>Sustainable Buildings</b>	Complacency new building or refurbishment best practice for sustainability					
	Commitment to sustainability confirmed through planning authority					
	Accredited third party sustainability assessment					
	Use of low impact materials					
	Resource efficiency (demolition & material reuse)					

## Appendix B: Benchmarks Audit Framework

### *Contaminated Soil*

Applicable legislative framework: Planning Advice Note 33, development of contaminated land (Scottish government, 2000).

The framework states that “The Scottish Executive considers the "suitable for use" approach as the most appropriate to deal with our historic legacy of contaminated land, in a way that takes account of environmental, social and economic objectives” (Scottish government, 2000).

The 0 median score for contaminated soil therefore is set at the commitment to remediate contamination to the extent that it enables the land to be fit for the new assigned purpose. A higher commitment, for example to full filtering and clean up of all contaminants will receive a higher score.

### *Cycling and Pedestrian facilities*

Applicable legislative framework: Transport Scotland: a Long-term vision for active travel in Scotland 2030 (Transport Scotland, 2014)

The vision cites a range of goals for 2030. It can be expected of new regeneration developments that they aspire to reach these goals, as their nature allows for elaborate infrastructure planning. Walking and cycling must become mainstream travel options. To facilitate this, main roads all have segregated cycling areas or high quality and safe alternatives. Suburban and rural roads have low speed limits. Awareness about the provision is raised with the local community and facilities are clearly signed. Road safety and cycling training is an integrated part of education and community programmes. There are good links between active travel and public transport nodes. There is appropriate support for cycle hiring schemes, car clubs etcetera (Transport Scotland, 2014).

The 0 median score commits to basic facilities and requirements for active travel such as the provision of cycleways. Higher commitments to a clear integrated active travel structure and education will receive a higher score.

### *Urban Design*

Applicable legislative framework: There is no definitive framework currently in place, however the report *Barriers to delivering Mixed use development: Final Report* provides a useful guide (Douglas Wheeler Associates and Ann Flint Associates, 2009).

The benchmark is adjusted according to the extent to which a commitment is made to overcome the barriers mentioned in this report. To what extent is there a:

- clear shared vision of the mixed-use development concept
- active collaboration on mixed-use with partners
- an effective masterplan
- a clear delivery strategy for mixed-use

The definition of mixed-use is adaptable to local cases, to what extent was a definition present?

The median 0 will represent a clear presence of mixed-use design in the masterplan. A clear definition and clear commitment to theorizing the concept receives a higher score.

### *Energy and Resource Consumption*

Applicable legislative framework: Scottish Planning Policy (Scottish government, 2014).

The framework includes targets such as 70 per cent target recycled, and maximum 5 per cent sent to landfill, both by 2025 for all types of waste. Additionally it provides for separate collection of different types of waste to prevent contamination and increase reuse and recycling options. The requirements for new developments are the following:

- promote developments that minimise the unnecessary use of primary materials and promote efficient use of secondary materials;
- support the emergence of a diverse range of new technologies and investment opportunities to secure economic value from secondary resources, including reuse, refurbishment, remanufacturing and reprocessing;
- support achievement of Scotland's zero waste targets: recycling 70% of household waste and sending no more than 5% of Scotland's annual waste arisings to landfill by 2025; and
- follow the waste hierarchy: waste prevention, reuse, recycling, energy recovery and waste disposal (Scottish government, 2014).

These requirements are both for the development itself and the building process.

The 0 median is assigned to efforts to meet these targets, a commitment to higher percentages or particular commitments to circular economy concepts will receive a higher score.

### *Biodiversity*

Applicable legislative framework: 2020 challenge for Scottish biodiversity (Scottish government, 2013). Scotland's Biodiversity – It's in your hands – A strategy for the conservation and enhancement of the biodiversity in Scotland: an overview of the implementation plans 2005-2008 (Scottish government, 2004).

The frameworks emphasize a vision where networks of greenspace a new importance in improving quality of life for those who live there and in enhancing local biodiversity (Scottish government, 2004). Biodiversity goals must be integrated with policy at all levels.

Management of land, water and living resources must be integrated.

The 0 median will be assigned to developments with a separate attention to biodiversity. An integrated greenspace and biodiversity plan throughout the development will receive a higher score.

### *Green Infrastructure*

Applicable legislative framework: Green Infrastructure: Design and Placemaking (Scottish government, 2011a).

The framework indicates a set of features that should be included in the Masterplan phase of the development. These include:

- Designing individual spaces for multifunctional benefits
- Designing sustainable and attractive places and communities served with green infrastructure
- Identifying likely management costs at the outset and designing solutions to suit the budget

In the overview below, several features are mentioned.



The building – home, garden or workspace	Connections	The street	Connections	Neighbourhood	Connections	Strategic places
						
<ul style="list-style-type: none"> <li>• Green roofs</li> <li>• Living walls</li> <li>• Gardens or grounds</li> <li>• Rainwater harvesting systems</li> <li>• Driveways (permeable)</li> </ul>	<ul style="list-style-type: none"> <li>• Pedestrian paths and rights of way</li> <li>• Cycling routes</li> <li>• Green Links and corridors</li> </ul>	<ul style="list-style-type: none"> <li>• Boundary features eg hedges</li> <li>• Street trees</li> <li>• Verges</li> <li>• Swales</li> <li>• Porous paving</li> <li>• Sustainable Urban Drainage Systems (SUDS)</li> </ul>	<ul style="list-style-type: none"> <li>• Pedestrian paths and rights of way</li> <li>• Cycling routes</li> <li>• Green Links and corridors</li> </ul>	<ul style="list-style-type: none"> <li>• Amenity greenspace</li> <li>• Informal recreation spaces</li> <li>• Playspaces</li> <li>• Allotments, community growing spaces</li> <li>• Playing fields</li> <li>• Sports areas</li> <li>• Urban parks</li> <li>• Burial grounds, cemeteries</li> <li>• Swales</li> <li>• Urban woodlands</li> <li>• Ponds</li> <li>• Water courses</li> </ul>	<ul style="list-style-type: none"> <li>• Pedestrian paths and rights of way</li> <li>• Cycling routes</li> <li>• Green Links and corridors</li> <li>• River and canal corridors including their banks</li> </ul>	<ul style="list-style-type: none"> <li>• Civic scale spaces</li> <li>• Public parks and gardens</li> <li>• Green Networks</li> <li>• Country &amp; Regional Parks</li> <li>• Natural/semi-natural greenspaces</li> <li>• Forests and Woodlands</li> <li>• Grasslands</li> <li>• Designed landscapes</li> <li>• Formal gardens</li> <li>• City farms</li> <li>• Blue Networks</li> <li>• Rivers, lochs and Wetlands</li> </ul>

*Green Infrastructure examples* (Scottish government, 2011a).

As there are no binding requirements for green infrastructure, the 0 median will represent a commitment to having features of green infrastructure in the development. A higher score will be awarded to developments where green infrastructure is integrated in the complete design of the site.

### *Sustainable Buildings*

Applicable legislative framework: Building (Scotland) Act 2011 (Scottish government, 2011b).

This amendment to the Building (Scotland) Act states that:

- “7.1 Every building must be designed and constructed in such a way that—
- (a)with regard to a dwelling, a level of sustainability specified by the Scottish Ministers in respect of carbon dioxide emissions, resource use, building flexibility, adaptability and occupant well-being is achieved;
- (b)with regard to a non-domestic building, a level of sustainability specified by the Scottish Ministers in respect of carbon dioxide emissions is achieved; and
- (c)a statement of the level of sustainability achieved is affixed to the dwelling or non-domestic building” (Scottish government, 2011b).

The 0 median hence will be placed at meeting these requirements. A higher score will be awarded to a clear commitment to exceed these minimum requirements.

### *Community involvement/Behaviour change*

Applicable legislative framework: There is no clear framework for stimulating sustainable behaviour change, nor a clear definition of the responsibility of local authorities in

this respect. However, projects like the Scotland 2030 project show a commitment of the Scottish government to work on sustainable behaviour change (Scottish government, 2016b).

The 0 median will be assigned to development that includes either initiatives, or support for initiatives that stimulate sustainable behaviour and awareness. A higher score will be assigned to developments where behaviour change is an integral part of the design and planning of the project.

## Appendix C: Three Pillars Interview Framework

<b>Pillar</b>	<b>Category</b>	<b>Indicator</b>	
<b>Social</b>	Consultation	Consultation Plan in appropriate time phase	
		Design Review	
	Community Needs	Community Centre	
		Leisure facilities	
		Health and social care facilities	
		Children's playgrounds	
		Shops	
		Integration and social inclusion	
		Built Environment	
	Housing	Heritage and local identity	
		Location and Condition of buildings	
		Street Safety	
		According to demographic needs	
		Tenure Mix	
		Management	
	<b>Environmental</b>	Site Regeneration	Community ownership
			Inclusive Design
			Local training and skills
Urban Design		Remediation Contaminated Soil	
		Bicycle facilities and pathways	
		Pedestrian Walkways	
		Facilities for small scale food production	
		Land-use efficiency	
		Mixed use design	
		Passive Solar Potential	
Project Infrastructure	Solid Waste Collection		
	Organic waste and Composting		
	Surface Water Treatment		
	Water Management/Flood Risk		

	Energy & Resource Consumption	Energy use reduction measures
		Inclusion renewable energy sources
		Combines Heat and Power systems
		Decentralized Energy Systems
		Re-use materials
		Ability to repair and sustainable maintenance
	Water Strategy	Water use reduction Measures
	Ecological Strategy	Preservation/stimulation biodiversity
	Transport Strategy	Public Transport Nodes
		Transport Capacity
		Multi-purpose trips facilitation.
		Active travel stimulation
		Reducing the need for commuting – i.e. community workspace et al.
		Adequate cycling storage space
	Climate Change Adaptation	Flood risk
		Increased temperatures
		Increased weather volatility
		Changes in ground conditions
		Snow build up and Ice
		Impact on water resources
	Green infrastructure	Availability Green Space according to best practice guides
		Management and future maintenance
		Green Infrastructure is part of Masterplan

	Community Involvement	Masterplan details community involvement in execution sustainability goals
		Training and user manuals for sustainable facilities are provided
	Light Pollution	Lighting efficiency
		Upward transmission
	Sustainable Buildings	Complacency new building or refurbishment best practice for sustainability
		Commitment to sustainability confirmed through planning authority
		Accredited third party sustainability assessment
		Use of low impact materials
		Resource efficiency (demolition & material reuse)
<b>Economic</b>	Local Economy	Employability
		Local economy
		Economic Viability

## Appendix D – Section 7 Silver Level requirements

“A dwelling at this first optional upper level should meet all the standards in Sections 1 – 6 that apply to the building for the Bronze level and, in addition, the dwelling should comply with the Silver level in each of the eight aspects below.

### Aspect Silver level 1: Carbon dioxide emissions

All new dwellings that meet or exceed the Target Emissions Rate (TER) detailed in Section 6, Energy of this Handbook, will automatically meet the Silver level criteria in respect of CO<sub>2</sub> emissions. This is due to the 21% improvement on the 2010 standards that occurred in October 2015.

### Aspect Silver level 2: Energy for space heating

Maximum annual demand for useful energy for space heating should be:

- 40kWh/m<sup>2</sup> for houses, or
- 30kWh/m<sup>2</sup> for flats or maisonettes

To assess, the output from box no.99 of the SAP 2012 DER worksheet should be no more than the figures above.

### Aspect Silver level 3: Energy for water heating

At least 5% of the dwelling or domestic building's annual energy demand for water heating should be from:

- heat recovery and/or renewable sources with little or no associated fuel costs (e.g. solar thermal water heating and associated storage or heat recovery from greywater) that are allocated for water heating.

To assess, the annual energy demand for water heating in kWh multiplied by 0.05, should be no more than the contribution from specified equipment that uses renewable energy and/or heat recovery. A SAP spreadsheet is available for this calculation here: <http://www.bre.co.uk/sap2012/page.jsp?id=3817>.

Where a building contains more than one dwelling (such as a block of flats or terrace of houses) the average annual energy demand for water heating may be met by installations of

renewable sources and/or heat recovery for the block. This is similar to the buildings with multiple dwellings guidance in Section 6.

#### Aspect Silver level 4: Water use efficiency

Enhanced or additional products should be provided as follows:

- WCs of average flush volume not more than 4.5 litres
- Wash hand basin taps with a flow rate not more than 6 l/m
- shower heads with a flow rate not more than 8 l/m, and
- 1 water butt (with a min. capacity of 200 litres) for outdoor use per dwelling. Dwellings without a private garden or landscaped area, or if there is no access to rainwater collection (for example if there is no external rainwater pipe within the curtilage) are excluded.

The flow rates referred to align with performance bands in the Bathroom Manufacturers Association's water efficient product labelling scheme (BMA scheme). Reference can be made to the performance bands within the BMA scheme or equivalent standards. Kitchen or utility room sinks are not included in low flow fitting targets at this level. Consideration should be given to the flow rates that combi boilers (if fitted) need to activate their water heating function when specifying taps and shower heads with lower flow rates. When installing low volume flush WCs, the pipe diameter and gradient inter-relationship is critical in order that the new and any existing sections of the drain are self-cleansing.

#### Aspect Silver level 5: Optimising Performance

a. Quick start guide: Provide guidance to the occupants on the ways in which the specific dwelling is intended to function and how to optimise its performance on the scope, format and contents of the guide for occupants. Supplementary guidance with a performance specification as well as links to an example completed quick start guide is in Annex B. This is additional to the written information to be provided to occupants under Section 6.

b. Resource use display: Install a real-time resource use monitor that displays electricity use, located in an easily accessible and readable position.

#### Aspect Silver level 6: Flexibility and Adaptability

Provide a home office space dedicated for home working/study to include:

- A clear space, against a wall or partition, where a desk of 1800mm long x 600mm deep could be placed. Alternatively, the desk space could be 'L' shaped in plan as long as each leg of the 'L' is a minimum length of 1200mm. Diagrams below show the two desk options with associated activity spaces.
- 2 switched electrical sockets in addition to those that should be provided under Section 4.
- A connection to allow direct access to internet services (unless such a provision is made elsewhere in the dwelling).
- For natural daylight there should be line of sight to a window, glazed external door or rooflight.
- Generally ventilation, accessibility, safety and escape should meet all the other standards however, see paragraphs below.

In any dwelling, the home office space can be in a circulation space but should not be located in a protected enclosure. The desk space and/or its activity space can locally reduce a corridor width to 800 mm and should not interfere with door swings. In any dwelling, the home office space can occupy a room by itself even if this room is too small to be an apartment. In this case, this small room should be ventilated as if it were an apartment. In any dwelling, the home office space can occupy a part of the enhanced apartment but the desk space and its activity space should be additional to the defined spaces and access of the enhanced apartment, as described in guidance in Section 3. In any dwelling the home office space can be in a room that includes the kitchen but the desk space and or its activity space should not interfere with kitchen worktops, appliances or manoeuvring spaces.

To allow some more flexibility in smaller dwellings (those of not more than 2 apartments) the home office space can be in any apartment. But in this case, the desk space and its activity space should not overlap with the minimum furniture provision or associated activity spaces. The height of the home office should be not less than 1.8m over the activity space and 1.5m over the desk space. For dwellings over 150m<sup>2</sup> floor area, two home office spaces should be provided.

Aspect Silver level 7: Well-being and security

- a. Noise separation: Design performance levels for separating walls and separating floors associated with attached dwellings should be:
  - Minimum airborne sound insulation: 58 dB DnT,w



- Maximum impact sound transmission: 54 dB L'nT,w Performance levels for noise isolation for separating walls and separating floors should be verified by carrying out a sound test as indicated in the guidance to Section 5.

b. Noise reduction between rooms: Design performance level for a minimum airborne sound insulation should be 44 dB Rw. This refers to all internal partitions in all dwellings and intermediate floors within houses and maisonettes excluding storage cupboards and should be substantiated by manufacturer's laboratory test certificates.

c. Enhanced natural lighting: The enhanced apartment should be provided with a glazed area of not less than 1/8th of the floor area of the apartment.

d. Security: Install a 13 amp fused spur, suitable for an intruder alarm system, located within 2m of the main entrance door.

Aspect Silver level 8: Material use and waste

Recycling of solid waste: Provide a dedicated internal space with a volume of at least 0.12m<sup>3</sup> (120 litres) and no dimension less than 450mm, for storing recyclable material. The storage space should:

- be able to store small amounts of recyclable material (e.g. metal, glass, plastic, cardboard and/or paper)
- be easily cleanable
- be additional to the general 1m<sup>3</sup> kitchen storage in Section 3, and
- facilitate temporary storage before transfer to a main storage point or a collection point, whether for the dwelling or for a group of dwellings.

It is recognised that local authority provision, resources and preferences for collecting separately or together will vary across Scotland. Therefore subdivision into containers for different materials is optional" (Scottish government, 2017, p. 384-386).