



Castlegate Grey to Green Phase 2 (28R18SO2556)

Summative Assessment Final Report

Co-ordinated by Sheffield City Council
November 2022



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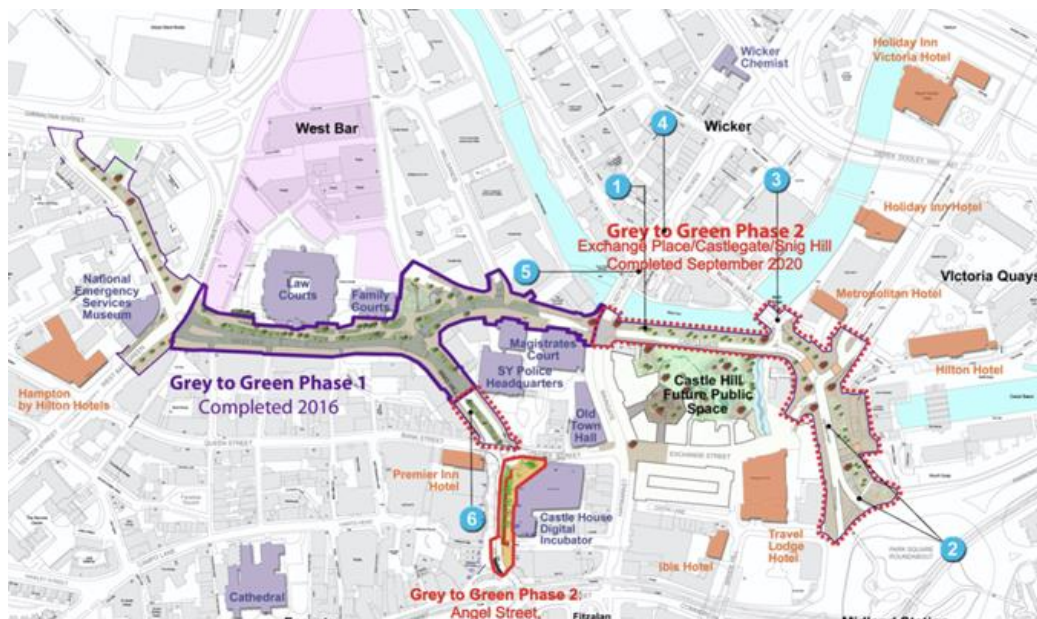
Introduction

Castlegate Riverside is a key regeneration area of Sheffield city centre on its NE edge and is the link to a major hotel and business district. It suffered from severance of public transport, walking and cycling by redundant roads and related infrastructure, surface water flood risk, poor air quality and environment. It had significant economic potential, but the current setting is a disincentive to investment which has stalled since 2008.

The Grey to Green 2 intervention was a key part of the regeneration strategy for Castlegate to be delivered by the City Council with significant input from the University of Sheffield's Landscape Department. Other local steering groups, such as the Castlegate Partnership have also been very active throughout the scheme. The partnership includes local businesses and other occupiers, the Environment Agency and the Canal and River Trust amongst others. It is a locally based, small scale 'whole place', low carbon initiative. The main aim is to reduce carbon emissions utilising green/blue infrastructure as well as other adaptations to drive modal shift and improving climate change resilience for the Castlegate Riverside area of Sheffield City Centre.

Before the Grey to Green 2 intervention, the project area which was formerly a part of the city's Inner Ring Road, is 100% impermeable, 80% occupied by up to six lanes of highway and only 20% by footways.

Phase 2 has converted a large area of redundant hard surface highway into a chain of public spaces, water meadows, dedicated cycle-walking routes and introduced an extensive network of Sustainable Urban Drainage (SUDs). Phase 2 follows the completion of Grey to Green Phase 1 in 2016 (also ERDF funded) which attracted both local and national awards and interest for its transformational and innovative approach.



In terms of market failure, this kind of large-scale transformation at this location would not have been provided by the private sector as it lies entirely within the adopted public highway. It also has multiple beneficiaries, many of which are visiting or passing through. Additionally, development values are relatively low and the benefits are too widely spread over this spectrum of users. A comprehensive approach such as is proposed by Grey to Green can only be delivered by a public highway authority.

The project has fully met the objectives it set out to deliver. In terms of challenges, Covid has meant a delay in completion of the first major contract part of this scheme (with contractor NMCN) and Covid also played a part in terms of the project's extension to Angel St (with contractor Esh) as delivery of key materials (Portuguese granite kerbs) were delayed by over 4 months, caused time delays and increased costs.

This project addressed two Priority Axes, namely P4 Low Carbon (by reducing greenhouse gas emissions, promoting sustainable transport and urban design activities linked to green/blue infrastructure and tree planting) and P5 Climate Change Adaptation (by providing climate change resilience and enhanced biodiversity).

The project was jointly funded by the Sheffield City Region, the European Regional Development Fund and Sheffield City Council.

Methodology

This report has been co-ordinated by Sheffield City Council (SCC) using a mixed method-based approach. SCC has collated a significant amount of anecdotal evidence and information from occupiers and stakeholders as well as objectively achieving all the objectives and outputs the project set out to do.

Externally, we have worked closely with Professor Nigel Dunnett and students from the University of Sheffield's Landscape Department as well as private consultancy ECUS (commissioned to evaluate the impact on biodiversity of the scheme).

The objectives of this summative assessment are:

- a) To examine the project design, delivery and management and draw lessons learnt;
- b) To explore how biodiversity has been enriched by the scheme
- c) To show how the radical transformation enabled by the project has led to an increased use and positive perceptions of the project area

Given the above, this report is structured as follows. Firstly, the project context is explained as well as the design process, management and engagement with stakeholders and occupiers as part of the construction process. Secondly, on the main findings of two externally commissioned reports from a well-known ecology consultancy, ECUS. It has evaluated the impact on biodiversity created by the scheme (relatively unknown up until now), one of the key outputs. Finally, as regards

impacts, we have also undertaken an evaluation exercise with the University of Sheffield to look at changes in public uses of the previously mainly highway area.

Section 1: Project Context

This section provides an overview of the project's objectives, the green stormwater infrastructure innovations the project brings and its innovative planting design.

1.1 Project objectives

The project key objectives were:

- a) the transformation of environmental performance, habitat creation permeability and climate change resilience of this part of Sheffield City Centre;
- b) increasing the connectivity of Castlegate to the rest of the City Centre and to link up all active travel routes around the area (pedestrians, cyclists and public transport);
- c) to reconnect the riverside hotel and business district to the core city centre
- d) to establish a palace for people, outdoor events and vitality.

1.2 Site description

The project site is located in the Castlegate area of Sheffield's city centre, the site of government buildings, businesses, and apartment buildings. The area was formerly unattractive to economic investment for two major reasons: the area was difficult and unpleasant for pedestrians to traverse due to the roadway infrastructure, and the area is prone to flooding.

The high impervious surface coverage in the city centre meant most rainfall drained directly to the River Don. A major flood in 2007, where the River Don rose 5 meters (16.4 feet), resulted in significant economic damage and mobilized the city toward action. The construction of a relief roadway outside of the City Centre reduced vehicular traffic in the project area and created an opportunity to eliminate road lanes to make space for more robust pedestrian infrastructure and green stormwater infrastructure.

1.3 Green stormwater infrastructure innovations

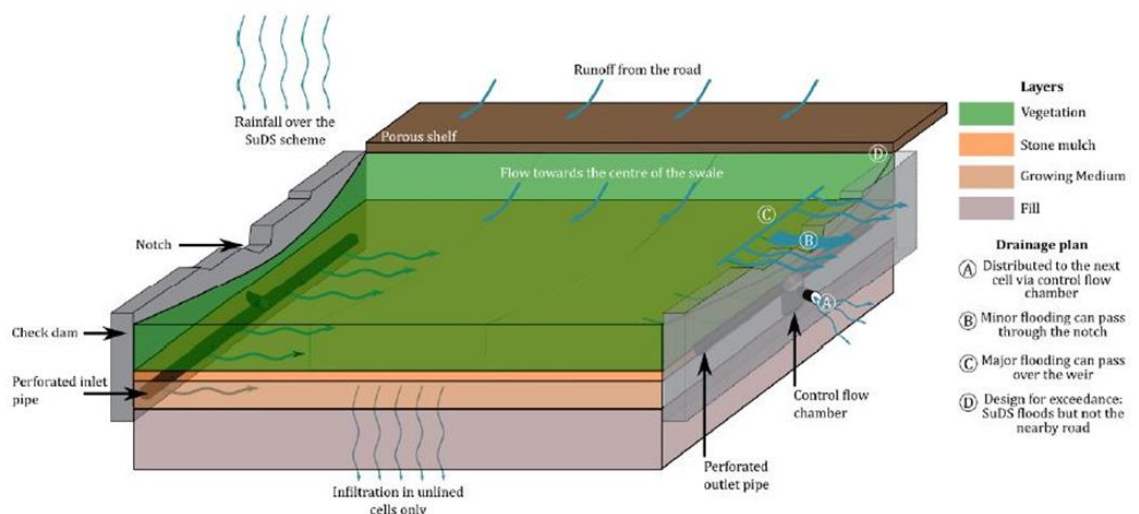
Sheffield City Council's Design Team worked with Professor Nigel Dunnett from the University of Sheffield's Landscape Department and his landscape architecture studio students at the University of Sheffield to design rain gardens and bioswales/ Sustainable Urban Drainage (SUDs) in the project area. The length of bioswales was divided into a number of cells using check dams.

The bioswales are shallow depressions that are lined under the soil along the edges to encourage water flow into the bioswales, and unlined in the basin area

to allow infiltration (with the exception of end-cells). Thorough assessment of contamination pathways in the project area supported the decision to use largely unlined bioswales.

The curbs along the bioswales are nearly flush to the street to allow water to flow into the bioswales. Under low intensity rain events, water flows slowly from one cell to the next downhill cell through perforated pipes at the base of the check dam or infiltrates into the underlying soil. Under high intensity rain events when the rate of rainfall exceeds the combined rate of pipe outflow and infiltration, water ponds in the bioswale but the check dams prevent it from rushing downhill immediately (Lhomme-Duchadeuil, 2018). The bioswale system was designed to handle a 100-year storm event plus an additional 30% of rainfall volume to account for climate change (Lhomme-Duchadeuil, 2018). The bioswales are integrated into pedestrian and cycle infrastructure, connecting the area to the rest of the city.

Storm events since the major floods in Sheffield in 2007 (two in particular in 2018 and 2020) have shown that the Sustainable Urban Drainage in the Grey to Green project has worked as it was designed to do and held water for a critical period as part of the Council's surface water management strategy.



Water flow into and through the components of a bioswale cell. Image credit: Adrien Lhomme-Duchadeuil (University of Sheffield)

1.4 Planting design

Sheffield City Council envisioned an urban meadow aesthetic for the bioswale and rain garden plantings. Instead of using a planting plan that specifies locations for each individual plant, the design team established three types of planting zones – wet, semi-wet, and dry – and created a list of plants for each that were randomly planted at a density of 8-12 plants per square meter. Bulbs were also planted in drifts for additional seasonal visual interest.

The only plants with specified locations were trees, evergreen structural plantings, and grasses to create a wave pattern along the length of the bioswale cells. To achieve visual appeal quickly, several species of fast growing and early flowering plants were included in the mixes.

Research by the University of Sheffield on the impact of the meadow style plantings suggest that it significantly improved the aesthetic experience of the streetscape and reduces reflected radiative heat, thereby likely to reduce thermal stress on nearby pedestrians (Lhomme-Duchadeuil, 2018).

Central to the health of the plants was the selection of soil substrate for the bioswales and rain gardens. The team chose to use an engineered soil mix composed of 70% crushed sandstone, 20% compost, and 10% sandy silt loam mixture, the combination of which provides good drainage, good soil structure, and nutrients.

A second determinant of the success of the plantings was the post-construction maintenance regime. The design team chose a private contractor maintenance company, Green Estate Ltd., with experience in green stormwater infrastructure maintenance to perform twice-yearly maintenance. This initial dedicated maintenance regime was for 3 years after which the project was handed to SCC's maintenance teams. In December, the contractors remove only the dormant plant growth with untidy appearance, and then remove the remainder of dormant growth in February.

Section 2: Project Progress

The Grey to Green Phase 2 project was delivered in two distinct stages: the main one (Exchange St/Castlegate (the street)/ Snig Hill) completed in summer 2020 and the smaller one, Angel St. completed in Spring 2022.

Both stages were impacted negatively by Covid. Completion of the main phase was delayed by 4 months and costs significantly increased. On Angel St, which started on site in summer 2021, Covid was a significant contributing factor to the delay in the arrival of key material from Portugal and the increase of costs payable to the contractor due to this.

Albeit delayed due to Covid, overall, the project has been a major success in terms of outputs and impacts achieved. The estimated contract value was £5.160m and the actual final contract spend has been £4.892m through good contract management and value engineering.

All outputs that the project set out to do have been achieved: 238 tons of reduced CO₂, 1.04 Ha of surface area of habitats supported in order to attain a better conservation status and 25 businesses and properties with reduced flood risk.

The basis for the success the innovatory and award-winning Grey to Green 'approach' is that we have already delivered Grey to Green Phase 1 very successfully in 2016. It was also funded by the Sheffield City Region, ERDF and Sheffield City Council. Many lessons were learnt regarding design, engagement, planting scheme and contract management which Phase 2 has benefitted from.

Section 3: Project delivery and management

The project was managed on the principles of a 'strong client team' which means that the client is also the contract manager for ERDF (and the Sheffield City Region), managing all claims and reports to the two funders.

The project has designed the scheme to all RIBA Stages (which stand for Royal Institute of British Architects) and procurement documentation was prepared subsequently. The procurement process (for both Grey to Green Exchange Place/ Castlegate/Snig Hill and Angel St) was through the YOR Civils Framework.

The project had appropriate governance and management structures, as approved in the ERDF full application, which replicated the previous successful Grey to Green 1. A copy of the organigram is attached in Appendix H.

The project had 5 levels of reporting. Everything operated as expected. With Covid, online alternatives to meetings face to face had to be arranged:

1. Project Board, which was chaired by the Project Sponsor, Simon Ogden. Meetings were co-ordinated by Lucia Lorente-Arnau (Client)
2. Project Team. These were co-ordinated by the project managers (Gary Wright for the NMCN contract and Richard Pearson for the Esh contract) and took place regularly during the design as well as the construction period.
3. General Reporting: Project Managers and contractor site managers produced monthly Highlight and PM reports for the Client.
4. Financial monitoring: meetings took place regularly between the Client, Cost Manager, SCC External Funding Finance Officer and ERDF Claims Officer to ensure all information for ERDF Claims was available. All activities have been successfully delivered to the highest standards.
5. Regular communications with stakeholder and occupiers of the project areas. Newsletters were emailed to key stakeholders and occupiers by the project client every 4-6 weeks. They included progress from the project manager and the contractor and key issues for the next 4-6 weeks. A copy of one of these can be found in Appendix B.

This project did not have direct beneficiaries. Beneficiaries for this project are: Sheffield City Council, main contractor that delivered the scheme, businesses currently occupying the area and their employees as well as residents and visitors to the areas.

Cyclists (the project designed segregated cycle lanes throughout) and pedestrians are also beneficiaries, given the improvement in infrastructure. Regular discussions

with the Cycle Sheffield group indicate that the routes created by the project are widely used and liked by all members. The scheme is regularly on social media, and it is associated with very positive comments from cyclists and pedestrians alike as it has improved the quality of their living and working environment. The conversion of inner-city highway to shared space has made an important statement regarding the importance of public realm, liveability and human focus.

SCC undertook detailed consultation with stakeholders, occupiers and the general public on the Grey to Green Phase 2 scheme, in March 2018 for the NMCN contract (Exchange Place/ Castlegate (the street)/ Snig Hill and in January 2021 for the Esh contract (Ange St). The proposed concept plan was supported by more than 90% of respondents. There is a high level of satisfaction with the completed works as reported through regular meeting and communications with occupiers and stakeholders. A copy of the evaluation report from the March 2018 is attached in Appendix A.

Section 4: Project Outputs and Outcomes/ Impact

4.1 Overview

The project has fully met the environmental sustainability and equality/ diversity objectives set out in the approved ERDF application at the start of the process.

In terms of environmental sustainability, the project has transformed the environmental performance, setting and connectivity of the northern eastern edge of city centre by a 'whole place' approach to environmental regeneration. The pedestrian and cycle priority as well as sustainable urban drainage over large areas is critical for urban climate-change adaptation and to address environmental issues such as flooding, poor air quality and elevated temperatures. The project has also achieved a 'Very Good' Sustainability Performance rating for a Construction CEEQUAL Assessment. The innovative planting has also meant that biodiversity has improved to more than 560% from previously.

In terms of equality and diversity, the main impact of the scheme will be for those who have restricted physical mobility and/or restricted sight or hearing. Early discussions took place with the Council's Access Liaison Group which brings together representatives of these communities followed by a site visit and further modifications to the scheme to respond to all their advice, resulting in a positive sign-off for the project. Sheffield City Council is committed to promoting equal opportunities and diversity through a comprehensive policy. The public infrastructure as a result of this project is fully DDA compliant. Equality is integrated into all aspects of project planning, design, and implementation.

The project has received a substantial amount of local, regional and national publicity. As an example, see is a recent article by Gardens Illustrated (Appendix C).

4.2 Outputs

The project has delivered in full the project outputs and all evidence submitted to ERDF:

- (C34) a reduction of 238 tons of carbon emissions and harmful pollutants (237 through ARUPS report and the scheme's completion certificate plus an extra ton through the sequestration of new trees planted in the scheme)
- (P6) 25 businesses with a reduction of water surface flooding with the completion of the scheme as designed
- (C23) The creation of 1.08 Hectares of new surface area habitats. As regards Increased Habitats, the Ecologist Consultancy ECUS have produced two reports which evaluate the impact of these improvements. measuring the improvements in biodiversity terms

We have paid particular attention to the evaluation of the biodiversity due to the planting elements of the scheme. The full reports are included in Appendix D and E below. As a summary:

- A team of suitably qualified consultants were appointed to determine the baseline ecological value of the Phase 2 sites (Exchange Place/ Castlegate/ Snig Hill and subsequently, Angel St). An extensive habitat survey was conducted, prior to development works commencing.
- To demonstrate the enhancement of biodiversity value quantitatively, the Building Research Establishment Environmental Assessment Method (BREEAM) Land Use and Ecology calculator was utilised to allocate a biodiversity value to the site before and after the development
- The BREEAM calculator was utilised as it makes provision for amenity planting whereas the DEFRA biodiversity calculator (a widely used method of determining the biodiversity value of a site) is based chiefly on naturalised habitats and so was not Sheffield City Council Grey to Green Biodiversity Assessment 2 considered suitable given the urban nature of this site and the amenity based planting scheme, which does not correlate easily with a 'naturalised' habitat within the DEFRA calculator
- The use of the BREEAM calculator showed a 561% increase in biodiversity in the G2G2 main element (Exchange Place/Castlegate/Snig Hill) and a 643% increase in biodiversity in the G2G2 Angel St element.
- The initial landscape proposals and planting plans were reviewed and a qualitative and quantitative assessment made in respect of biodiversity value. A management Plan was drawn up too for the two areas of the project.
- Appendix G shows the striking and much-loved planting achieved by the Grey to Green 2 scheme

4.3 Outcomes. Post construction Evaluation of use and perceptions about Sheffield's Grey to Green scheme. A comparison between Phases 1 and 2. (Full report in Appendix F).

Grey to Green is a pioneering project, incorporating flood risk management and innovating planting design which looks to increase public interactions and uses of (newly created) outdoor spaces.

Through a range of techniques such as questionnaires and observations, this research evaluation project by Imogen Glover (University of Sheffield's Landscape Architecture Master Student) set out to compare the overall human interaction around the new spaces and changes between Phase 1 (completed in 2016) and Phase 2 (completed in 2022). Evaluation of these aspects is important as it will help improve future design and tackle any issues that have been identified. 350 questionnaires were completed over the course of a two-week period in June 2022. 175 of these were in G2G Phase 1 and the remaining 175 in G2G Phase 2. This report also contains a comparison to a 2016 evaluation by Xueyang Xong (through 341 questionnaires in 2016 relating to G2G Phase 1).

The key findings are [Note: Phase 1 is short for Grey to Green Phase 1 and Phase 2 is short for Grey to Green Phase 2]:

- For Phase 2, there is more than 50% of visitors that come to visit the site for leisure reasons, and 25% for work. This is the reverse as in Phase 1 indicating that the project attracts people who live outside the area to come to Catlegate. This is important, given the negative perceptions of Castlegate as a destination.
- Nearly for all 30% of all respondents from Phase 2, the visit to the site was a first time, compared to 15% in Phase 1
- The perception of safety in both Phase 1 and Phase 2 is significantly greater than pre-grey to green construction
- This positive perception of the completed scheme, for Phase 1 and Phase 2, also extended to public maintenance of the space, access to seating in the project area, attractiveness and maintenance
- The scores for perception of safety when travelling through Grey to Green at night were slightly lower in Phase 2 than in Phase 1, although only 39% of respondents said they need to go through the site at night.
- The Council has worked with a local entrepreneur to help establish the first fresh flower market in Sheffield on the site of Grey to Green 2 in Castlegate (the street). This has been going for over a year now and is very successful. Interestingly, only 25% of the people who were interviewed had heard of the Pollen Market which indicates a need to broaden publicity around it
- 'Comfortability' around the site (defined in regard to feeling secure and happy within the site) is extremely high for both Phase 1 and Phase 2, over 95% on both.
- In terms of what the public liked about Phase 2, planting came top with cycle lanes, seating and a place for relaxation second;

- The evaluation also looked at other amenities that the public thought were missing or insufficient. 30% of respondents would not add or change anything in Phase2, to keep as it is. The most popular improvements would be more coffee shops and similar amenities and more shade and cover for sunny days and improvements to the Castle Site (currently boarded up). These results confirm the Council's own assessment
- The reports also reports the large amount of school and other educational visiting groups the area (12 observed in the 2 week period), with the main interest being the planting and Sustainable Urban Drainage. Some child play was observed within the 2-week period (16 times). These are interesting findings for the Council as we promote visits to the City Centre and attract more people with young children to live in the City Centre too
- Finally, the report also highlights a number of instances where anti-social behaviour is observed in Phase 1 and 2. The Council is aware of these issues and is working with a multi-disciplinary team to address them.

4.4 Other outcomes & impact

Other important outcomes have been achieved, summarised below:

- as part of the Sheffield City Region's (SCR) funding, job creation was an outcome. We have reported to the SCR a total of 547 jobs created by the scheme. The monitoring was disrupted during Covid;
- reclaiming 2.4 Ha of redundant highway for sustainable drainage, active travel routes and striking planting (blue-green infrastructure), to bring about environmental as well as social and economic benefits
- as regards the SUDs (and in collaboration with Yorkshire Water), reduced requirement to process surface water via Sewage Treatment Works leading to reduction in the pressure on sewers and a catchment reconnected to its watercourse (River Don)
- Reduction of surface temperatures due to trees and planting
- Improved health and wellbeing through less reliance on unsustainable modes of transport and created a setting which people want to spend time in. Grey to Green 2 has become one of Sheffield's favourite cycling route, for commuters as well as used by families at the weekend.

All the above can be attributable to the project's activities as we have halved the highway space and converted into green/blue infrastructure. We have also pedestrianised a major street in the area, Castlegate (the street).

Beyond the above, and in terms of strategic added value, the Grey to Green 2 project has:

1. Pre-project assessment: The area did not meet sustainability or carbon reduction standards. It currently includes a part of the city's Inner Ring Road, is 100% impermeable, 80% occupied by up to six lanes of highway and only 20% by footways. There were no cycling routes or green areas. After completion of the project, approximately 40% of the project area is carriageway (from 5 or 6 lanes down to 2 or 3) and 60% has become Sustainable Urban Drainage (SUD). All of the

SUDs have been planted in the highly successful meadow-type planting developed in Sheffield as well as cycling and priority pedestrian facilities.

2. Pre-project assessment: Lack of relevant connectivity of sustainable modes of transport. As part of the project, 1,800m² of new cycle lanes and improved pedestrian priority areas have been provided, which have enhanced these carbon neutral modes of transport. They link this part of the City Centre to five long distance walking and cycling radials routes along the Lower Don Valley, Upper Don Valley, Canal towpath, Sheaf Valley Park and National Cycle Route 65 as well as to other parts of the City Centre (such as the train station and the Sheffield Hallam University).

3. Pre-project assessment: How the economic recession of 2008 affected the Castlegate area and Sheffield in general. The process of transforming this area began with the regeneration of Victoria Quays in the mid-1990s. The re-routing of the Inner Ring Road was designed to include the river and canal-side areas within the perceived and functional city centre, indicating the economic potential of Central Riverside. The completion of the Inner Relief Road in 2008 coincided with the world recession and halted development plans for a decade during which carbon reduction and climate change resilience have become major drivers of the Grey to Green approach. Sheffield's Gross Value Added (GVA) is also considerably lower than the national average. Projects like Grey to Green are critical to bridge this gap. Strategies such as the Grey to Green are catalyst for change by improving the setting for investment and raising sustainability awareness of investors. This has already been proven is the Grey to Green Phase 1, where local site owners name the public realm enhancement as a catalyst for their investment. We have already started to see interest in the Castlegate area economic investment following the completion of Grey to Green Phase 2, although Covid has brought some delay to quantifying the full results.

Section 5: Project Value for money

ERDF is expected to provide a grant of £1.657m towards the eligible construction costs of £4.892m. This represents 33.87% of funding. However, the total cost of the scheme (construction costs plus fees, surveys, design and other costs) is around £7m. So the total ERDF funding is about 23.67% of the required funding.

This is similar to Grey to Green Phase 1 (completed in 2016 and also funded by ERDF, Sheffield City Region and Sheffield City Council. The ERDF grant was £992k with total costs of circa £4m so the ERDF grant provided 24.82% of costs.

Grey to Green Phase 1 provided circa half of a Km of linear improvements. However, Grey to Green Phase 2 has provided double that, nearly 1 km of linear improvements with a similar grant % intervention (24.82% for Phase 1 vs. 23.67% of Phase 2). This is considered excellent value for money.

Section 6: Conclusions and Lessons Learnt

Things that went well/ Strengths:

1. Innovative/ highly technical design (SUDs and planting);
2. The project successfully obtained approval for three separate Full Business Cases to enable its delivery (SCC, SCRIF and ERDF);
3. Delivered what it set out to do and strong project structures to manage and deliver it well
4. Broadly within budget, despite increase in costs due to covid related increase in costs and delays in materials coming from outside the UK
5. Good communication strategy from the contractor and the client with residents/ stakeholders.
6. Proactive and successful extended role of the 'client'/ project promoter;
7. Financial systems set up by the Client team to draw down the funding worked well. All Claims (ERDF and SCRIF) submitted in time and with the required level of evidence;
8. The team responded well to financial challenges to keep the project on track;
9. Amey became involved very early on the outline stage (with responsibility for Highway, Lighting and Traffic Engineering) and carried through to end of construction. This consistency and the background knowledge of the engineers involved proved very useful;
10. There was consistent input from the Project Manager and Quantity Surveyor from beginning to the end of the scheme to help resolve issues with the contractor and successfully conclude the NEC process;
11. The contractors, NMCN and Esh, were able to deliver high quality work and was flexible to respond to unexpected events during construction;
12. The project was able to capitalise maintenance of landscaped areas to 3 years (not the usual 1 year) to maximise the chance of successful establishment. The contractor was very supportive of this process;
13. Outcome of ERDF audits very positive;
14. Multi- Award winning scheme;

Things that 'could have gone better'/ weaknesses:

1. Initial SCC approval process did not acknowledge the highly technical nature of the scheme and complexity of funding arrangements. These have been reviewed and resolved for future schemes;
2. Tight timescales to deliver the scheme ;

3. The project had a great deal of technical challenges. Of relevance was the decision to line or not line the SUDs. There were delays and problems with the quality/ contents of the contamination reports issued by Amey. After lengthy discussions and technical reports, they were all resolved
4. A number of specific issues arose with the contractors throughout the contract. We would like to highlight the following, such as delays in granite kerbs (Esh), contractor not looking to advance work programme and allow reasonable time to resolve complex issues (Esh) and finally, the benches (they were a design and build but the sub-contractor appointed by NMCN did not provide the required quality which had to be resolved)
5. Site manager (Esh contract) was perceived to have inadequate skills/ experience and possibly lack of appropriate senior support to manage the needs of such complex scheme
6. Contractor has delayed completion of 'snagging' issues for no apparent reason (both contracts)
7. NMCN went into administration which has delayed the return of the contingency
8. Circumstances beyond our control. Covid meant that the project was delayed and essential construction materials were also significantly delayed, which also increased scheme costs.

Finally, in terms of improving the delivery of the project, the lessons learnt exercise undertaken suggest the following:

- a) In future contracts, consider the introduction of penalties into the original procurement of granite kerbs to de-risk the scheme;
- b) Clear communication during the procurement process and stick to timescales when placing direct orders;.
- c) Grey to Green includes complex highway design. Ensuring that these designs are final prior to going to site, which would reduce the number of compensation events;
- d) Contractor's site supervision staff – ensure continuity and relevant experience;