



THE
ENVIRONMENT
PARTNERSHIP



URBAN GREENING FACTOR MANCHESTER CITY COUNCIL FEASIBILITY STUDY DECEMBER 2023

TEP
Genesis Centre
Birchwood Science Park
Warrington
WA3 7BH

Tel: 01925 844004
Email: tep@tep.uk.com
www.tep.uk.com

Offices in Warrington, Market Harborough, Gateshead, London and Cornwall

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Prepared by	TEP - Warrington
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Author	Maggie Fennell Wells
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Checked	Tom Ridley
Approved	Francis Hesketh

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Executive Summary

1. This report examines the feasibility of introducing an Urban Greening Factor (UGF) policy in Manchester's emerging Local Plan 2023/4 to 2038/9.
2. UGF is recommended by Natural England as a useful tool in building green infrastructure on development sites. UGF (then known as Green Space Factor), was trialled in Sweden some 20 years ago and is adopted in several major world cities. The London Plan includes UGF policy. Interestingly, UGF was tested by the Mersey and Red Rose Forest in the period 2008-2010 and was advocated for use in Greater Manchester and Merseyside.
3. UGF promotes the use of vegetation and surfaces that provide shade, passive cooling, flood risk mitigation, biodiversity, air quality and visual interest. Features such as pervious paving, raingardens, street trees and green roofs are scored and the aim is for a development site to achieve a collective threshold score. Figure 1 below shows the scores achieved by different surface cover types in West Gorton Park (Manchester's sponge park).

Urban Greening Factor - Scores – from West Gorton Park

Typical Scores for different surface cover types

Woodland / Wetland / Meadow: 1 (the maximum)

Street Tree with large pit: 0.7

Green Roof: 0.7

Rain Garden: 0.7

Perennial planting: 0.5

Amenity grass: 0.4

Granular surface: 0.2

Permeable paving 0.1

Sealed Surface: 0



Figure 1: Urban Greening Factor scores for vegetation in West Gorton Park

4. The central reference source and specification for the Urban Greening Factor is Natural England's report NERR132 Urban Greening Factor for England - Development and Technical Analysis¹
5. Local Authorities can vary the specification and threshold scores as they wish, in line with local priorities - it is not a mandatory universal system like Biodiversity Net Gain.

The Need for a "Manchester Green Factor"

6. TEP's report on the need for off-site biodiversity net gain arising from Manchester's Local Plan² confirms that many sites in the development pipeline have little baseline biodiversity value. This means that BNG will not drive significant environmental enhancement on Manchester's development sites. Additionally, the BNG metric

¹ [Urban Greening Factor for England – Development and Technical Analysis - NERR132 \(naturalengland.org.uk\)](https://naturalengland.org.uk/publications/urban-greening-factor-for-england-development-and-technical-analysis/)

² TEP Report Reference 9998.017, dated December 2023

places relatively little weight on urban habitats such as raingardens, green roofs and living walls, so developers have little incentive to choose such habitats, which are widely seen by stakeholders as being important for place-making and climate resilience.

7. Manchester's existing policy framework promotes the use of BNG, trees and SuDS. However, this study examined 24 recently approved developments and found that only 5 of them would achieve the recommended UGF threshold scores of 0.3 for commercial development and 0.4 for residential development.
8. Thus neither BNG nor the existing policy framework will drive significant urban greening in Manchester's development pipeline.
9. Experience from London shows that UGF policy drives positive design behaviours amongst developers and their advisers and the results are broadly welcomed in terms of place-making and climatic resilience of new developments.

Consultation with developers and stakeholders

10. Twelve Manchester developers were contacted for their views on the feasibility of UGF policy. Chapter 3 of this report summarises the consultation. Most developers had little knowledge or experience of the UGF. There was little resistance to the idea, and a broad welcome for the place-making and climate benefits arising from policy adoption.
11. Developers were nervous about compliance requirements, given the forthcoming need for mandatory BNG and SuDS and the associated technical reports, but provided the additional reporting burden was not great and that the policy is applied universally, with a transition period, the developer group appear to be satisfied that UGF policy is appropriate.
12. Experience from London shows that UGF policy compliance is much simpler than BNG, with developers and their professional advisers welcoming the flexibility that UGF offers - developers can select the types of urban greening that most suit their site. UGF policy is also framed on a "supply or justify" basis i.e. if the threshold score cannot be achieved for over-riding technical reasons then permission can still be given.
13. Environmental and planning stakeholders were also supportive of UGF policy. Various suggestions were made about how the core specification set out in NERR132 might be modified to promote UGF outcomes considered appropriate to Manchester. These suggestions are recorded at chapter 5 of this report, and include suggestions about promoting surface cover types that contribute most to downstream water quality and flood risk. One interesting suggestion was that riparian land adjacent the development site could be included in the UGF calculation - UGF calculations normally apply only to the "red-line-boundary" of a development; but inclusion of riparian land might stimulate developer investment in river and canal corridors.

Application to Manchester

14. TEP examined 24 consented schemes. It is clear that developments in Manchester will need to make greater use of civic trees in large pits, flower-rich planting, green

roofs and raingardens if they are to achieve the required UGF threshold. Chapter 4 of this report provides a very detailed analysis of the 24 schemes.

Introducing a Manchester Greening Factor policy - some notes

15. UGF policy applies principally to design stages and compliance can be assessed through relatively simple reports associated with the landscape scheme submitted at application and condition discharge stages. A landscape maintenance plan is also advised, but it is likely that this could be incorporated into the mandatory habitat management and monitoring plan (HMMP) that will be required under BNG legislation.
16. The report concludes that a universal application of the UGF policy to all types of development that are covered by BNG legislation is appropriate i.e. householder development and most forms of permitted development would be exempt. There is a case for phasing in the policy requirement. Developers and relevant City Council departments which adopt highways, drainage and public realm should be involved in the detailed policy formulation and training process, particularly if Manchester-specific variations to the core UGF specification are adopted.
17. Chapter 6 of this report has a more detailed summary of the issues around policy introduction and monitoring.

2.0 Aim and Objectives

Aim

- 2.1 The aim of this study is to understand how the use of an Urban Green Factor (UGF) could enable green infrastructure to be embedded within new developments in Manchester to increase both biodiversity and resilience to climate change, given that a significant proportion of development sites are on brownfield land that may have little or no biodiversity value.
- 2.2 The study will inform policies on an Urban Green Factor within Manchester's Local Plan.

Context

- 2.3 Manchester is already known as one of the world's greenest cities but it recognises the need for new development to deliver more greenery than has previously been the case. This means street trees, raingardens, blue/green roofs, SuDS features, living walls, meadows and landscape structure planting. These are critical for place-making, inward investment, urban cooling, flood resilience and biodiversity.
- 2.4 The UGF is not new; in fact it was first trialled in Sweden about 20 years ago. It has been included in the London Plan for a few years. Initial fears over the viability and technical success of greening measures have now largely been allayed with technological advances in the installation of features such as green/blue roofs, SuDS-enabled tree pits and living walls. Indeed, Manchester has been at the forefront of some of these technologies.
- 2.5 The UGF consists of two parts. The first is a 'target score' which provides a numerical value between 0 and 1 which developments of various types should aim to achieve. For example, London sets a target score of 0.3 for commercial developments and 0.4 for residential developments³.
- 2.6 The second part is a set of weighting factors attributed to different greening measures which are multiplied by the surface area of each measure as proposed in the new development design. The sum of these totals divided by the surface area of the whole site should meet or exceed the target score for that type of development in order to pass through planning. Further explanation is available from Natural England NERR132 Urban Greening Factor for England - Development and Technical Analysis⁴
- 2.7 The Biodiversity Net Gain (BNG) requirement for new developments which will become mandatory from January 2024 is different from UGF. It is particularly focussed on ecological improvements, and demands over 10% increase in measurable biodiversity improvements compared to a pre-development baseline.

³ [Urban Greening Factor \(UGF\) guidance | London City Hall](#)

⁴ [Urban Greening Factor for England – Development and Technical Analysis - NERR132 \(naturalengland.org.uk\)](#)

- 2.8 A parallel study by TEP confirms that mandatory BNG will not drive significant urban greening on most Manchester developments, simply because baseline biodiversity values are generally low. Mandatory BNG is beneficial because it establishes a clear focus on retention and enhancement of on-site biodiversity and drives nature-focussed design. But it does not drive significant greening on sites of low baseline value, nor does it incentivise landscape types that provide sustainable drainage benefits.
- 2.9 If Manchester is to encourage more urban greening and establish a baseline expectation of what is required on all sites, additional policy levers will be needed; for example Local Plan policies on Urban Greening, sustainable drainage hierarchy, site-specific regeneration frameworks and design codes.
- 2.10 The UGF is more focussed on permeability and the use of greenery for wider environmental gains in built up areas, when compared with the BNG system - examples of urban greening are shown at Figure 2. UGF also does not require a percentage increase from a baseline measurement, which means that it can demand comparatively better environmental performance for sites which are completely impervious or artificial and would have scored a 'zero' baseline.
- 2.11 The UGF is also designed for delivery on site and has no option to purchase credits or provide greening off site, unlike BNG.

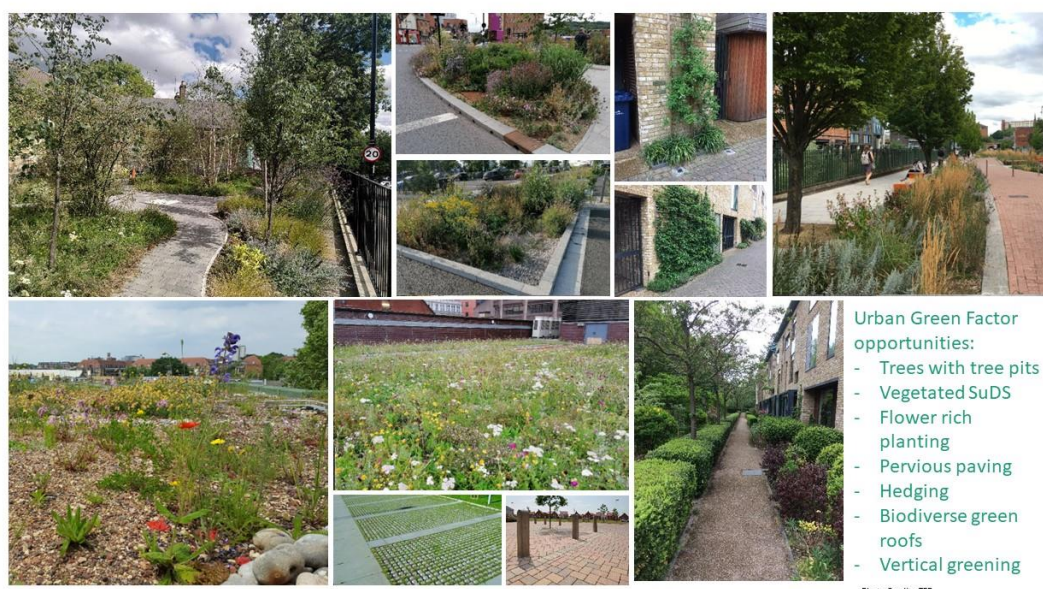


Figure 2 Examples of Green Infrastructure features included in UGF

Objectives

- 2.12 The study has the following specific objectives:
- 2.13 To engage with local developers on the subject of the Urban Greening Factor, in order to understand how much knowledge they have, and record their opinions, concerns and any suggestions they may have about how to implement a UGF policy.

- 2.14 To look at the potential impact of the UGF on real life examples across a range of developments in Manchester, where possible comparing this to BNG results, to demonstrate the relationship between the two metrics and potential overlap.
- 2.15 To identify the level of UGF that would be practical and viable within Manchester and whether this should be the same across Manchester or vary in any way, such as by local area or proposed use.
- 2.16 To identify how policy requirements for different types of GI would be dealt with in a UGF policy, for example how the UGF weightings and target scores should be balanced to get the most appropriate results for Manchester.
- 2.17 To identify the process required for the City Council to monitor UGF.

3.0 Structure of this report

- 3.1 Chapter 4 provides a detailed summary of the developer consultation.
- 3.2 Chapter 5 summarises the detailed analysis of Manchester development sites that have received planning permission in the absence of a UGF policy. It assesses what UGF score the developments would achieve, and what modifications might be needed to achieve the relevant UGF threshold score.
- 3.3 Chapter 6 provides TEP's review of the current Urban Green Factor standard as is applied in the London Plan and makes recommendations for modifications that could be adopted in a "Manchester Green Factor (MGF)". This includes:
 - a short review of the application of UGF in London and elsewhere.
 - comments from Manchester stakeholders, including developers, planners and environmentalists.
 - a short technical review of the UGF system, including some updates to the underlying evidence base.
- 3.4 Chapter 7 provides recommendations on how the MGF might be adopted into Local Plan policy, including a commentary on how it would be monitored. Chapter 8 provides a glossary.
- 3.5 The report is accompanied by the following appendices:
 - Appendix A is the UGF Questionnaire for Developers; and
 - Appendix B is the UGF Weighting Factors used in the study.

4.0 Developer Consultation

- 4.1 Manchester is fortunate to have a community of developers, planners, architects and urban designers who share the goal of a green city.

Scope

- 4.2 Manchester City Council provided a list of 12 consultees that are actively involved in development in the city, across a range of development types but with a focus on housing. Manchester Airport Group (MAG) was included and also has a role as a statutory consultee in relation to Civil Aviation Authority matters.

Methodology

- 4.3 TEP devised a questionnaire (see Appendix A) for developers to establish the type of activity, level of experience of UGF, views about potential benefits and concerns of the system, and opinions about the practical implementation of the scheme.
- 4.4 The questionnaire and email invitations all included an explanation of the UGF and provided links with further information including a summary from the Landscape Institute, London Plan Guidance on UGF, and the Natural England guidance document (NERR132 Edition 1).
- 4.5 Responses were collected and recorded in June and July 2023.

Results

- 4.6 Of the 12 organisations approached, 5 provided interview responses, 2 filled in the questionnaire, and Manchester Airport Group (MAG) provided a written statement response. One declined as they felt they had relatively little future development in the city. At least three attempts were made to contact all unresponsive consultees.
- 4.7 The response from MAG noted that they are a statutory consultee on local planning applications, and that precise details for individual applications would be judged according to any potential risk of bird strike at the airport. There are some urban greening measures proposed within the UGF that may, particularly when combined, encourage bird species that are considered problematic in the aviation industry. MAG would thus need to judge particular development proposals as they arise. It is noted that UGF policy can allow exemptions if developers can show that specific greening measures are not achievable.
- 4.8 The following summary of responses covers the remaining seven structured responses received.
- 4.9 All respondents had little or no prior knowledge of the UGF. All responses are therefore based on a brief explanation of the system in the case of the interviewees, and on signposted research in the case of the questionnaire responses.
- 4.10 Six of the seven respondents are building residential units at a scale where they will include some retail/commercial/community units alongside the homes, working primarily or uniquely in the MCC area, classing local development as essential to their business. One is a nationwide developer with a moderate interest in the MCC area and does most kinds of development but is less involved in affordable housing.

Benefits of an Urban Green Factor Policy

- 4.11 All respondents recognised the importance of increased, good quality urban greening and the multiple benefits provided.
- 4.12 Consultees were asked whether they agree/disagree with four statements on the potential benefits of a UGF policy, and to provide explanation of their answers.
- 4.13 The statements claimed that:
- a UGF policy would ensure urban greening is delivered onsite to improve local environmental quality,
 - UGF policy is essential to ensure that inner urban areas are more resilient to climate change particularly regarding shade and flood resilience,
 - UGF policy is an important driver for good placemaking, and
 - UGF policy offers a flexible menu of greening techniques for developers to choose from.
- 4.14 Three of the seven respondents agreed with all statements without reservation. Two (including the nationwide developer) agreed with all statements, with caveats that it would need to align with BNG, be careful to support place-making and not be biased towards certain greening measures, and not stifle growth.
- 4.15 Two respondents had significant concerns that a 'one size fits all' metric might produce a 'tick box' approach and be detrimental to local placemaking, and that it will arrive amongst a multitude of other measures to contribute to an overly complex system that is difficult for developers to navigate. One disagreed that UGF policy would successfully raise environmental quality, the other disagreed that it provided a flexible menu of greening techniques when compared to the current system with no restrictions.
- 4.16 Additional benefits were also described, listed here with the number of mentions: health and wellbeing (4), social value of improved community interaction (2), more attractive neighbourhoods for residents (1), better access to amenities through reduced flooding (1), seasonal interest (1), consistent city-wide greening (1), passive cooling (1), countering habitat loss (1).
- 4.17 *"The majority of current projects have a green flavour to them - that's what our communities are asking for, not just the planting but the feel-good factor of their involvement with it"* - Social Housing Developer

Concerns about Introduction of an Urban Green Factor policy

- 4.18 Consultees were asked whether they agree/disagree with three statements on potential concerns about a UGF policy, and to provide explanation of their answers.
- 4.19 The statements claimed that:
- a UGF policy would create extra costly requirements to comply with both offsite BNG and onsite UGF measures,
 - a UGF policy would be inhibited by Building and Fire Safety Regulations and insurance restrictions on installing certain types of greening within the building fabric,

- there is such a significant skills shortage that it will not be possible to deliver the policy.
- 4.20 Five of the seven respondents agreed with concerns over the cost of this policy in relation to additional BNG requirements, one of the two that disagreed was the nationwide developer who noted that there might be a cost issue for affordable housing but that was not within their scope.
- 4.21 Five respondents disagreed or were unsure that fire regulations and insurance would be an issue, one of the two who agreed thought there would be a short-term issue with insurance.
- 4.22 Three respondents agreed that skills shortages are an issue, with one of those highlighting skills deficiency in long-term maintenance and another worried about skills on the design side particularly.
- 4.23 Other concerns were described, listed here with the number of mentions:
- increase in cost of schemes to the point where they become unviable (3);
 - conflicting goals of different council departments (2) - e.g. highways maintenance incentivising lower scoring measures for areas they adopt;
 - lack of baseline measure may dis-incentivise renovation of brownfield sites by adding to the cost (2);
 - conflicting/confusing goals of a proliferation of new rules and requirements (1) - e.g. thermal efficiency and renewable energy targets devoting roof space to solar PV rather than green roofs;
 - duplication of other existing policies and requirements (1) - e.g. SuDS hierarchy drainage requirements from local utilities;
 - lack of information about funding for long term maintenance and the need to avoid adding to service charges for affordable housing residents (1);
 - sudden step change would be awkward for developers (1).
 - Concerns were also noted that UGF policy could have a negative impact on place-making by pushing certain high-scoring features to the detriment of others that might score less but have good place-making value.
- 4.24 When asked how the Council might help alleviate any concerns, the following suggestions were proposed:
- ensure the UGF policy ties in with Homes England criteria (Building for a Healthy Life⁵) and existing grants/funding for green measures;
 - look at ownership models;
 - do not make it mandatory;
 - provide extra funding and support;
 - provide clear, phased implementation;
 - make sure it fits clearly into a coherent bigger picture.
- 4.25 There was a general enthusiasm amongst local developers for continued engagement and communication with the council on this topic as it progresses.

⁵ [BFL-2020-Brochure.pdf \(designforhomes.org\)](#)

4.26 *"I'm not sure that a one size fits all rule is ever a driver for good placemaking, in fact it definitely isn't. Because placemaking is about understanding the area and the context."*

4.27 *"Green space often detracts from our ability to offer sufficient land value."*

Compliance Thresholds

4.28 The London Plan threshold figures of 0.3 for commercial developments and 0.4 for residential developments were cited and developers asked to comment if these should apply to Manchester.

4.29 Of the seven respondents one thought that Manchester should keep the same targets as London i.e. with residential scoring higher, two thought targets should be consistent across all sectors, and the remaining five were not sure.

4.30 When asked whether student accommodation should be classed as residential or commercial for the purpose of UGF⁶, one respondent answered residential and one answered commercial, the other five were not sure.

4.31 When asked whether different locations should have different thresholds, there were two clear negatives from the seven respondents. Others found it difficult to answer and discussed the balance between accounting for local context and providing consistent guidelines, and the need to ensure that development on brownfield sites is not impeded.

4.32 When asked to review the weighting scores of individual greening measures using the figures from the London Plan as a guide, none of the respondents proposed changes. Those participating in interviews explained that they would need to be much more familiar with the system to provide that information.

Management and Maintenance of Urban Greening

4.33 When asked about provision and future-proofing of greening measures, there was a wide variety of suggestions and comments: developers should provide contributions for upkeep; use section 106 commitments; bundle with BNG requirements; insist on maintenance plans as a planning requirement and enforce within current planning system; provide specific funding for holistic outcomes; include maintenance and management stakeholders in the conversation through the policy development.

4.34 *"We need to have regular updates on this throughout the development as it progresses and possible further input from our maintenance and management teams."*

Exemptions

4.35 When asked whether there should be exemptions there were different opinions, listed here with the number of mentions:

- the policy should make allowances for exceptionally difficult sites (3);
- the policy should allow for offsite measures/ compensation payments (2);
- there should be a minimum threshold to exempt smaller schemes (2);

⁶ Student accommodation is classed as "residential" by DLUHC in statistical returns about development

- there should be no exemptions (1); or possibly in line with BNG threshold;
- the policy should consider exemptions for affordable housing (1);
- the policy should apply only to land outside the building footprint (1).

Transition and Review Period

- 4.36 When asked what a suitable transition period would be, six respondents answered between one and three years, and one suggested five years. There were notes recommending phased implementation, coordination with local plan progress, and the importance of scenario testing and engagement over specific timescales.
- 4.37 When asked about review frequency, there were various opinions listed here with the number of mentions: review yearly (2), review in line with local plan (2), review in line with BNG policy review (1); review more frequently in early stages (3); review every 5 years (1).
- 4.38 *"If designers really get their heads around this and can create clever designs that get the correct scores without costing too much that would make all the difference."*

Analysis

- 4.39 It was clear that the developers who responded were keen to engage with the topic and would benefit from further information. There is little resistance to the concept of UGF for Manchester, and a majority welcoming the policy, at least in principle. Where concerns were expressed, these related to the implementation of the policy
- 4.40 The concerns around how the policy would fit alongside BNG indicate that it is important to set out the purpose of the Urban Greening Factor clearly in relation to BNG. The advantage of providing extra greenery for sites which have no existing biodiversity needs to be sensitive to the cost implications and general social benefits of revitalising such sites.
- 4.41 The way in which this policy links with the wider objectives of the Local Plan will be important, to show how the Urban Greening Factor is contributing to achieving wider goals and delivering value for money. This could address the fear of duplication - what we are gaining from the UGF beyond the existing requirements, and a concern over the proliferation of new environmental compliance requirements for developers.
- 4.42 Engagement from wider council stakeholders involved in the design, delivery and maintenance will be important throughout, particularly to avoid conflicting objectives. If those responsible for adopted highways infrastructure are on board and promoting the installation of more SuDS and trees, this may significantly help developers implement the UGF policy.
- 4.43 The wider conversations about who pays for green infrastructure and how we ensure it remains well-maintained are very relevant to this subject.
- 4.44 Developers noted the value of a simple and universal system - a "level playing field" - but accepted there could be exemptions for certain low-impact schemes. There was a welcome for the flexibility in UGF policy, for example where developers can demonstrate they have made every attempt to attain the required threshold but over-riding factors mean they cannot implement specific greening measures.

- 4.45 Further communication about how the scheme is working in other areas like London may also be of benefit given the developers' current lack of experience. A transition period for introduction of the policy would be welcomed, to allow for awareness-raising in the local development community.

5.0 Worked examples

- 5.1 MCC provided details of 24 projects that have received planning approval to see how the UGF might work out in practice across a variety of sites.
- 5.2 All 24 sites were measured to calculate their "putative UGF score" (described below) and a brief analysis of how the UGF score compared with BNG Assessments, where available.
- 5.3 6 schemes were subject to more detailed analysis to determine what sort of greening measures might be added to reach the required UGF threshold (0.3 for commercial schemes and 0.4 for residential schemes).

Methodology

Putative UGF Score Calculations

- 5.4 The sites were chosen to provide a range of project types, sizes and locations.
- 5.5 The 24 sites were analysed using existing planning documents either provided by MCC or obtained from the planning portal. This consisted of a range of different documents and level of detail, dependent on what was submitted for planning at the time of application. The 24 Sites, their respective Manchester Ward, Type of Development and Planning Application Number are shown in Table 1:

Table 1 UGF Worked Examples

Project Name	Ward	Type	Application Number
Jackson's Brickworks	Miles Platting & Newton Heath	Residential	133700
Land to the west of Rodney Street	Ancoats & Beswick	Residential	134154
Circle Square No.3, Princess Street, Newman Street and Cloak Street	Deansgate	Commercial	134288
Ev0 Building, Didsbury Technology Park	Didsbury West	Commercial	135309
Land bounded by Silvercroft Street, Crown Street and the Mancunian Way	Deansgate	Residential	126668

Project Name	Ward	Type	Application Number
Crown Street Phase 2 (Phase C)	Deansgate	Commercial	133516
Albert Bridge House, Bridge Street	Deansgate	Residential	135834
Land at Poland Street	Ancoats & Beswick	Commercial	130627
University of Manchester, Owens Park, Fallowfield Campus	Fallowfield	Commercial	110184
Hangar 4, Pinfold Lane, Manchester Airport	Woodhouse Park	Commercial	136879
Waterside House, The Oaks, Business Park	Brooklands	Commercial	127060
Plot P1, Land at Palma Avenue to East of Terminal 2	Woodhouse Park	Commercial	119802
Land off Elizabeth Street	Cheetham	Commercial	133125
Land at Downley Drive	Ancoats & Beswick	Residential	130390
Former Showcase Cinema, Hyde Road School	Ardwick	Commercial	129076
Land on the corner of Poland Street and Jersey Street	Ancoats & Beswick	Residential	130354

Project Name	Ward	Type	Application Number
Land off Louisa Street	Clayton & Openshaw	Residential	134775
School at Ashton Old Road	Clayton & Openshaw	Commercial	135649
The Imperial Lounge, Victoria, food store	Charleston	Commercial	133148
New Lidl food store	Old Moat	Commercial	135647
Former Mather & Platt Foundry, Grimshaw Lane	Miles Platting & Newton Heath	Commercial	129444
Atlas Business Park, Simonsway	Woodhouse Park	Commercial	135952
Greenheys Building	Hulme	Commercial	136934
One Medlock Street, Manchester	Hulme	Student Accommodation	135419

- 5.6 The target scores and weightings for different greening measures were used as in the London Plan UGF Guidance (Appendix B). Additionally, the UGF Target score was assumed as commercial for student accommodation⁷, and as residential where any private residential development is proposed.
- 5.7 Area measurements for each green feature were taken using computer software to measure directly from masterplans, planting plans or the best architectural layout available from the planning portal.
- 5.8 Once measured, the putative UGF for each site is calculated in a two part process:
- 1) For each Surface Area Type - multiply the UGF Factor * Area
 - 2) (\sum UGF Scores) / Total Development Area

⁷ Although DLUHC class student accommodation as residential in statistical returns, so a decision would need to be made by MCC if they wish to adopt UGF policy as to which Target Score to set for student accommodation

- 5.9 Detailed BNG Metrics were used, where available, to provide measurements. The metric calculations were sense-checked through measurement of one surface cover type to compare the accuracy of the BNG measurements. These measurements could then be transferred directly to the calculation spreadsheet, except for tree cover and hedgerows.
- 5.10 Where possible, planting plans were used to calculate the tree canopy area within designs. This was taken as the square of the 20-25 year average canopy size per species, taken from reputable nursery websites e.g. *Sorbus aucuparia* = 4m canopy diameter at 25 years so $4 \times 4 = 16\text{m}^2$. Tree canopy (for proposed trees) is calculated differently under BNG and UGF systems, and the BNG metric 3.x can generate large overestimations when transferred to the UGF system. Therefore, the UGF canopy area was calculated separately, according to the methodology described above. (see also the note on methodological limitations below)
- 5.11 The proposed hedge area was calculated using the following assumptions: Native or species-rich hedges were assumed to be 1.2m wide unless stated otherwise; Ornamental hedgerows were assumed to be 0.8m wide unless stated otherwise; Where no detail was provided, hedgerows were assumed to be 1m wide (i.e. the average of the two width assumptions). This allows the conversion of linear hedgerow measurements from BNG to area measurements for UGF analysis.
- 5.12 Figure 3 and 4 show how a typical layout was measured, and the level of detail required to make accurate putative UGF scores. Jackson's Brickworks is the largest residential application analysed, with Figures 3 and 4 constituting just one phase of the development.



Figure 3 Jackson Brickworks Phase 1 Planting Strategy



Figure 4 Jackson's Brickworks Phase 1 Planting Strategy Post-Measuring

Detailed Analysis of Six Sites

- 5.13 Six of the above sites were further analysed to highlight opportunities for improving their UGF score. The sites chosen were
- Jackson's Brickworks,
 - Circle Square,
 - Land Bounded by Silvercroft Street, Crown Street and the Mancunian Way,
 - Crown Street Phase 2,
 - The Ev0 Building in Didsbury
 - Land West of Rodney Street.
- 5.14 Lower scoring developments were chosen as case studies for how to improve UGF scores based on both constraints and opportunities. Land West of Rodney Street was also chosen as a development scheme with a good UGF score.

Limitations and Lessons Learnt to apply to a Manchester UGF policy

- 5.15 The analysis was carried out using UGF scores in London Plan guidance (see Appendix B). This differs slightly from current Natural England guidance although the differences are not significant in terms of the overall reliability of the analysis of compliance with UGF standards.

- 5.16 All the planning applications, planting plans and masterplans used for this analysis were from existing consented applications. Therefore, the landscape designs were produced prior to any need or indication of the possibility of a UGF policy in Manchester. Thus the issues set out below are not a critique of the quality of design or presentation by the selected developments.
- 5.17 The variety of planning applications chosen provided a range of layout document types and detail. This resulted in layouts measured from masterplans, planting plans or less detailed drawings, and meant that there was no standardised type of plan from which to measure.
- 5.18 Layouts with less detail were often ambiguous as to planting details which can result in an incorrect allocation of surface type (for example, Intensive vs. Extensive Green Roof, Groundcover vs. Flower-rich perennial planting). Due to the nature of this exercise, in these circumstances the lowest score was assumed for a conservative UGF calculation. Typically, softworks or planting plans worked best for analysis as they are clearer, with less obstructions by hard surfaces, objects or text. They also contain information key to allocating a surface classification and calculating tree canopy.
- 5.19 The software used by TEP measures area by straight lined polygons, and therefore circular or rounded features can be slightly over or underestimated.
- 5.20 The London Plan UGF Guidance proposes directly measuring tree canopy from the given layout documents. In practice, many of the documents provided gave unrealistic canopy sizes based on the species. This was due to a) maximum potential size given and b) standardised sizes given for all trees on the plan. The method employed during this study is likely an overstatement as it calculates a square area, rather than a circular canopy.
- 5.21 Standard trees also have two different UGF scores dependent on soil to canopy ratio. Information on soil volume within tree pits was very rarely available, so a "common sense check" of layouts was made to estimate whether trees have abundant or scarce capacity for soil volume. For example, trees within, overhanging or close to hard surfacing score lowly, whereas trees set within large areas of soft landscaping score highly.
- 5.22 Any surface-cover classification should be justified through looking at seeds/species mixes and management plans to ensure the quality and diversity will be sustained. This level of detail has not been provided in many applications.
- 5.23 If a UGF policy is introduced, supporting guidance should be given to design teams to assist with presentation and calculation of UGF:
- Advice on level of detail and measurements to be included on plans
 - Advice on how to relate landscape and drainage specifications to UGF surface cover types
 - Advice on how tree canopy sizes and soil volume/tree pit dimensions are to be measured, so that a comparison to the desired UGF Surface Cover Type is well-evidenced.

Results

Putative UGF Score Calculations

- 5.24 Each development was given a target score with which to compare the putative score, allowing an assessment of which, and how many, developments would have passed the UGF during planning.
- 5.25 The Project Name, Target and Putative scores, and whether the design would have passed or failed for all 24 developments is listed in Table 2 below. Where a BNG metric was available, this is noted in Table 2.

Table 2 UGF Scores

Project Name	Target Score	Putative Score	Pass/Fail	BNG Score
Jackson's Brickworks	0.4	0.239	Fail	Negative on-site post-development score of c39 units.
Land to the west of Rodney Street	0.4	0.472	Pass	Positive score of c 1% noted, although the metric had flaws and a correct calculation would generate a positive score of c15%
Circle Square No.3, Princess Street, Newman Street and Cloak Street	0.3	0.304	Pass	N/A
Ev0 Building, Didsbury Technology Park	0.3	0.21	Fail	-11.06%
Land Bounded by Silvercroft Street, Crown Street and the Mancunian Way	0.4	0.273	Fail	N/A

Project Name	Target Score	Putative Score	Pass/Fail	BNG Score
Crown Street Phase 2 (Phase C)	0.3	0.054	Fail	N/A
Albert Bridge House, Bridge Street	0.4	0.323	Fail	+27.65%
Land at Poland Street	0.3	0.338	Pass	N/A
University of Manchester Owens Park Fallowfield Campus	0.3	0.252	Fail	N/A
Hangar 4 Pinfold Lane Manchester Airport	0.3	0.024	Fail	N/A
Waterside House, The Oaks, Business Park	0.3	0.232	Fail	N/A
Plot P1 Land at Palma Avenue to East of Terminal 2	0.3	0.068	Fail	N/A
Land off Elizabeth Street	0.3	0.127	Fail	N/A
Land at Downley Drive	0.4	0.09	Fail	N/A
Former Showcase Cinema Hyde Road School	0.3	0.291	Fail	N/A
Land on the corner of Poland Street and Jersey Street	0.4	0.188	Fail	N/A

Project Name	Target Score	Putative Score	Pass/Fail	BNG Score
Land off Louisa Street	0.4	0.193	Fail	N/A
School at Ashton Old Road	0.3	0.182	Fail	N/A
The Imperial Lounge, Victoria, Food store	0.3	0.072	Fail	N/A
New Lidl food store	0.3	0.058	Fail	N/A
Former Mather & Platt Foundry, Grimshaw Lane	0.3	0.258	Fail	-42.69%
Atlas Business Park, Simonsway	0.3	0.231	Fail	-45.02%
Greenheys Building	0.3	0.456	Pass	4965.67% (very high score due to absence of biodiversity pre-development)
One Medlock Street, Manchester	0.3/0.4 (Student Accom)	0.525	Pass	59.79%

- 5.26 In total, 5/24 developments passed the UGF, representing 20.83% of the study sites. As noted earlier, this is not a criticism of the quality of landscape design; it is merely a reflection that the developments were not required to carry out, or comply with, a UGF assessment.
- 5.27 Of these, 4 (80%) were commercial developments, which have the lowest UGF requirement. 12, or half, scored over 0.1 (and therefore achieved 33% or 25% of the target score). 6 scored below 0.1, achieving less than 33% or 25 % of their target score, of which all but one were commercial developments.

UGF and BNG

- 5.28 There is a positive correlation between UGF and BNG. Developments with large BNG scores, such as Rodney Street, Greenheys Building and One Medlock Street, easily pass their respective target UGF scores.
- 5.29 Conversely, the Former Mather & Platt Foundry, Ev0 Building and Atlas Business Park developments have BNG scores of less than -40%, and both fail the UGF analysis.
- 5.30 The Albert Bridge House development is the exception, passing 10% BNG but failing the UGF target. This is because of the low baseline BNG value.
- 5.31 Most applications were not submitted with BNG Metric calculations, and therefore the sample size is relatively small for these conclusions. However, developments with significantly more green features would likely produce better BNG scores, and vice versa. Therefore, UGF policy should be seen as a complementary policy to BNG, but one that allows a distinction between more vegetation types, and gives better weighting to such designs. This is evident in the distinction between "groundcover planting" and "flower-rich" planting, with significantly different scores.
- 5.32 The true extent that UGF and BNG may influence or constrain each other are likely to be more evident once BNG becomes mandatory in January 2024, with evidence likely to arise from the cities which already have a UGF policy.

Detailed analysis

- 5.33 The 6 developments earmarked for further analysis of how their respective UGF scores could be improved were studied by TEP's London Landscape Design team, using their previous experience of working with London UGF projects. The results can be seen below. Note that the Land Bounded by Silvercroft Street and Crown Street Phase 2 (Phase C) are two phases of the same development. They have therefore been analysed as one application for this exercise.
- 5.34 The detailed analysis resulted in several common themes found across the proposals.
- 5.35 UGF and BNG are both trying to drive changes in design and the priority given to biodiversity and urban greening. Reviewing and scoring schemes that were designed without a UGF scheme in place can help to identify some missed opportunities, but it doesn't allow consideration of how UGF policy can influence site layout. UGF and BNG should drive changes in the early design stages, not just the "tacking-on" of greening once layout, form and massing are agreed.
- 5.36 If UGF policy was in place, the design team would have factored the requirement in from the start, meaning a greater attention to tree pits, SuDS features and increased use of pervious paving and green roofs.

- 5.37 There are certain aspects of urban greening that UGF addresses that are not captured through BNG. One of the limitations of the BNG metric is that all ornamental planting – often a substantial area of urban greening - is all categorised as either introduced shrub or vegetated garden (both low distinctiveness). This fails to recognise more thoughtful, diverse and flower-rich ornamental plantings. UGF goes some way to addressing this by giving a higher score to “flower-rich” plantings compared to “groundcover”.
- 5.38 These categories could be further improved to tie in better with planting categories typically used by landscape designers and to encourage a greater focus on the range of wildlife benefits that ornamental plantings can deliver. A UGF policy in Manchester could, for example, be accompanied by design guidance on plant selection and management that nudges developers towards flower-rich and pollinator-friendly mixes.
- 5.39 The other key design behaviour that UGF drives, is providing adequate soil volumes for new tree planting, by giving urban trees planted with adequate soil volumes a higher score. This has previously been highlighted as information which is currently lacking from the majority of planting plans and layouts utilised for this analysis. There is therefore an opportunity to request this information for future planning applications.
- 5.40 Easy wins can be made in respect of switching to pervious paving, where appropriate, shifting from amenity grass to more diverse grassland and wildflower plantings, introducing more thoughtfully designed ornamental plantings (flower-rich) and increasing tree planting (preferably with adequate soil volumes).
- 5.41 The contribution of tree planting to UGF score can be further enhanced by designing in larger soil volumes for trees, including through the use of connected tree pits, Stockholm tree pit soils or root cells. This does add cost, but additional costs can be minimised by designing in more space for trees in soft landscaped areas from the beginning, rather than squeezing trees in to 1.2m wide gaps between parking bays.
- 5.42 Other moderate wins can be made through use of biodiverse green roofs. London experience is that biodiverse green roofs are now becoming normal – either driven by BNG/UGF or Council policy (e.g. Cambridge City Council requires all flat roofs to be green), or both. There are limitations for lightweight, large span structures and where pitch-roofs are used.
- 5.43 Façade-based interventions (living walls, climbers) are feasible but technology and maintenance experience is an uncertainty for developers. London experience is that well positioned climbing plants, with good soil volumes at ground-level and adequate training wires to climb up are relatively inexpensive and can be incredibly effective.
- 5.44 Plug planted, irrigated living wall systems constitute a design-led decision based on client feelings on balance of cost, visual impact and sustainability in terms of irrigation and maintenance.
- 5.45 Medium density residential schemes of a family-housing nature are challenging in respect of UGF because of the high proportion of the site which is either building or private garden (which are mostly restricted to amenity grass and paving). This is not expected to be a development type used widely in Manchester.

5.46 The detailed UGF analysis for the chosen projects is provided below.

Jackson's Brickworks

5.47 Jackson's Brickworks is a large scale, two phased residential development within Miles Platting & Newton Heath Ward. Phase 1 and Phase 2 were measured separately, with the green features of Phase 1 being much more detailed (see Figure 3). This highlights one of the limitations of measuring UGF from past planning applications which were not designed to be UGF compatible.

5.48 On medium density residential schemes of a family-housing nature it is difficult to score > 0.4 because of the predominance of:

- Paved surfaces;
- Houses; and
- Private rear gardens.

5.49 Having said this, the following opportunities exist (see Figure 5):

1. Maximise street greening, including trees in connected tree pits, vegetated SuDS elements and flower rich plantings;
2. Use pervious paving where appropriate;
3. Integrate hedging into front gardens and car parking areas, as well as in public open space; and
4. Biodiverse green roofs on apartment blocks.



Figure 5 Jackson's Brickworks Phase 1 UGF Opportunities

Land Bounded by Silvercroft Street and Crown Street Phase 2 (Phase C)

- 5.50 These combined planning applications constitute a mixed purpose development in Deansgate. This includes a small, multi-storey school (Phase 2/C) adjacent to a large residential development, with residential towers joined by a residents' garden, all contained within extensive public open/green space. The school is set within the wider area, and is particularly constrained in terms of proposed and potential green features.
- 5.51 This project highlights potential constraints on the UGF score for phased developments. If phases of the development include only buildings and immediate frontage, without green roofs it is very difficult to achieve a UGF score >0.4 . However, if the UGF considers all phases then a score >0.4 may be possible.
- 5.52 Our assessment of the current scheme resulted in a UGF score of <0.4 . This could be improved by (shown in Figure 6):
1. Wildflower meadow and flower rich ornamental planting;
 2. Integrate pervious paving and vegetated SuDS elements, where appropriate; and
 3. Biodiverse green roofs.
- 5.53 Figure 6 shows the opportunities for both sites. The school is the building at the northern boundary.



5.54 The Ev0 Building design consists of a six storey commercial office building, a three storey car park and associated landscaping and highway works, located in Didsbury West.

5.55 For schemes that propose large areas of surface parking and large commercial/industrial buildings key opportunities (Figure 7) for greening include:

1. Extensive tree planting in car parking areas with connected tree pits, where possible;
2. Pervious paving and vegetated SuDS elements to manage surface water from the extensive hard surfacing;
3. Biodiverse green roofs; and
4. Vertical greening of blank facades.

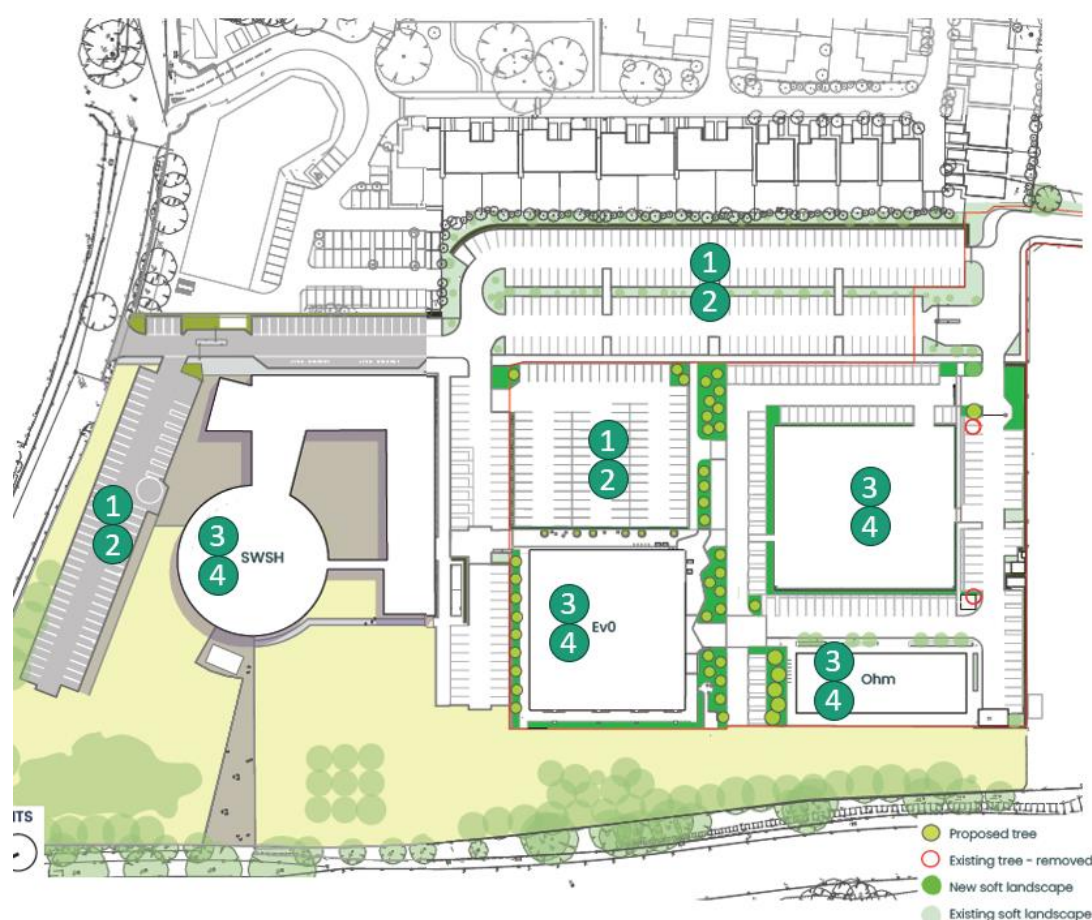


Figure 7 Ev0 Building, Didsbury UGF Opportunities

Land West of Rodney Street

- 5.56 This is a residential development in Ancoats & Beswick, which comfortably achieves a UGF score greater than 0.4. Key contributors to this are the extensive tree planting, planting of wildflower meadow, and use of rain gardens as part of the drainage strategy.
- 5.57 Many different greening opportunities at ground level have been taken. However, this scheme could be further enhanced with, as shown in Figure 8:
1. Biodiverse green roofs; and
 2. Vertical greening with climbing plants.



Figure 8 Land west of Rodney Street UGF Opportunities

Amending Landscape Designs to Enhance UGF Score

- 5.58 The detailed analysis included hypothetical manipulation of the surface cover measurements to establish what changes could be made to enable developments to achieve their target scores.
- 5.59 Crown Street Phase 2 (Phase C) consists of a small, multi-storey school within a wider application. The school currently has no green features, although there is a porous play area upon the roof (485m²). Adding the following features would enable the development to achieve a target of 0.3, from an original putative score of 0.054:
- Additional porous surfacing to the outdoor, ground floor play area (316.m²);
 - 710m² green wall to the outside walls;
 - 265.6m² green roof canopy cover above the entrances (currently polycarbon/glass).

- 5.60 This would depend on whether any MCC UGF policy would require porous surfacing to connect to a SuDS or retention basin. UGF policy in other cities, such as London, has been reluctant to accept porous surfacing which does not connect to a SuDS or retention basin, given that there is no ecosystem service provision or alleviation of urban flooding. Crown Street Phase 2 (Phase C) would in this case have scored 0.0 originally, as there is no indication the porous play surface connects to any system other than directly to the sewerage system. This example shows the constraints of an enclosed, small scale urban development, which has little option other than to add permeable surfacing and green wall/roofs.
- 5.61 The Land Bounded by "Silvercroft Street, Crown Street and the Mancunian Way" development has also been analysed in this way. An original putative score of 0.273 was improved to the target score of 0.4, using the following adjustments to the design:
- 2800m² of sealed surface was converted to 2000m² permeable paving, 200m² wildflower meadow, 400m² open water pond, 200m² rain gardens;
 - 10 trees of a 36m² canopy were added, with an assumption they scored the higher 0.8 UGF factor;
 - 500m² of groundcover planting was upgraded to flower-rich perennial planting;
 - 300m² of amenity grassland upgraded to wildflower meadow; and
 - 500m² of green wall and 300m² of intensive green roof could be added to the large residential blocks, with the 49m² currently proposed upgraded to this typology too.
- 5.62 The Ev0 Building design originally scored 0.210, and is the largest of the three developments which underwent hypothetical UGF improvement. A target score of 0.3 was achieved through the following adjustments:
- 8500m² of sealed surface could be converted to 8000m² permeable paving, 400m² intensive green roof and 200m² more rain garden;
 - 300m² amenity grassland could be upgraded to wildflower meadow;
 - 160m² high scoring trees could be added (10no. 16m² canopy trees) within soft landscaping areas;
 - 484m² groundcover planting could be upgraded to flower-rich perennial planting;
 - 400m² of green walls could be added to the office buildings; and
 - The hedgerows could be upgraded to double row hedgerows, increasing their total area 340m².
- 5.63 The above developments show what can be achieved through addressing UGF requirements during the planning phase, with the proposed upgrading of areas of green features, or hard surfacing unlikely to reduce the amount of commercial or residential space in the application.
- 5.64 These improvements are likely to also improve respective BNG scores, improve ecosystem services and provide prospective residents or commercial tenants with a more pleasing aesthetic.

- 5.65 Whilst larger scale developments may provide additional features and area to try to improve UGF scores, they can be constrained by their original designs. Hypothetical adjustments for Jackson's Brickworks, which is a much larger scale than the two examples above, still came up far below the target score.
- 5.66 The hypothetical adjustments to the landscape designs outlined above could be achieved without loss of development footprint, although would be likely to result in higher landscape installation costs. However, if a scheme is designed with UGF targets in mind from the outset, some or all of these additional costs could be avoided.

Summary

- 5.67 The initial analysis highlights that most previous site layouts submitted with planning applications would have failed the target UGF scores. However, detailed analysis has shown that changes to layouts prior to the application phase can be made to achieve these targets without significantly compromising site function or provision.
- 5.68 "Land West of Rodney Street" is highlighted as an example of best practice, easily exceeding the target UGF score of 0.4 through a combination of a large proportion of green area, coupled with selection of high scoring habitat and planting mixes.
- 5.69 The presence of a UGF policy should encourage developers to choose more diverse, eco-friendly designs. For example, large areas of amenity grassland can be interspersed with wildflower patches, providing a much higher UGF. Likewise, many developments currently have large expanses of paving or parking spaces. The use of permeable paving, connecting to SuDS or rain gardens will both increase the UGF score of a site, and provide additional biodiversity net gain and ecosystem service benefits. Green features such as green roofs and walls are absent from many designs, but provide a source of green surface without reducing the space available for other features.
- 5.70 The calculation of putative UGF scores using non-UGF targeted planning applications has highlighted opportunities to smoothen the transition to such a policy, in particular by making it clear what information should be presented on layout and planting plans.
- 5.71 For example, requiring a standardised, easy to measure document should be compulsory. A clear, coloured masterplan with minimal writing or objects overlayed can reduce the analysis time considerably. Similarly, requesting detailed planting plans, complete with species name, number and projected 25-30 year canopy size for trees will enable faster analysis. Requesting that these canopies should be accurately represented on the masterplans will also improve the process.
- 5.72 Experience from London is that the standardisation of UGF requirements for masterplans and planting plans allows easier comparison and checking for planning officers who may be required to proof a UGF score.
- 5.73 An emphasis should be made to developers that further care and consideration during the design phase will save time calculating UGF scores, or subsequently having to redesign layouts to achieve targets.

- 5.74 There is a further opportunity for Manchester to acknowledge and address potential constraints which have arisen in cities with existing UGF policies. Improving the definitions and measurement advice, or altering the associated scores for surface cover types can be tailored to promote certain features and designs, based on the needs of Manchester. This could allow Manchester to produce a policy which further increases potential benefits to wildlife, biodiversity and ecosystem services.

6.0 Towards a Manchester Green Factor

Technical Review of UGF

- 6.1 The central reference source for UGF standards is NERR132 Urban Greening Factor for England - Development and Technical Analysis⁸.
- 6.2 It is an informal and evolving standard, based on international application and experience, and Local Authorities are encouraged by Natural England to adopt it with local modifications where appropriate.
- 6.3 A Manchester Green Factor policy will need to refer to the above as a central reference document which provides specifications and sources of guidance. Although the MGF will not have mandatory status (by contrast to Building Regulations), it will be important to ensure that the policy either refers to the NERR132 as a specification, making it clear that NERR132 will be updated from time to time.
- 6.4 If the MGF is to include any amendments to the NERR132 system or allow bespoke features and specifications, these will need to be published for consultation, along with a note that the bespoke items will also be reviewed from time to time by the City Council.

Local Practitioner input

- 6.5 Stakeholder workshops were held in September 2023, with environmental and planning practitioners at which the UGF was discussed. This was in addition to the developer questionnaire discussed at Chapter 3.
- 6.6 Based on show of hands, 40% of practitioners had little or no prior knowledge of UGF, 40% had heard of it and understood its intention, and 20% were reasonably familiar with it.
- 6.7 Practitioners were given an introduction to the UGF and were shown some of the worked examples at Chapter 4 above. They were asked whether there were particular surface cover types or other modifications to the UGF that should receive lower or higher priority in an MGF.

Surface Cover Types that should be prioritised.

- 6.8 Practitioners identified the following types as being of highest priority for Manchester, with specific commentary on proposed degree of escalation noted in brackets below:
- Surface Cover Types that reduce urban heating
 - Rivers and Canals
 - Permeable paving, especially where it can reduce flood risk and discharges to CSO's (two suggestions that it should be increased to a score of 0.2 or even higher, consistent with detention basis or chlorinated water features which have no biodiversity value, but do have sustainable drainage benefits)

⁸ [Urban Greening Factor for England – Development and Technical Analysis - NERR132 \(naturalengland.org.uk\)](https://www.naturalengland.org.uk/Urban-Greening-Factor-for-England-Development-and-Technical-Analysis-NERR132)

- Amenity Grassland, because it is of community value for informal recreation, and outside private gardens can be managed in "No-Mow-May" style which is valued by the community and has some invertebrate benefits
- Green walls with climbers rooted in soil should have higher value than modular systems
- Flower-rich perennial planting could be elevated perhaps up to 0.9 or even equal status with semi-natural vegetation, where it has similar soil depth and botanical diversity.
- Rain gardens (one suggestion of increase to 0.9)
- Standard trees in large connected tree pits (one suggestion of increase to 0.9)
- Green walls (one suggestion of increase to 0.7)
- Extensive green roof with substrate >80mm (one suggestion of increase to 0.8)

Surface Cover Types that should have reduced priority

6.9 Delegates identified the following types as being of lower priority for Manchester, with specific commentary on degree of escalation noted in brackets

- Amenity grassland, particularly in private gardens (with some suggestions of a reduction to 0.3, from 0.4)
- Green roofs, because they have limited community value for recreation.
- Flower-rich perennial planting - where it is in free-standing planters rather than being in soil - for reasons of limited soil biodiversity contribution
- Modular green wall systems should have lower priority than climbers rooted in soil, with one suggestion that a modular system should have a score of 0.2 or 0.3.
- Green walls of any type were seen as slow to establish

New or additional surface cover types

6.10 Delegates identified the following suggestions felt most relevant to Manchester's inner urban communities experiencing high degrees of development-related change.

- Trees of large mature canopy dimension. It was noted that UGF policy might have an unintended consequence of pushing developers to select smaller trees, because these are more able to comply with the soil volume criterion of "minimum soil volume at least two-thirds of the projected canopy of the mature tree. Guidance is needed on this matter to clarify minimum expectations.
- Habitats that have community use e.g. fruit trees or land available for food-growing
- Features of community or heritage value that also have biodiversity value
- Features that have deeper substrates than strictly necessary and thus can re-use materials
- Surface cover types and soils/substrates that can assist with a known contamination issue e.g. raingardens or willow beds on flowpaths to watercourses of less than good status.

Riparian Connectivity and Water Quality Enhancement

- 6.11 Some practitioners suggested that, given the critical importance of Manchester's rivers and canals to its biodiversity, heritage and community, any site that includes a riparian zone, or directly adjoins a riparian zone, or forms part of a surface water flowpath that directly outfalls into a riparian zone; should require a higher threshold for urban greening.
- 6.12 On a parallel note, sites with riparian connectivity should also include UGF measures that reduce surface flows and sediment/contaminant discharge to the riparian zone.
- 6.13 The Canal and Rivers Trust suggested that where a development site adjoins a waterway, the developer should be able to offer improvements to the waterway corridor as part of their UGF calculation, even when outside the "red-line boundary" used for UGF calculation. This would presumably also benefit their BNG assessment. Jacksons' Brickworks was cited as an example of a scheme whose red-line boundary runs along the canal corridor. Under UGF rules, only environmental improvements within the red-line-boundary would be eligible, but under the proposed amendment, the developer could enter into an agreement with the waterway corridor owner (in this instance, CRT) to carry out works such as hedging, reedbeds, marginal enhancements, or even culvert removal.

Other Observations

- 6.14 Many practitioners noted that the obligation to manage UGF features is critical and an MGF policy must set out expectations on what is required of a managing organisation.
- 6.15 One suggestion was that permeable paving should be set as a minimum expectation in any relevant parts of the civic realm where fully-sealed surfaces are not mandatory.
- 6.16 Where products and finishes are carbon-positive or where they involve use of material that has been derived from re-use e.g. soils from green waste or gravels from demolition; then the MGF could award extra credits.

Learnings from Elsewhere

- 6.17 Natural England hosted an information session in September 2023 which provided a summary of progress on UGF with contributions from early adopters including London and Southampton. Key points were:
- UGF aims to make places better for people and wildlife, and to improve climate resilience in the built environment.
 - UGF is a tool for dialogue and a mechanism for measuring greening. It helps to give developers clarity and answer the question '*How much greening is enough?*' It does not replace human judgement or seek to stifle development.
 - UGF needs to work closely alongside other policies that protect existing features, ensure continued maintenance and adoption of greening measures in the long term.

- Supplementary planning documents may be used to provide technical guidance, details of any exemptions, and measurement and compliance criteria.

7.0 Recommendations

- 7.1 Based on the findings of this study, TEP recommends pursuing the idea of incorporating a "Manchester Green Factor" policy into the next Local Plan.

Policy Justification

- 7.2 The MGF policy wording will need to be closely aligned with the wider City Vision and related policies on climate change and adaptation, place-making, trees, SuDS hierarchy and BNG. The justification will need to explain the background to UGF, its support by Natural England and its alignment with national and local GBI principles. The justification should note that other policies cannot deliver comprehensive urban greening across all development types, and cite the evidence that BNG cannot deliver significant urban greening on many inner-urban sites that form the great majority of the City's 15 year development pipeline.

Core Reference Source and Specification

- 7.3 The policy should refer to the core guidance issued by Natural England (NERR132). This contains specifications and references to standards, which are updated from time to time. If there are any additional surface cover types that the City Council wishes to be eligible for use in the MGF, these should be defined and their score justified.
- 7.4 The Council should determine whether it considers student accommodation to be residential or commercial for the purpose of setting UGF thresholds. The default would be to define it as residential, based on DLUHC construction monitoring protocols.

Variations to Core References and Specification

- 7.5 The Council may wish to vary the following in a Manchester Greening Factor:
- The threshold score to be achieved by residential and commercial developments (currently 0.4 and 0.3 respectively).
 - The particular scores to be ascribed to particular surface cover types (see discussion at chapter 5).
 - Whether to allow developers to take account of enhancements to off-site land in their UGF calculation - refer to discussion in chapter 5 about the possibility of including adjoining riparian or canal-side land because of the potential benefits to water quality and biodiversity.
 - Whether to direct developers towards use of particular surface cover types e.g. require the use of larger tree pits unless there is justification and evidence on lack of feasibility.
 - Whether to disallow scoring of certain surface cover types in private curtilages where their long-term sustainability is questionable.
- 7.6 As a general principle, minimal variation from the core standard is recommended because variation adds complexity and cost to the developer and for the planning officer assessing the UGF submission.

- 7.7 This study makes it clear that even the introduction of the "standard UGF" will result in an enhanced level of urban greening compared to current practice. One of the positive features of the UGF is that it is a simple and accessible process that offers developers a good degree of choice; in comparison to BNG which is a more complex metric that is highly directive in terms of its trading rules and required habitats, and is unlikely to incentivise larger urban trees or rain gardens for example.
- 7.8 Thus at least in the early years of MGF policy implementation, minimal variation from the core standard is recommended, although TEP considers the following variations have greatest merit in Manchester:
- Directing developers to select the higher-scoring tree pit as a default.
 - Allowing the enhancement of adjoining riparian or canalside land to be included in a UGF calculation.
 - Allowing a small additional score where the developer can install a feature of community and heritage interest into the landscape.

Exemptions

- 7.9 An MGF policy can be introduced on a "supply or justify" basis i.e. the development should achieve the threshold unless a clear justification can be provided, typically relating to insurmountable technical constraints such as contamination or subsurface issues which prevent use of deep tree pits or pervious landscapes.
- 7.10 The minimum application size should be aligned with the BNG metric requirements for small sites i.e. householder development is exempted, along with custom and self-build schemes.

Compliance and Submission Requirements

- 7.11 Guidance to developers should be provided on:
- Standards of presentation of plans and measurements to support their UGF calculation - refer to comments in section 4 about the difficulties TEP experienced when analysing layout and landscape plans.
 - Clarity of presentation of information on tree pit, soil volumes and species / stock selection, where the higher score is being claimed.
 - A requirement to ensure that the UGF Report should be consistent with the mandatory BNG report; in terms of measurements of site area and on-site habitats post-development.
 - A template management and maintenance plan, taking into account foreseeable future pressures such as climate change and overshadowing from planned neighbour developments.

Monitoring

- 7.12 Monitoring of an MGF can be incorporated into the standard processes used by the City Council's Development Management team for assessing and recording the landscape details. A UGF report will typically be submitted at planning application stage, but in any case the submission of landscape details under planning condition should also include a final UGF calculation, demonstrating compliance with policy and commitments made in application documents.

- 7.13 At determination stage, the Council will wish to see:
- The UGF calculation and associated measured drawings
 - A statement of delivery and long-term management, appropriate to the scale and level of detail of the development
 - As required - Information relating to exemptions or justifications as to why a scheme cannot attain the threshold score
- 7.14 At condition discharge stage, the Council will wish to see:
- An updated UGF calculation and associated drawings
 - A long-term habitat management plan, aligned with the document produced for BNG compliance where this is required.
- 7.15 For final discharge of conditions, the Council will wish to see:
- An audit of the as-built landscape scheme, confirming inspection by a suitably qualified ecologist/landscape architect. Again this should ideally be aligned with documents produced for BNG compliance, where these are required.
- 7.16 The Council should be able to track and monitor UGF scores against the register of planning permissions and build up a simple database to help analyse UGF scores in terms of development type and location.
- 7.17 For a more qualitative evaluation of the success of the UGF over time, it would be appropriate to have UGF as a standing topic in regular GBI officer meetings and in developer forums.
- 7.18 Developers should be engaged in a forum prior to final policy formulation, and also consulted again as part of the first formal UGF policy review at c 5 years (see section below).

Transition period

- 7.19 A short transition period is advisable i.e. a period of grace after the adoption of the Local Plan policy during which any new applications do not require to meet the MGF standards. Assuming that developers are provided with thorough briefing and ongoing involvement with policy development through the pre-submission stages of the Local Plan, the transition period could be as little as one year for major developments and two years for non-major developments.

Review period

- 7.20 If the MGF policy refers to the Natural England guidance as its core reference source, there is an assumption that this will be updated from time to time as new techniques and evidence emerge. The policy wording should allow for minor changes to the MGF to be made in line with changes to the Natural England guidance and to allow for the City Council to introduce additional surface cover types or compliance requirements it deems suitable.

- 7.21 In terms of a review of the effectiveness of the policy and whether significant changes should be made to the MGF surface cover scores and thresholds, a formal review at a five yearly interval after the transition period seems appropriate. This will allow collection of evidence from a number of completed schemes.

Developer Involvement

- 7.22 As the MGF policy is developed, the Council should seek continued engagement with developers, ensuring that they have a good understanding of the tool and its purpose.
- 7.23 As the policy develops, there should be clear communication of any timings and phased implementation.

Involvement of other Council functions

- 7.24 As the MGF policy is developed, other departments of the Council should be involved to ensure that their requirements for design and adoption of SuDS features and highway trees are considered. Any conflicts should be identified at an early stage and resolved through amendments to standard UGF specifications, or through amendments to established City Council adoption procedures, or both.
- 7.25 For innovative surface cover types that will be adopted and maintained by the City's open space teams, their input will be needed to ensure that long-term operation and maintenance requirements are built into any UGF specification; this probably applies most to living wall systems and raingardens which require specialist horticultural expertise.
- 7.26 The opportunity for UGF to transform horticultural skills and create new jobs in design and maintenance should be celebrated as a positive outcome. Manchester can continue its reputation as a centre of excellence in "Sponge City" thinking through the MGF.

8.0 Glossary

Biodiversity Net Gain: Biodiversity net gain (BNG) is a way of creating and improving natural habitats. BNG makes sure development has a measurably positive impact ('net gain') on biodiversity, compared to what was there before development.

In England, biodiversity net gain (BNG) became mandatory in 2024 under Schedule 7A of the Town and Country Planning Act 1990 (as inserted by Schedule 14 of the Environment Act 2021). For this report, mandatory BNG is the term used for the BNG requirements for developments where planning applications are expected to be submitted after January 2024. BNG is already offered, as a matter of planning policy compliance, for many developments already in the planning system, but these are not mandatory. Local Authorities will be expected to register, monitor and enforce BNG commitments made under the mandatory system.

BNG Metric: Government has published the statutory (official) biodiversity metric calculation tool which must be used by all developers in England required to provide mandatory BNG. It calculates the number of biodiversity units for existing habitat or habitat enhancements. Biodiversity units (BU's): For BNG, biodiversity is measured in standardised biodiversity units. There are three broad categories of BU:

- Habitat Areas e.g. grasslands, woodlands, wetlands, urban habitat types
- Hedgerows and Linear features
- Watercourses

The biodiversity metric measures the biodiversity value of habitats by calculating the number of biodiversity units pre and post development

Development Pipeline: For the purposes of this report, Manchester's development pipeline consists of sites identified in its Local Plan 2023/24 to 2038/9. Manchester City also has a database of sites which it expects to receive planning applications for housing, office and commercial developments.

Habitat Management and Monitoring Plan (HMMP): part of the legal documentation where mandatory BNG is required. It is a detailed plan that outlines how the land will be managed over at least 30 years to:

- create and enhance habitats for biodiversity net gain (BNG)
- manage and monitor the BNG

Householder development: An application for planning permission for development of an existing dwelling house, or development within the curtilage of a dwelling house for those living there.

SuDS hierarchy: The term covers techniques used to manage water runoff from development to reduce the quantity, and increase the quality, of surface water that drains into sewers. A general SuDS definition is that it mimics natural systems, and differs from traditional drainage in aiming to manage rain close to where it falls, ideally using techniques that incorporate wetland habitats. The SuDS hierarchy seeks to ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

- 1 store rainwater for later use
- 2 use infiltration techniques, such as porous surfaces in non-clay areas
- 3 attenuate rainwater in ponds or open water features for gradual release
- 4 attenuate rainwater by storing in tanks or sealed water features for gradual release
- 5 discharge rainwater direct to a watercourse
- 6 discharge rainwater to a surface water sewer/drain
- 7 discharge rainwater to the combined sewer.

Putative UGF score: For the purpose of this study, a putative UGF score was calculated for a sample of developments which had already received planning permission. The approved landscape masterplans were digitised and the proposed landscape types were assigned to UGF surface cover types. From this the UGF score was estimated using the multipliers in the London Plan UGF policy – see appendix B of this report. It is acknowledged that the approved landscape plans were not drawn up with UGF policy in mind, so a low “putative UGF score” is not a criticism of the quality of the design or the scheme layout. The purpose of generating a putative score is simply to assess whether current practice would attain the UGF scores required in the London Plan and/or Natural England guidance.

Surface Cover Types: Surface cover types are a the UGF that incorporate various urban greening measures proposed for a development site. Each are assigned different weightings reflecting environmental, social and biodiversity value and are used to calculate the greening factor to achieve or exceed the target UGF score. Surface cover types include the retention and protection of existing vegetation and trees, new areas of planting, hedgerows, trees and other landscape features including green roofs, green walls and sustainable drainage systems.

Stockholm Tree Pit Soils: A structural soil using a stone-based growing medium that can support pedestrian and vehicular traffic. Its use allows tree pits to be extended beneath hard surfacing. This enables designers to provide enough soil for a tree to be healthy and reach maturity. When designing tree pits with structural soils rainwater that has been collected from roofs, roads and paved surfaces is diverted into the tree pit. This is good for the trees and tree pits constructed using this approach also contribute to sustainable drainage systems (SuDS). The system was devised by the City of Stockholm and has demonstrated that exceptionally healthy trees can be cultivated when using structural soils. Standard machinery found on most building sites can be used to install structural soils which means that they are easy to use. Also, the simple design allows structural soils to be dug up after the pavement has been laid if any future ground works are required.

Urban Greening Factor (UGF): a planning tool to improve the provision of Green Infrastructure (GI) particularly in urban areas. The system assesses urban land in terms of Surface Cover Types. Developments can be scored in terms of the Weighted Scores for Surface Cover Types such as green infrastructure elements used in development including – vegetation and tree planting; green roofs and walls; sustainable drainage systems and water features; and paved surfaces. Surface Cover Types with higher permeability and vegetation canopy score highest.

There are two main components of the UGF: (a) a target factor score that sets a minimum proportion or percentage of greening for a particular site, area or land use; and, (b) a schedule of surface cover types and associated factor weightings that are used to calculate the score.

The UGF score is calculated by multiplying the area of each surface cover type by its factors; each figure is then added together and divided by the total area within the development site boundary that is commonly referred to the red-line boundary.

APPENDIX A: Urban Greening Factor Questionnaire for Developers

Urban Greening Factor for Manchester City Council

Developer Consultation

Background to the Consultation

Manchester City Council is keen to introduce an urban greening policy into its Local Plan. The City has aspirations for strong and sustainable growth in homes, employment and social infrastructure.

Manchester is already known as one of the world's greenest cities but it recognises the need for new development to deliver more greenery than has previously been the case. We mean street trees, raingardens, blue/green roofs, SuDS features, living walls, meadows and landscape structure planting. These are critical for place-making, inward investment, urban cooling, flood resilience and biodiversity.



Manchester is fortunate to have a community of developers, planners, architects and urban designers who share the goal of a green city. By introducing an Urban Greening Factor (UGF) policy into our Local Plan, we want to raise the bar for all types of development, ensuring that urban greening is included on site.

The UGF is not new; in fact it was first trialled in Sweden about 20 years ago. It has been included in the London Plan for a few years. Initial fears over the viability and technical success of greening measures have now largely been allayed with technological advances in the installation of features such as green/blue roofs, SuDS-enabled tree pits and living walls. Indeed Manchester has been at the forefront of some of these technologies.

We are seeking input and advice from key developers in shaping an UGF policy for Manchester. So we have appointed TEP to consult with developers by interview and questionnaire. TEP will also be running some technical feasibility tests on current and recent planning applications to assess what their UGF score would be.

Please email your complete questionnaires to maggiefennellwells@tep.uk.com by 30th June. 2023

About the Urban Greening Factor

Here are some useful links to find out more about the Urban Greening Factor:

A brief overview from the Landscape Institute: [What does the Urban Greening Factor mean for London? | Landscape Institute](#)

The London Plan Guidance: [Urban Greening Factor LPG \(london.gov.uk\)](#)

Full Explanation from Natural England: [Urban Greening Factor for England – Development and Technical Analysis - NERR132 \(naturalengland.org.uk\)](#)

Please answer the following questions

YOUR BACKGROUND

Q1	How important is development in Manchester City to your business? Select one option.	
	Essential – it has been and will be core to our investment plans	
	Important – and likely to become more so	
	Important – but likely to become less so	
	Moderate – it forms a relatively small part of our portfolio and we will invest only where we see strategic benefit	
	Minor – it is a small part of our portfolio	

Q2	Do you have any experience of the Urban Greening Factor? Select one option.	
	Yes, we have used it on our own developments	
	Yes, we are aware of other developments that have used it	
	Yes, we have read about it and understand it, but haven't seen it applied to any UK developments	
	No, we have little or no prior knowledge of it	

Q3 What type(s) of development are you likely to bring forward in Manchester in the next 10-15 years? Select all that apply.

Residential (including student)	
Commercial	
Retail	
Industrial/Logistics	
Education/Leisure/Healthcare	
Other (please specify)	

BENEFITS OF UGF

The City Council considers that an Urban Greening Factor has important benefits.

Q4 Please indicate if you agree or disagree with the following statements and give any examples to illustrate your response.

Statement	Agree/ Disagree	Example
4a UGF policy will ensure that urban greening is delivered on site, thus maintaining and raising local environmental quality.		
4b UGF policy is essential to ensure that inner urban areas will be more resilient to future climate change, especially in respect of shade and flood resilience		
4c UGF policy is an important driver for good place-making		

4d UGF policy
offers flexibility for developers
to choose from a menu of
greening techniques

Q5

Are there any other benefits from an Urban Greening Factor policy?
Describe below.

CONCERNS

The Council recognises there are concerns over the introduction of an UFG Policy

Q6	Please indicate if you agree or disagree with the following statements and give any examples to illustrate your response.		
	Statement	Agree/ Disagree	Example
	6a With the forthcoming introduction of mandatory Biodiversity Net Gain (BNG) legislation, the habitats required for urban greening score relatively poorly in the BNG metric. This means developers may still have to provide costly on and off-site solutions to meet BNG and UGF requirements.		
	6b Building and Fire Safety Regulations and insurance industry restrictions will prevent us from installing certain types of urban greening within the building fabric		
	6c There is such a significant skills shortage in the design and installation of urban greening features that it will not be possible to deliver the policy		

<p>Q7 Are there any other concerns you have about the introduction of UGF policy? How can the City Council assist the development sector to address these concerns?</p>
<div></div>

IMPLEMENTATION

The Council is minded to adopt the same thresholds and habitat scoring criteria as London, to reduce the opportunity for confusion. The default London approach is to require predominantly residential development to score at least 0.4 (40%) and predominantly commercial development to score at least 0.3 (30%).

Q8

Are there any types of development in Manchester that should have higher or lower thresholds? For example, should student accommodation be classed as residential for UGF purposes?

Q9

Are there any locations in Manchester that should have higher or lower thresholds? For example should developments in or near river valleys have higher thresholds, because the river valleys are crucial green and blue infrastructure networks? Or alternatively where the UGF score is lower than average and increased green infrastructure is needed to improve climate resilience?



Q10

Surface Cover types score differently using the UGF system. Below is a table showing the standard scores. Please indicate in column 3 whether you think any of the scores should be higher or lower for Manchester. If you want to suggest an alternative please do so. For example, you may think that given the need for flood resilience, pervious paving should score higher than 0.1; which in turn would mean that developers would need to deliver less urban greenery on site to meet the minimum score. Alternatively you may feel that civic trees are critical for place-making, so their score should be higher than shown

Surface Cover Type	Standard Factor	Should Manchester adopt a different factor?
Semi-natural vegetation (e.g. trees, woodland, species-rich grassland) maintained or established on site	1	
Wetland or open water (semi-natural; not chlorinated) maintained or established on site	1	
Intensive green roof or vegetation over structure; substrate minimum settled depth of 150mm – GRO-Code-2021-Anniversary-Edition.pdf	0.8	
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two-thirds of the projected canopy area of the mature tree – Trees in Hard Landscapes: A Guide for Delivery - Trees and Design Action Group (tdag.org.uk)	0.8	
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket) – meets the requirements of GRO Code GRO-Code-2021-Anniversary-Edition.pdf	0.7	
Flower-rich perennial planting – Perennials / RHS Gardening	0.7	
Rain gardens and other vegetated sustainable drainage elements – Case studies (susdrain.org)	0.7	
Hedges (line of mature shrubs one or two shrubs wide) – Hedges: selection / RHS Gardening	0.6	
Standard trees planted in pits with soil volumes less than two-thirds of the projected canopy area of the mature tree	0.6	
Green wall – modular system or climbers rooted in soil – The NBS guide to façade greening (Part Two) NBS	0.6	

Groundcover planting – Ground cover plants / RHS Gardening	0.5	
Amenity grassland (species-poor, regularly mown lawn)	0.4	
Extensive green roof of sedum mat or other lightweight systems that do not meet GRO Code GRO-Code-2021-Anniversary-Edition.pdf	0.3	
Water features (chlorinated) or unplanted detention basins	0.2	
Permeable paving – Permeable surfacing options (susdrain.org)	0.1	
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone)	0	

Q11

How would you recommend ensuring the future performance of green spaces provided given that they will be situated in a dynamic urban environment with potential for further construction nearby, and subject to likely changes in the wider environment. Please consider:

- The impact of planned phases of the same development
- The impact of future developments outside of the project scope
- General ongoing maintenance provision in a changing climate



EXEMPTIONS

- Q12 Are there any (limited) circumstances where the requirement for delivery of UGF via on-site measures can be exempted, allowing for a compensatory contribution to off-site public realm greening? Please expand on your answer with examples of how the City council can fairly assess exemptions.

TRANSITION AND REVIEW

- Q13 What time period should be allowed for transition between adopting and enforcing the UGF policy?

- Q14 How often should the UGF policy be reviewed? NB the Council may adopt a policy with implementation details in Planning Guidance, the latter being reviewed on a regular basis.

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DEMONSTRATION

Q15

Do you have any current or recent planning applications you would like TEP to run an Urban Greening factor feasibility test on? TEP has a small budget for testing schemes. You will need to provide a baseline habitat survey, the BNG calculation and a measured landscape masterplan. In return you will receive an analysis of the UGF score that would be achieved by your development, and notes on how the scheme might be modified to meet the UGF threshold. The intention is for the results to be put in the public domain so please do not suggest any schemes you need to maintain as confidential.

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Thank you for your contribution.

APPENDIX B: UGF Weighting Factors used in study

These are based on figures from the London Plan Guidance - Urban Greening Factor

Semi-natural vegetation (e.g. trees, woodland, species-rich grassland) maintained or established on site	1
Wetland or open water (semi-natural; not chlorinated) maintained or established on site	1
Intensive green roof or vegetation over structure; substrate minimum settled depth of 150mm – GRO-Code-2021-Anniversary-Edition.pdf	0.8
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two-thirds of the projected canopy area of the mature tree – Trees in Hard Landscapes: A Guide for Delivery - Trees and Design Action Group (tdag.org.uk)	0.8
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket) – meets the requirements of GRO Code GRO-Code-2021-Anniversary-Edition.pdf	0.7
Flower-rich perennial planting – Perennials / RHS Gardening	0.7
Rain gardens and other vegetated sustainable drainage elements – Case studies (susdrain.org)	0.7
Hedges (line of mature shrubs one or two shrubs wide) – Hedges: selection / RHS Gardening	0.6
Standard trees planted in pits with soil volumes less than two-thirds of the projected canopy area of the mature tree	0.6
Green wall – modular system or climbers rooted in soil – The NBS guide to façade greening (Part Two) NBS	0.6
Groundcover planting – Ground cover plants / RHS Gardening	0.5
Amenity grassland (species-poor, regularly mown lawn)	0.4
Extensive green roof of sedum mat or other lightweight systems that do not meet GRO Code GRO-Code-2021-Anniversary-Edition.pdf	0.3
Water features (chlorinated) or unplanted detention basins	0.2
Permeable paving – Permeable surfacing options (susdrain.org)	0.1
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone)	0

DRAWINGS



HEAD OFFICE

Genesis Centre,
Birchwood Science Park,
Warrington
WA3 7BH

Tel: 01925 844004
E-mail: tep@tep.uk.com

**MARKET
HARBOROUGH**

The Reynard Suite,
Bowden Business Village,
Market Harborough,
Leicestershire,
LE16 7SA

Tel: 01858 383120
E-mail: mh@tep.uk.com

GATESHEAD

Office 26, Gateshead
International Business
Centre,
Mulgrave Terrace,
Gateshead
NE8 1AN

Tel: 0191 605 3340
E-mail: gateshead@tep.uk.com

LONDON

8 Trinity Street,
London,
SE1 1DB

Tel: 020 3096 6050
E-mail: london@tep.uk.com

CORNWALL

4 Park Noweth,
Churchtown,
Cury,
Helston
Cornwall
TR12 7BW

Tel: 01326 240081
E-mail: cornwall@tep.uk.com
