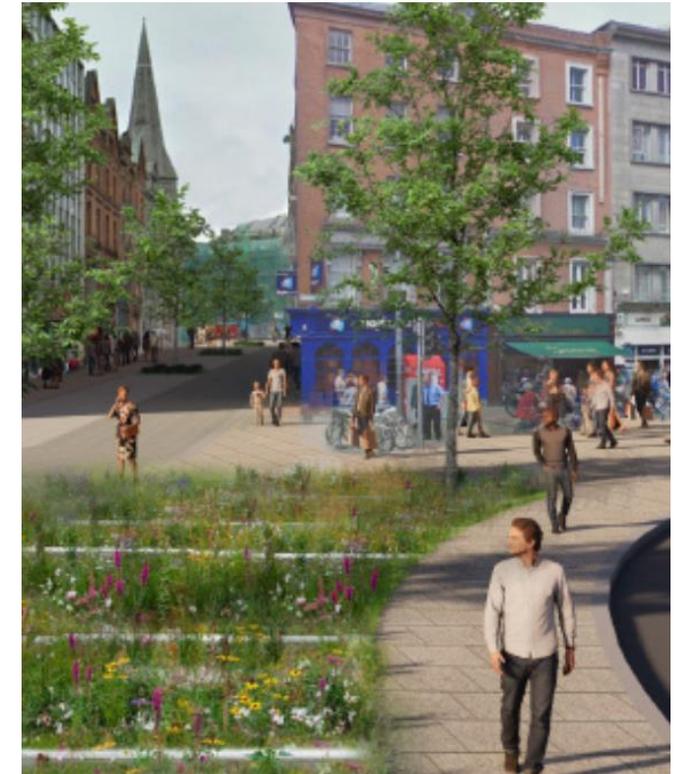# Biodiversity Net Gain
and
Sustainable Drainage Systems Toolkit

This is a high-level prospectus/catalogue that identifies the BNG benefits of different SuDS assets and how to maximise them. It is a practical guidance document that is aimed at users with an existing level of understanding of the concepts. It does not include detailed explanations of concepts or illustrative design examples.

ATKINS
Member of the SNC-Lavalin Group

NATURAL ENVIRONMENT INVESTMENT READINESS FUND

YorkshireWater

EAST RIDING OF YORKSHIRE COUNCIL

Environment Agency

Hull City Council

Contents

What is Biodiversity Net Gain?

What is Biodiversity Net Gain?

- "Development that leaves biodiversity in a better state than before"
- An overall increase in biodiversity following a new development, **measurable using habitat as a proxy**
- Wider benefits – e.g. health and wellbeing, climate change adaptation, water quality
- Some Local Planning Authorities already require it and many organisations have internal net gain targets
- In England, the net gain system runs alongside existing policy and legal protection of key sites, habitats and species

Environment Act 2021 - 10% BNG will be mandatory for Town & Country Planning Act projects in England from November 2023 (with some exemptions)

Nationally Significant Infrastructure Projects will require a 10% BNG from November 2025.
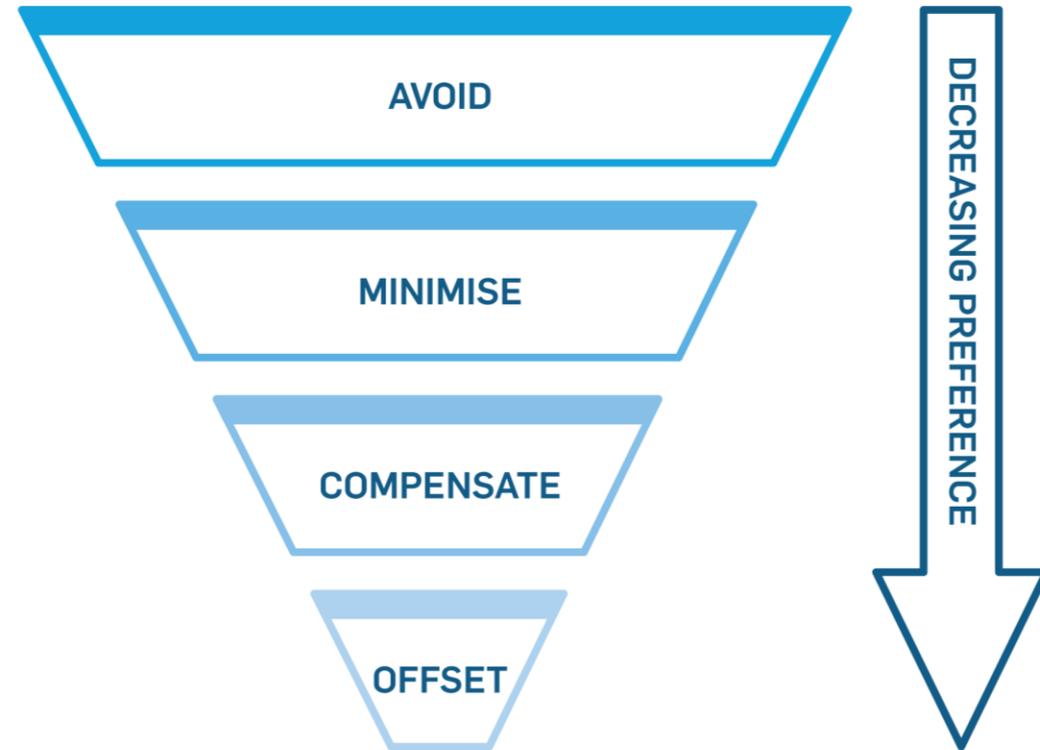
Biodiversity Metric 3.1 launched April 2022 and has been used to inform this Toolkit. Metric 4.0 was released in March 2023.

Mitigation Hierarchy

The sequential approach to applying the mitigation hierarchy, as set in Biodiversity Metric 3.1, is that habitat loss and damage should be:

Avoided
Minimised
Remediated (i.e. restored)
Compensated – as a last resort.

Application of the mitigation hierarchy is encouraged by Biodiversity Metric 3.1 because "it allows overall biodiversity gains to be achieved more easily through the avoidance of on-site habitat losses, rather than relying solely on the creation of new habitat or the enhancement of existing habitat.

BNG Guidance...

Biodiversity Net Gain
Good practice principles for development

ciria   CIEEM Chartered Institute of Ecology and Environmental Management   IEMA Transforming the world to sustainability

CIRIA, CIEEM and IEMA (2016) *Biodiversity Net Gain – Good practice principles for developments.* Available via: https://cieem.net/wp-content/uploads/2019/02/Biodiversity-Net-Gain-Principles.pdf [accessed March 2023]

Biodiversity net gain.
Good practice principles
for development
A practical guide

CIEEM Chartered Institute of Ecology and Environmental Management   IEMA Transforming the world to sustainability   ciria

CIRIA, CIEEM and IEMA (2019) *Biodiversity Net Gain – Good practice principles for developments – A practical guide.* Available via: https://cieem.net/wp-content/uploads/2019/02/C776a-Biodiversity-net-gain.-Good-practice-principles-for-development.-A-practical-guide-web.pdf [accessed March 2023]

CIRIA, CIEEM and IEMA created and launched:
- 2016: Biodiversity Net Gain – Good practice principles for developments.
- 2019: Biodiversity net gain – A practical guide.

British Standard for BNG published in August 2021– UK guidance BS 8683

Multiple guidance documents are released with each version of the Biodiversity Metric

Planning Advisory Service - https://www.local.gov.uk/pas/topics/environment/biodiversity-net-gain-local-authorities

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Using the Biodiversity Metric

- A tool to audit the biodiversity value of land
  - *To measure the biodiversity benefits of land management*
  - *To measure gains and losses of biodiversity for projects and/or developments*
  - *To calculate how much compensation is needed when natural or semi-natural habitats are permanently lost*
- Biodiversity Metric 3.1 launched April 2022 and has been used to inform this Toolkit. Metric 4.0 was released in March 2023

This tool (latest version of the Metric) is the industry standard and specifically referred to in Environment Act 2021.

Calculation of Gains or Losses

➢Biodiversity Metric spreadsheet tool includes separate metrics for
  ➢*area habitats,*
  ➢*hedgerows (linear habitat), and*
  ➢*watercourses*
➢Units cannot be traded between area habitats, hedgerows and watercourses

Simple maths?   (Post Biodiversity Units) − (Pre Biodiversity Units) = (Net Change)
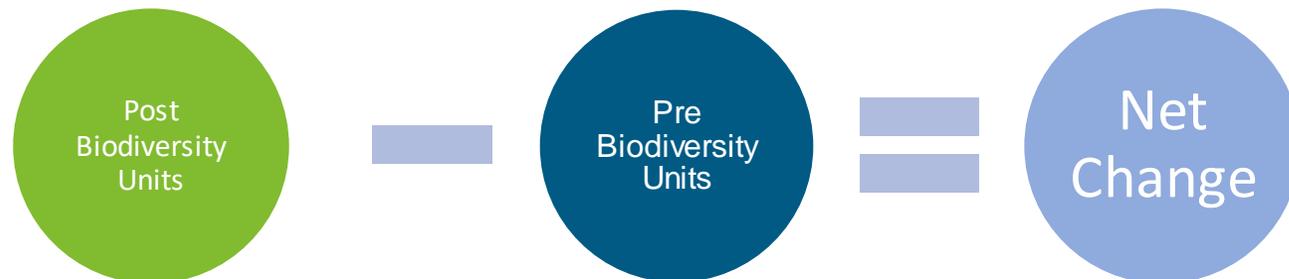
Biodiversity Metric 3.1 - Habitats

Habitats Metric: Pre-development score

Area (Ha) ✖ Distinctiveness ✖ Condition ✖ Strategic Significance = Pre Biodiversity Units
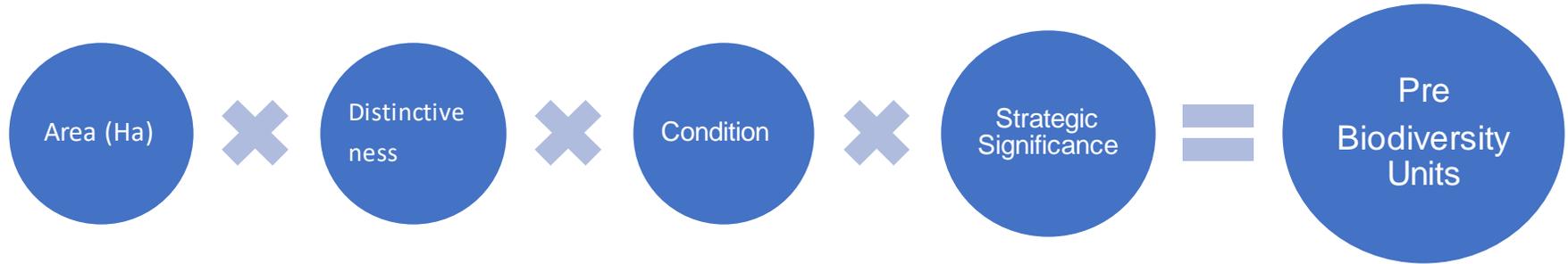
Habitats Metric: Post-development habitat creation

Area (Ha) ✖ Distinctiveness ✖ Condition ✖ Strategic significance

Difficulty to create ✖ Time until Target condition ✖ Spatial Risk = Post Biodiversity units
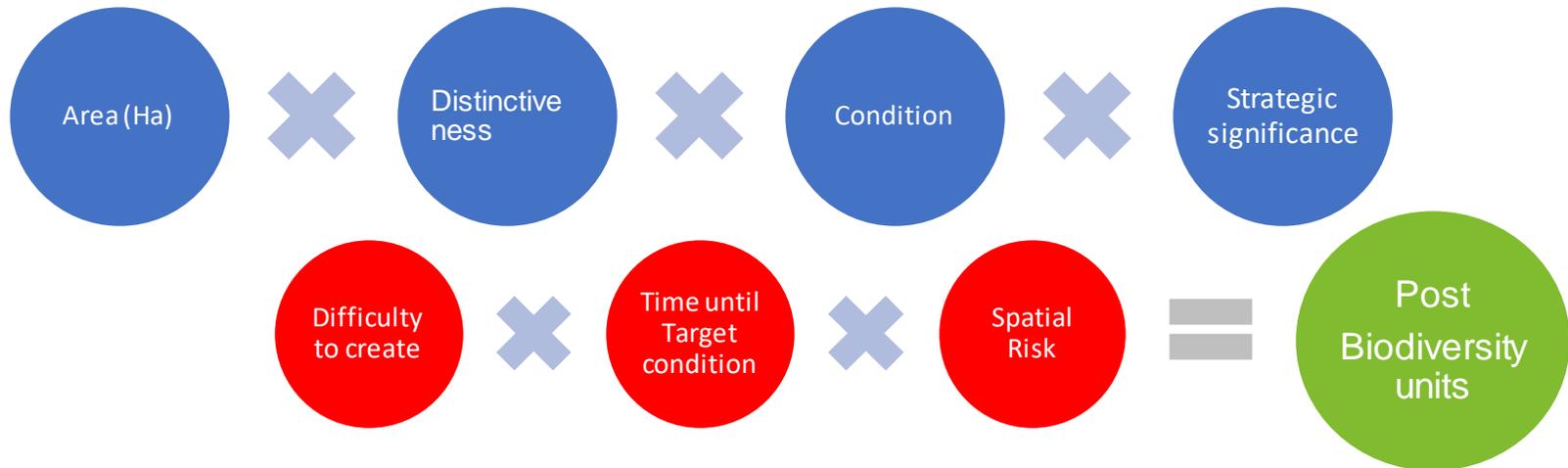
* Calculations are slightly different for the rivers element of the Metric

Habitat Creation in Advance and Delayed Habitat Creation

1 hectare of woodland created at the same time as development

Broad Habitat	Proposed habitat	Area (hectares)	Temporal multiplier						Habitat units delivered
			Standard time to target condition /years	Habitat created in advance/years	Delay in starting habitat creation/years	Standard or adjusted time to target condition	Final time to target condition/years	Final time to target multiplier	
Woodland and forest	Other woodland; broadleaved	1	15	0		Standard time to target condition applied	15	0.586	4.69

1 hectare of woodland created 5 years before development

Broad Habitat	Proposed habitat	Area (hectares)	Temporal multiplier						Habitat units delivered
			Standard time to target condition /years	Habitat created in advance/years	Delay in starting habitat creation/years	Standard or adjusted time to target condition	Final time to target condition/years	Final time to target multiplier	
Woodland and forest	Other woodland; broadleaved	1	15	5		Standard time to target condition applied	10	0.700	5.60

1 hectare of woodland created 5 years after development

| Broad Habitat	Proposed habitat	Area (hectares)	Temporal multiplier						Habitat units delivered
			Standard time to target condition /years	Habitat created in advance/years	Delay in starting habitat creation/years	Standard or adjusted time to target condition	Final time to target condition/years	Final time to target multiplier	
Woodland and forest	Other woodland; broadleaved	1	15		5	Standard time to target condition applied	20	0.490	3.92

Delayed or advanced creation is reflected in the Metric. Advanced creation resulting in comparably more units delivered and delayed creation resulting in comparably fewer units delivered than if creation took place at the same time as the development.

Trading Rules

Trading rules applied by the Metric which require that any loss of habitat is replaced on a 'like for like' or 'like for better' principle. The trading rules applied for individual habitats are based on their distinctiveness.

Generally, trading errors are easier to avoid in urban areas due to baseline habitats often having 'very low' or 'low' distinctiveness.
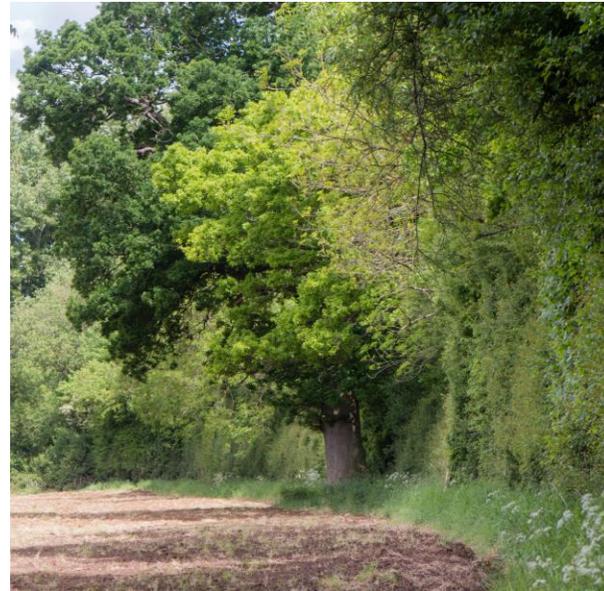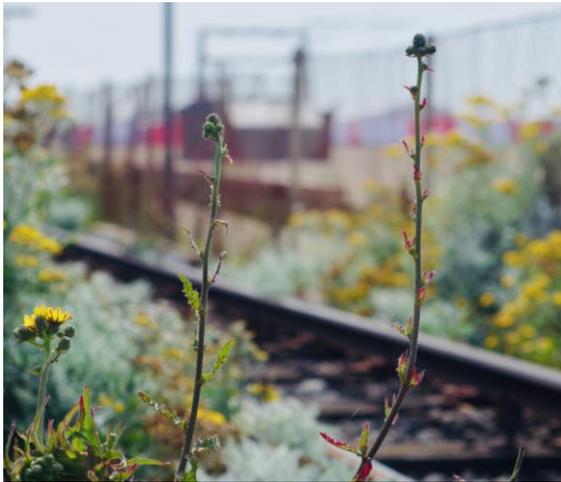
Mechanisms for Biodiversity Net Gain Delivery

Habitat secured for at least 30 years via planning obligations or conservation covenants

Onsite (units)

Potentially in full or combination

Delivered on-site via habitat creation/enhancement via soft estate/green infrastructure/landscaping

Offsite (units)

Delivered through new habitat creation/enhancement on land holdings or via habitat banks. May involve legal agreements with public or private landowners directly or via a broker
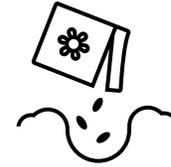
Statutory Credits (2023 onwards)

Only if units not available

Paid into central government managed system to support landscape-scale strategic habitat creation

Spatial Risk

Spatial risk is an element of the Metric that is relevant to offsite habitat enhancement/creation only. It considers how close to the site the offsite enhancement/creation is. The closer to the site the offsite enhancement/creation is the better the result is within the Metric.

Spatial risk multiplier		Spatial risk multiplier
Spatial risk category		
Compensation inside LPA or NCA, or deemed to be sufficiently local, to site of biodiversity loss		
Compensation outside LPA or NCA of impact site but in neighbouring LPA or NCA		
Compensation outside LPA or NCA of impact site and beyond neighbouring LPA or NCA		
Intertidal habitats - Compensation inside same Marine Plan Area, or deemed to be sufficiently local, to site of biodiversity loss		
Intertidal habitats - Compensation outside same Marine Plan Area but in neighbouring Marine Plan Area		
Intertidal habitats - Compensation outside Marine Plan Area of impact site and beyond neighbouring Marine Plan Area		

Habitat Types within the Metric

Broad Habitat	Proposed habitat	Area (hectares)	Distinctiveness	
			Distinctiveness	Score
Urban	Artificial unvegetated, unsealed surface		V.Low	0
Urban	Bioswale		Low	2
Urban	Ground level planters		Low	2
Urban	Rain garden		Low	2
Urban	Urban Tree		Medium	4
Urban	Sustainable urban drainage feature		Low	2
Grassland	Modified grassland		Low	2
Grassland	Other neutral grassland		Medium	4
Lakes	Ponds (Non- Priority Habitat)		Medium	4
Wetland	Reedbeds		High	6

- Critical to think about how the SuDS solution relates to the habitat types within the Metric. The Metric terrestrial habitat types being predominantly based on UKHab[1] (a habitat classification system)
- Distinctiveness is set but condition status is where gains can be made with us tweaking the design – need to review condition criteria[2] for these habitat types

[1] https://ukhab.org/   [2] Technical Annex 1 of The Biodiversity Metric 4.0 - JP039 (naturalengland.org.uk)

How to Make BNG Work?

- Design and Ecology engagement from start of a project & engage stakeholders early
- GIS / CAD parameters must be measurable for baseline and design. GIS means data can link to areas
- SuDS specialists, landscape architects & ecologists co-designing high scoring & genuinely deliverable habitats (realistic for location, soils & long term management)
- Design on a landscape scale: '**bigger, better, more, and joined up**' principles
- Make provision for long term management

Restoration area
Landscape corridor
Stepping stone corridor
Core area
Linear corridor
Buffer zone
Sustainable use area
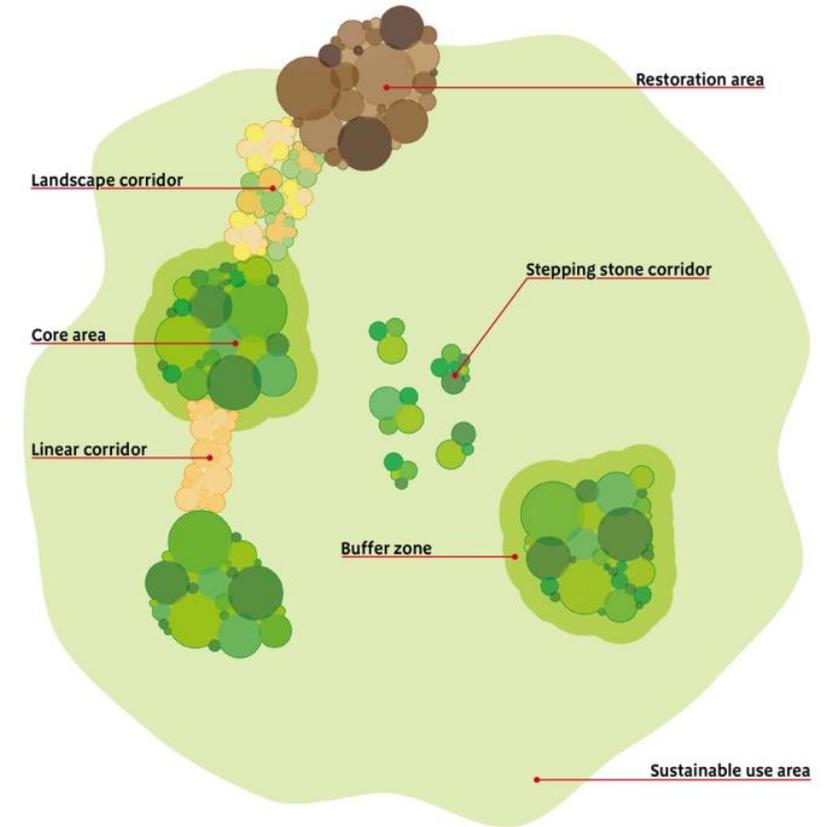
From 'the Lawton Report' Defra (2010) "Making Space for Nature: a review of England's wildlife sites and ecological network"

Site Selection Considerations

When looking for **locations to develop** SuDS or other biodiversity enhancement measures, target areas that support existing **habitats of very low distinctiveness** where possible (e.g. hardstanding areas). If this is not possible, target areas that support **low distinctiveness habitats** (e.g. modified grassland).

Semi-natural habitats should be **retained as a priority** and enhanced where possible

The potential presence of other **ecological constraints** will need to be considered e.g. **protected species**

If **irreplaceable habitats** are **lost** to a scheme, then a **biodiversity net gain cannot be claimed. Bespoke compensation** would be required.

BNG gains do not have to be restricted to the SuDS interventions themselves, an effective way of delivering BNG units and increasing biodiversity value is **enhancing retained habitats** (including condition enhancements) **around proposed SuDS intervention areas**.

Irreplaceable habitats include **veteran/ancient trees**

Although veteran/ancient trees are typically associated with ancient woodland and wood pasture/parklands, it is worth noting that even urban/street trees can be veteran/ancient!

The Woodland Trust's Ancient Tree Inventory[1] (ATI) is a good place to start when identifying veteran/ancient trees.
However, not all veteran/ancient trees are included in the ATI and also trees recorded in the ATI might not have been confirmed as being veteran/ancient

[1] Ancient Tree Inventory - Woodland Trust

Always **retain trees as a priority** rather than remove and then replace.

Examples:

- If one small tree (<30 cm DBH) in moderate condition is being lost (0.03 units) you would need to replace with 3 small trees in moderate condition (0.04 units) to replace the units lost.
- If one medium tree (>30 to <90 cm DBH) in moderate condition is being lost (0.29 units) you would need to replace with 24 small trees in moderate condition (0.3 units) to replace the units lost.
- If one large tree (>90 cm DBH) in moderate condition is being lost (0.6 units) you would need to replace with 50 small trees in moderate condition to replace the units lost (0.62 units).

Hull City Council's stance would be to replace trees lost with two new ones (in line with Hull's City Council policy)

However, note how the size of the tree effects BNG calculations

Retaining and adding trees on individual projects can help areas align with Natural England's Green Infrastructure Standards, which states that local urban tree canopy cover should be increased by an agreed % based on the locally defined baseline – taking into account local needs, opportunities and constraints.

SuDS Intervention Types and BNG

Habitat Classification

The Biodiversity Metric habitat types are largely based on the UKHab classification system.
There are a number of relevant urban habitat types for SuDS:

- Sustainable urban drainage feature[1]
- Bioswale
- Rain garden
- Ground level planters

However, these may not always be the most suitable classifications, depending on the characteristics of the SuDS. A suitably experienced ecologist should always be consulted.

The following slides show a translations of standard SuDS interventions to Biodiversity Metric habitat types and assumptions about the condition of these habitats.

Although some of the SuDS interventions have been classified as grassland habitat types in this instance, urban habitat classifications of bioswale and sustainable urban drainage system are also used in the Biodiversity Metric (as above) and may be more suitable habitat classification types in some situations.

Beyond this, slides describe how additional BNG value may be added to these standard SuDS interventions.

[1] Terminology amended to 'Sustainable drainage system' in Metric 4.0.

Summary

The below table gives a comparison of how the different types of SuDS compare in terms of the Biodiversity units they are assumed to generate upon creation. It also illustrates how enhancing standard SuDS designs can generate more biodiversity units.

SuDS Type	Standard SuDS Design			BNG Enhanced SuDS Design		
	Habitat Classification	Condition	Units Delivered	Habitat Classification	Condition	Units Delivered
Swales, Aqua Greens, Detention Basins, Filter Strips or Green Wall/Embankments	Modified grassland	Moderate	0.03	Other neutral grassland	Moderate or Good	0.07 or 0.08 (respectively with condition)
Permeable Paving	Artificial unvegetated, unsealed surface	N/A - Other	0.00	No enhancements available for this SuDS type		
Planters	Ground-level planters	Condition Assessment N/A	0.02	As above		
Bioretention Areas	Rain garden	Moderate	0.04	Rain garden	Good	0.05
Tree pits*	Urban tree	Moderate	0.02	Urban tree	Good	0.03

The above scenario assumes a 0.01 ha / 100 m² area of 'Developed land; sealed surface' habitat, considered of low strategic significance, is lost (this baseline being worth 0 units, meaning 0 units are lost). It assumes 0.01 ha of the above habitat in question is created and considered of low strategic significance.

* For the urban trees it is assumed two small trees (with an assumed diameter at breast height of 30 cm or less after 30 years) are planted within one of the other created SuDS types.

Please take note of these statements. In brief, the table compares units generated by two small trees to those generated by 100 m² of each other SuDS type

Swales

A shallow, broad channel in an urban/peri-urban setting that is assumed to support managed, species-poor grassland that is dominated by a few fast-growing grasses such as rye grasses, Yorkshire fog and crested dog's tail, with a low cover of wildflower species.

Assumed to support managed grassland that could have >5 species per m^2 but no more than 9 and is generally a short, homogenous sward height. It is assumed that there might be some physical damage to the grassland and areas of bare ground due to high levels of access and regular management, but typically no bracken or scrub cover, or invasive non-native species, due to the regular management.

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Click HERE for enhancements that can boost BNG for swales

Aqua Greens

Multi-use green spaces that are assumed to support managed, species-poor grassland that is dominated by a few fast-growing grasses such as rye grasses, Yorkshire fog and crested dog's tail, with a low cover of wildflower species.

Assumed to support managed grassland that could have >5 species per m^2 but no more than 9 and is generally a short, homogenous sward height. It is assumed that there might be some physical damage to the grassland and areas of bare ground due to high levels of access and regular management, but typically no bracken or scrub cover, or invasive non-native species, due to regular management.

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Click **HERE** for enhancements that can boost BNG for aqua greens

Detention Basins

Vegetated depressions that are assumed to support managed, species-poor grassland that is dominated by a few fast-growing grasses such as rye grasses, Yorkshire fog and crested dog's tail, with a low cover of wildflower species.

Assumed to support managed grassland that could have >5 species per m^2 but no more than 9 and is generally a short, homogenous sward height. It is assumed there might be some physical damage to the grassland and areas of bare ground due to high levels of access and regular management, but typically no bracken or scrub cover, or invasive non-native species, due to regular management.

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Click **HERE** for enhancements that can boost BNG for detention basins

Filter Strips

Vegetated, sloping strips of land that are assumed to support managed, species-poor grassland that is dominated by a few fast-growing grasses such as rye grasses, Yorkshire fog and crested dog's tail, with a low cover of wildflower species

Assumed to be support managed grassland that could have >5 species per m^2 but no more than 9 and is generally a short, homogenous sward height. It is assumed that there might be some physical damage to the grassland and areas of bare ground due to high levels of access and regular management, but typically no bracken or scrub cover, or invasive non-native species, due to regular management.

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Click **HERE** for enhancements that can boost BNG for filter strips

Green Embankments (sometimes referred to as Green Wall)

Vegetated embankment that is assumed to support managed, species-poor grassland that is dominated by a few fast-growing grasses such as rye grasses, Yorkshire fog and crested dog's tail, with a low cover of wildflower species.

Assumed to be managed grassland that could have >5 species per m^2 but no more than 9 and is generally a short, homogenous sward height. It is assumed that there might be some physical damage to the grassland and areas of bare ground due to high levels of access and regular management, but typically no bracken or scrub cover, or invasive non-native species, due to regular management.

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Click HERE for enhancements that can boost BNG for green walls

Permeable Paving

Paved surfaces that are permeable to water.

UKHab Habitat Classification	=	Artificial unvegetated, unsealed surface
Assumed Condition	=	N/A – automatically assigned condition score of 0

Planters

Rainwater planters outside properties or streetside.

UKHab Habitat Classification	=	Ground level planters
Assumed Condition	=	N/A – automatically assigned condition score of 1 in the metric

There are no suggested enhancements for these SuDS types.

Where possible, the most worthwhile habitats to create (in terms of BNG units) in an urban/peri-urban setting are semi-natural habitats such as other neutral grassland and mixed scrub, rather than more artificial urban interventions such as planters, rain gardens etc.

Bioretention Areas

Landscaped depressions planted with a combination of native and non-native species, including grasses.

It is assumed that mixed planting will provide a varied vegetation structure, with no single ecotone (e.g. scrub, grassland, herbs) accounting for more than 80% of the total area. Although it is considered that a typical rain garden supports a diverse range of flowering species, it is assumed that these generally comprise at least some non-native species. It is assumed that no invasive non-native species would be present.

UKHab Habitat Classification	=	Rain garden
Assumed Condition	=	Moderate

Click **HERE** for enhancements that can boost BNG for bioretention areas

Tree Pits

Individual street trees in pits, often with planting beneath. All trees are inputted as small trees in the metric.

It is assumed that tree pits will typically support non-native tree species and the trees planted will not be mature and will not support features such as loose bark, cavities, deadwood etc. It is assumed that the tree will not be subject to significant adverse anthropogenic effects (e.g. vandalism, herbicide use). If there is to be planting beneath the tree, it is assumed more than 20% of the canopy will oversail vegetation beneath.

UKHab Habitat Classification	=	Urban tree
Assumed Condition	=	Moderate

Click **HERE** for enhancements that can boost BNG for tree pits

Enhancements

For Swales, Aqua Greens, Detention Basins, Filer Strips or Green Embankments

UKHab Habitat Classification	=	Modified Grassland
Assumed Condition	=	Moderate

Standard SuDS design

UKHab Habitat Classification	=	Other neutral grassland
Assumed Condition	=	Moderate or good

Enhanced SuDS design

Key changes from standard to enhanced are as follows:
- Species-rich grassland seed mix should be used, that is of local provenance and consists of native species only.
- Species-rich grasslands should be mown just twice a year (once in Spring and once in late Summer/early Autumn). The arisings should be collected and disposed of, and not left on the grassland to decompose.

The following slide contains **important** additional information regarding this specific enhancement. A list of additional considerations can be accessed **HERE**.

Enhancements
For Swales, Aqua Greens, Detention Basins, Filer Strips or Green Embankments

In order for 'other neutral grassland' to reach its assumed condition, it must meet a specified number of criteria from the Metric's habitat condition assessment sheets. A summarised list of these criteria are included below but the original (accessed via Natural England's website) should be referred to for further detail.

Moderate condition = 3 or 4 of the following criteria are met
Good condition = 5 or 6 of the following criteria are met

- The appearance and composition of the vegetation must closely match characteristics of the other neutral grassland UKHab definition, including wildflowers, sedges and indicator species being very clearly and easily visible throughout the sward. This criterion is essential for **moderate** and **good** condition
- Varied sward height (at least 20% of the sward is less than 7 cm and at least 20 % is more than 7 cm)
- Bare ground cover between 1% and 5%
- Bracken cover less than 20% and cover of scrub less than 5%
- An absence of invasive non-native species. Combined cover of species indicative of sub-optimal condition and physical damage accounts for less than 5% of total area
- There are greater than 9 species per m^2. This criterion is essential for **good** condition

Enhancements
For Bioretention Areas

| UKHab Habitat Classification | = | Rain garden |
| Assumed Condition | = | Moderate |

Standard SuDS design

| UKHab Habitat Classification | = | Rain garden |
| Assumed Condition | = | Good |

Enhanced SuDS design

The key change from standard to enhanced is the use of native plant species only, including a diverse range of native flowering species that provide nectar sources for insects. Ideally of local provenance

The following slide contains **important** additional information regarding this specific enhancement.
A list of additional considerations can be accessed **HERE**.

Enhancements
For Bioretention Areas

In order for 'rain gardens' to reach their assumed condition, they must meet a specified number of criteria from the Metric's habitat condition assessment sheets. A summarised list of these criteria are included below but the original (accessed via Natural England's website) should be referred to for further detail.

Good condition = all of the following criteria are met

- Vegetation structure is varied. A single ecotone (i.e. scrub, grassland, herbs) not accounting for more than 80% of the total habitat area
- A diverse range of flowering plant species, providing nectar sources for insects. These species must be native species only (rather than non-natives beneficial to wildlife)
- A complete absence of invasive non-native species

Enhancements

For Tree Pits

UKHab Habitat Classification	=	Urban tree
Assumed Condition	=	Moderate

Standard SuDS design

UKHab Habitat Classification	=	Urban tree
Assumed Condition	=	Good

Enhanced SuDS design

Key changes from standard to enhanced are as follows:
- Native species to be used. Ideally of local provenance.
- Planting older trees to ensure they reach at least 2/3 the fully mature height of the species within 30 years of planting

The following slide contains **important** additional information regarding this specific enhancement.
A list of additional considerations can be accessed **HERE**.

Enhancements

For Tree Pits

In order for 'urban trees' to reach its assumed condition, it must meet a specified number of criteria from the Metric's habitat condition assessment sheets. A summarised list of these criteria are included below but the original (accessed via Natural England's website) should be referred to for further detail.

Good condition = 5 or 6 of the following criteria are met

- Native species (or more than 70% are native species if there is a block of urban trees being considered)
- The tree canopy is predominantly continuous, with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide (individual trees automatically pass this criterion).
- The tree is mature (i.e. at least 2/3 the fully mature height of the species) or veteran (or more than 50% within a block of urban trees are mature or veteran).
- Little / no evidence of an adverse impact on tree health by anthropogenic activities (e.g. vandalism, herbicide use). There is no current regular pruning regime so the trees retain >75% of expected canopy for their age range and height.
- Micro-habitats for birds, mammals and insects are present e.g. presence of deadwood, cavities, ivy or loose bark
- More than 20% of the tree canopy area is oversailing vegetation beneath.

Enhancements

Additional considerations when creating and maintaining a vegetated SuDS:

- **Management commitment** - to be included within the BNG metric, habitats must be secured for at least 30 years (this will need to include any necessary habitat management, monitoring and remediation). This will be a requirement via planning obligations or conservation covenants.
- **Slopes** - need to be suitably accessible for the required management of the habitat.
- **Cuttings disposal** – if the vegetation is cut, is leaving the arsing in situ appropriate for maintaining the habitat or the function of the SuDS? Or does it need to be removed? If so, are their compost areas available? Will green waste disposal need to be paid for?
- **Pollution sources** - for example, next to busy roads salt tolerant species may need to be considered
- **Water levels** - will the area be regularly wet or dry? This will influence what species that are appropriate to plant. In wet areas, you may want to consider marginal/emergent species e.g. sedges, iris
- **Soil type** – what pH does the soil have? What is the soil drainage like? What are the nutrients levels? These are all factors that impact the plant species that should be used.
- **Erosion** – for example, fast flowing water could wash away plants before they are well established. Could the connecting of drains be delayed? If not, consider the use of plug planting, turf or biodegradable seeding mats
- **Climate resilience** – with an increasing frequency of more extreme weather events, thought should be given to the species that can tolerate these extremes

Enhancements

Additional considerations when creating and maintaining a vegetated SuDS -
'other neutral grassland' / species-rich grassland spotlight

- **Soil type** – the pH of the soil could be tested to check neutral soils are present. If soils are calcareous or acidic, the habitat type being entered into the Metric may need to change and the use of plant species suited to the different soil pHs would need to be considered.
  Nutrients level could also be tested. Low nutrients are needed for species-rich grasslands. If nutrient levels are high, this can be addressed by either removing the nutrient rich layer to expose subsoils beneath/using subsoil for habitat creation if material is being brought in, or by cutting and removing the existing above ground vegetation repeatedly (the latter being less invasive and therefore preferable).

- **Management commitment** – if soil nutrients are low the grassland should be cut (with arisings collected) twice a year. Once in late summer/early autumn and once in spring. It may be possible to reduce this to one cut in late summer/early autumn.
  If soil nutrients are not low, the cut-and-collect will need to be more frequent in the first year or two (e.g. three cuts in approx. May, July and early September). The vegetation should be allowed to grow as tall as possible before cutting and removing (to allow the plants to extract the maximum levels of nutrients from the soil before they are cut and removed).

Enhancements

Additional considerations when creating and maintaining a vegetated SuDS -

'other neutral grassland' / species-rich grassland spotlight

- **Slopes** – should be at a gradient that still allows the vegetation on the slopes to be cut-and-collected. Mowers exist that allow you to cut and collect arisings, but consideration would need to be given as to whether mowers could cope with the angle of the slope.
- **Cuttings disposal** – as mentioned, cuttings will need to be removed to keep soil nutrient levels low. Disposal examples include, (1) the disposal of small quantities in separate small heaps in acceptable areas (e.g. wooded copses, bramble thickets, new tree and shrub planting areas) out of the public eye. (2) Paid for disposal at county green waste composting sites. The cost of this disposal may be offset by the reduction in mowing, that is often associated with species-rich grasslands.
- **Erosion** – for example, fast flowing water could wash away plants before they are well established. Could the connecting of drains be delayed? If not, consider the use of plug planting, turf or biodegradable seeding mats
- **Plant species selection** – multiple factors should be considered in additional to soil type, including:
  - **Pollution sources** - for example, next to busy roads salt tolerant species may need to be considered
  - **Water levels** - will the area be regularly wet or dry? This will influence what species that are appropriate to plant. In wet areas, you may want to consider marginal/emergent species e.g. sedges, iris
  - **Climate resilience** – with an increasing frequency of more extreme weather events, thought should be given to the species that can tolerate these extremes

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Other Habitat Types to Consider

Habitat Classification	Condition	Units Delivered
Reedbeds (Priority Habitat)	Poor	0.04
	Moderate	0.06
	Good	0.08
Wet woodland (Priority Habitat)	Poor	0.03
	Moderate	0.05
	Good	0.04
Ponds (Non- Priority Habitat)	Poor	0.04
	Moderate	0.07
	Good	0.10

There may be SuDS that could be classified as habitat types not yet mentioned within this Toolkit. Example habitat types are included in the table to the left.

The above scenario assumes a 0.01 ha / 100 m^2 area of 'Developed land; sealed surface' habitat, considered of low strategic significance, is lost (this baseline being worth 0 units, meaning 0 units are lost). It assumes 0.01 ha of the above habitat in question is created and considered of low strategic significance.

Other Biodiversity Interventions to Consider

While the following interventions do not deliver biodiversity units, they are still positive measures to include in/alongside SuDS interventions for the benefit of biodiversity.

Hibernacula +/
log piles

Bug hotels

Bird +/ bat boxes

Further Useful Resources

The Edinburgh Sustainable Rain Water Management Guidance, developed by Atkins on behalf of City of Edinburgh Council with support from the University of Abertay and SUSTRANS. Available via: Sustainable rainwater management guidance – The City of Edinburgh Council [accessed 24 March 2023]

A.Graham, J.Day, B.Bray and S.Mackenzie (2012) *Sustainable drainage systems - Maximising the potential for people and wildlife - A guide for local authorities and developers.* RSPB & WWT. Available via: sustainable-drainage-systems.pdf (rspb.org.uk) [accessed 24 March 2023]

Conclusion

SuDS can be used to deliver BNG in urban areas, if designed with biodiversity in mind with the following points being key:

- **Collaboration** – between SuDS specialists, landscape architects and ecologists
- **Site selection** – ideally baseline habitats being of very low (if not low) distinctiveness
- **Feasibility** – there are multiple factors to consider when determining the feasibility and probable success of SuDS interventions and associated habitat creation/enhancement
- **Long-term management** – this should be secured for at least 30 years