Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Design and Delivery of Soft Landscape Treatments in Urban Transport Environments

Overarching Technical Document

GE-ENV-03002

1. Introduction

1.1 Background

Transport Infrastructure Ireland (TII) aims to provide sustainable transport infrastructure and services, at a national scale, delivering a better quality of life, supporting economic growth, and respecting the environment.

TII's Statement of Strategy 2021-2025 is underpinned by sustainability. Within the Strategy, core sustainability goals are outlined which strive to deliver value in terms of circular economy, enhance air quality and biodiversity, reduce noise impact, and deliver wider societal value and cohesion.

TII values its people, customers and partners and has committed to becoming a leader in delivering and operating sustainable transport infrastructure in line with Project Ireland 2040, the Programme for Government, the UN Sustainable Development Goals and the European Green Deal.

Through provision of a safe, efficient and equitable transport system, TII can support integrated sustainable transport planning via appropriately balancing the development of transport modes, while also introducing new methods and interventions to meet longer-term sustainability aims.

TII has produced a Sustainability Implementation Plan (SIP), which consolidates years of ongoing sustainability commitments and builds on existing work such as the Statement of Strategy. The SIP sets a clear vision and roadmap for embedding sustainability throughout the organisation and its activities. Implementing this plan will require cross-cutting activities and collaboration such as dedicated engagement with external stakeholders. It will also involve uplifting and changing business as usual methods to the spatial design of our urban transport environments.

5 years (by 2026)

- Investigation into restoration of degraded ecosystems through sustainable management and continuing to address biodiversity loss, protecting nature and restoring habitats.

10 years (by 2031)

- Bring nature back into our lives in accordance with the EU Biodiversity Strategy.

15+ years (by 2036)

- Biodiversity conservation and green infrastructure directing economic benefits across sectors of our economy and improving rural livelihoods.

Figure 1.1: Extract from TII's SIP which illustrates how Landscape and Biodiversity are core elements in TII's short, medium and long term Sustainability actions.

Our urban transport environments are changing to accommodate more active travel. The National Investment Framework for Transport in Ireland (Department of Transport, 2021) modal hierarchy puts active travel (including walking, wheeling and cycling) first.

The space reallocation associated with this shift has significant potential to create places that are more equitable, functional, valuable, and beautiful. There is a real opportunity to increase vegetation in urban transport environments, so that roads are flanked by well-treed and planted linear parks, junctions become spaces that are defined and accented by the trees' presence and active travel routes traverse parks and open spaces.

This Document demonstrates the benefits of integrating soft landscape treatments into urban transport environments and the ways to achieve this.

New guidance on Redesigning Ireland's Transport for Net Zero (OECD, 2022), notes how all transport spaces matter, stating that: "all road and street spaces, even those that today carry substantial freight traffic, have a "place" function that needs to be studied and taken into account" (OECD, 2022).

Urban transport environments, including roads, streets and greenways, and the places and spaces along them all have very different characteristics. Fine grain town and village centres, low-density residential areas and urban fringe developments merge into industrial areas and the rural hinterland, each shaped by the landscapes and townscapes in which they reside and therefore requiring a different set of design solutions and soft landscape treatments.

This Document outlines which landscape treatment is best applied to each of the presented scenarios, explaining how these treatments would contribute to achieve better functionality and an increased value.

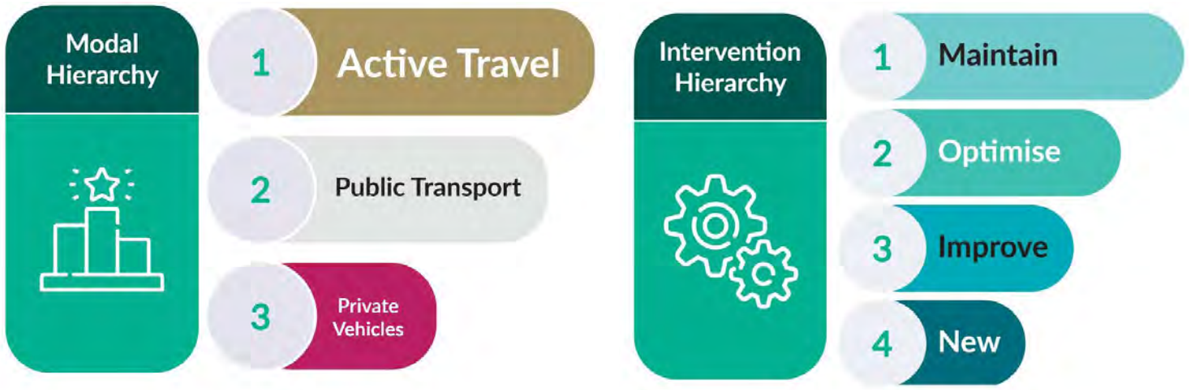
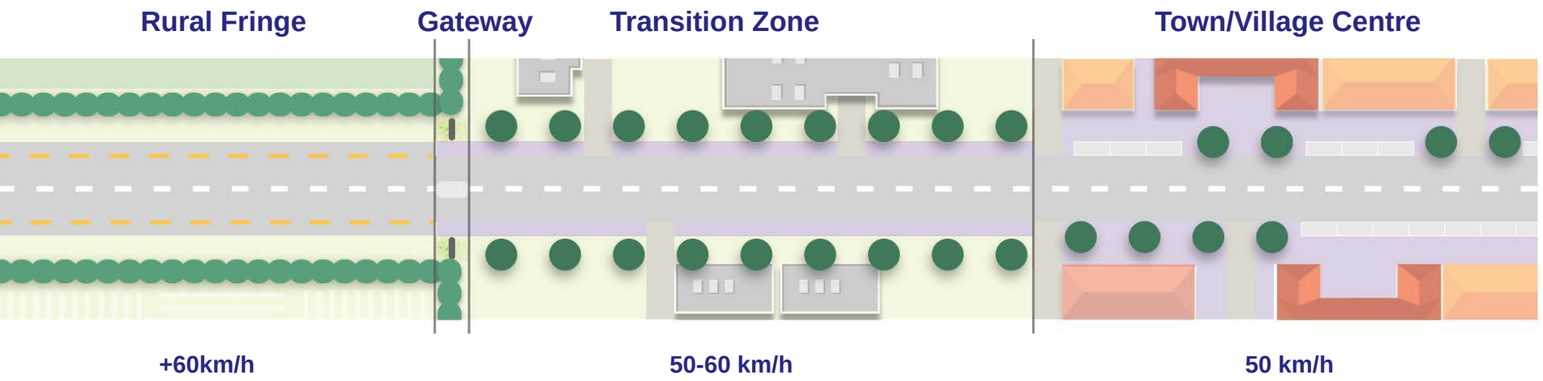


Figure 1.2: Modal Hierarchy from NIFTI (Department of Transport, 2021)

Figure 1.3: Biodiverse road side verge with mown paths and deadhedge for wildlife.

This Overarching Technical Document (OTD) provides guidance on design methodologies required to maximise the function and value of soft landscape treatments and shall be applied on all new, redesigned, and reallocated National Roads and Greenways in the following zones stemming from definitions in TII Publication (Standards) DN-GEO-03084 The Treatment of Transition Zones to Towns and Villages on National Roads.



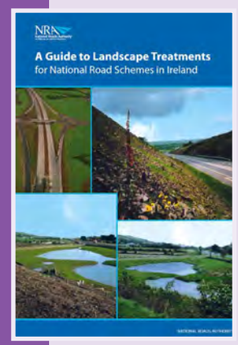
This document is to be read with TII Landscape Plan and TII Biodiversity Plan. Planning, design and delivery of soft landscape treatments must align with the objectives and actions outlined by these documents.

This Document supplements the information provided in the **TII Publication (Standards) DN-GEO-03084 The Treatment of Transition Zones to Towns and Villages on National Roads** and complements the **Design Manual for Urban Roads and Streets (DMURS)**.

In addition, this Document interfaces with a host of complementary design documents including, but not limited to;

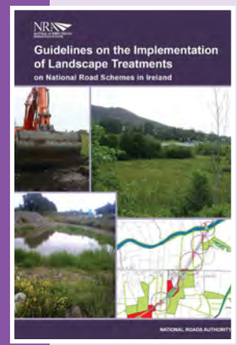
A Guide to Landscape Treatments for National Road Schemes in Ireland

GE-ENV-01102



Guidelines on the Implementation of Landscape Treatments on National Road Schemes in Ireland

GE-ENV-01103



Pollinator - friendly management on Transport Corridors - All Ireland Pollinator Plan

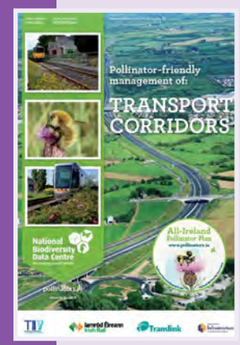


Figure 1.4: Soft landscape treatments along transport corridors across the four seasons.

This Document has been compiled by a multi-disciplinary team and has drawn upon the results of pilot studies, which are listed below along with a rationale for their selection:

- **N76 Grangemockler, Co. Tipperary**

  Demonstrates the application of soft landscape treatments through a typical Irish village.

- **N24, Carrick-on-Suir, Co. Tipperary**

  Demonstrates place-making within selected locations of a larger town including a school zone in a transition zone.

- **N21, Fossa, Co. Kerry**

  Demonstrates the use of soft landscape treatments in a linear settlement incorporating SuDS and Nature-based Solutions.

A project sheet summarising each of these three projects is available in Appendix B.

A separate Guidance Document (GD) GE-ENV-03001, sets out the recommended approach to the implementation of soft landscape in towns and villages on National Roads.

Figure 1.5: Grangemockler, N76 - Co. Tipperary.

1.2 Purpose of these Guidelines

The purpose of these Guidelines is to demonstrate how the multi-faceted benefits of soft landscape treatments in urban transport environments can be achieved. This Document:

1. Strongly encourages critical integration of biodiversity and landscape expertise at the outset of the Project.
2. Standardises the implementation of best practices aiming to deliver higher quality, sustainable and robust landscapes in urban transport environments across Ireland.
3. Encourages a method whereby soft landscape treatments complement the characteristics of the surrounding landscape and townscape.
4. Sets out principles, considerations, and requirements to be applied when planning, designing, selecting, implementing, maintaining and managing soft landscape treatments and species, including end of life considerations in and around urban transport corridors.
5. Facilitates improved results in delivering soft landscape.

Figure 1.6: New Grangemockler Scheme implementing soft landscape treatments.

Together with the Guidance Document GE-ENV-03001, the intent is to promote consistency to the consideration of soft landscape design during the planning, design, delivery and establishment phases of a national road project or greenway. Thus, the three documents must be viewed:

- Overarching Technical Document (**OTD**), for underpinning theory;
- Guidance (**GD**), outlining recommended approach to be adopted.
- Standard Construction Details (**SCD**) CC-SCD-03001 - CC-SCD-03017.

This Document is intended to be used by suitably qualified professionals as defined in Section 1.6 of the Guidance Document (GD) GE-ENV-03001. Consideration should also be given to the importance of multidisciplinary collaboration as explained below.

1.2.1 The Importance of Building a Multi-disciplinary Team

'Appointment of Landscape Professionals, Arboriculturists and Ecologists will enable incorporation of best practice into soft landscape treatment projects, as well maximising opportunities positively impacting society as a whole'

Implementation and establishment of soft landscape treatments in projects can be challenging and shall be achieved through multi-disciplinary collaboration. This collaboration includes TII, the Project Manager, Local Authorities, engineers, biodiversity, social value, and cultural heritage professionals, as well as any other relevant group as dictated by the project and study area characteristics. The composition of the multi-disciplinary team should in fact respond and be tailored to the project's needs.

Landscape Professionals should, at the direction of the Project Manager, be appointed as part of multidisciplinary teams on all infrastructure projects where soft landscape treatments are impacted and / or proposed and where the Landscape Professionals inclusion as part of the project team can help TII deliver on key policy areas as they relate to sustainability, landscape and biodiversity. This includes projects whereby urban transport proposals fall within areas of existing or proposed public realm.

The early appointment of Environmental Specialists shall be in line with the Project Managers Guidelines. Where appropriate, appointment of Landscape Professionals, Arboriculturists and Ecologists will enable incorporation of best practice into soft landscape treatment projects, as well maximising opportunities positively impacting society as a whole.

The roles of these professionals are detailed as follows:

Landscape Professionals and Landscape Architects

Landscape professionals/architects contribute to the planning and design processes at all relevant TII Project Phases, providing contextual analysis of the site and developing design objectives and principles based on the analysis of the context and local needs.

Landscape Architects would then progress to developing design proposals at both strategic and detailed levels of the project, producing tender packages and management and maintenance plans, and can be appointed to oversee key activities during the construction stage.

If a Landscape and Visual Impact Assessment (LVIA) is required for any part of the development, it should be carried out by a suitably qualified and competent Landscape Professional who has previous experience in this field. For further information, refer to TII Publication (Technical) PE-ENV-01101 Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects.

Refer to Guidance Document (GD) GE-ENV-03001 for Landscape Professional Roles and Requirements.

Arboriculturists

An Arboriculturalist is a specialist in the management and care of trees. Arboriculturists shall be employed to undertake tree surveys in accordance with BS 5837 (2012) (British Standard, Trees in Relation to Design, Demolition and Construction).

It is critical that a survey is carried out at the outset of projects where existing trees and / or hedgerows are located in proximity to the construction zone.

The tree survey informs the design team and the applicant of the quality, range, and condition of existing trees on site, maps root protection areas, summarises expected impacts, and details requirements and recommendations for protecting trees during the construction process. The survey has an important impact on the placement of various elements in the streetscape. Tree surveys must be appropriate to the scale and purpose of the receiving urban transport environment.

Refer to Section 5.1.1 for more information in relation to tree surveys, what they contain and how to survey different types of trees in the urban transport environment.

Ecologists

Ecologists analyse habitat and species data, in the context of the surrounding landscape and cultural conditions, to identify and advise on the best practical outcomes for nature.

An Ecologist's contribution is critical in assessing existing habitats and their biodiversity value, identifying constraints and impacts of the proposed development on biodiversity, and advising on conservation and / or mitigation measures that can act as a compensation, for biodiversity enhancement within the project. (Ecologists Ireland, 2017).

For more information in relation to commissioning ecological surveys refer to Section 5.1.1 and to Section 3.2.9 for ways to maximise biodiversity within projects.

Horticulturalists and Gardeners

Local horticulturalists and gardeners may have specialist expertise that can aid the Project and could be consulted as part of the design, implementation, and community engagement process.

Figure 1.7: Wildflowers thriving in a roadside verge.

1.3 Organisation of the Overarching Technical Document

SECTION 1: INTRODUCTION

Presents the context and purpose of the OTD and introduces some of the key definitions used throughout the document.

SECTION 2: SOFT LANDSCAPE LEGISLATION AND POLICY FRAMEWORK

Presents an overview of European, as well as national legislation and policy, and notes the relevant TII standards.

SECTION 3: THE FUNCTION AND VALUE OF SOFT LANDSCAPE IN URBAN TRANSPORT ENVIRONMENTS

Provides a comprehensive overview of the available placemaking and planting selection strategies.

SECTION 4: SOFT LANDSCAPE TREATMENTS DESIGN GUIDANCE

Outlines the methodology required to undertake a soft landscape treatment.

SECTION 5: SOFT LANDSCAPE PLANNING AND DESIGN ACTIONS

Describes processes involving surveying and data collection that should be undertaken to assist in the integration of Soft Landscape Design.

APPENDIX A: SAMPLE DOCUMENTS

A1: Requirements of a Brief for Procurement of Soft Landscape Professionals.

A2: Sample Management and Maintenance guide

A3: Sample Schedule of Quantities

A4: Sample Landscape Report

APPENDIX B: PILOT STUDIES

B1: N76, Grangemocklar

B2: N24, Carrick-on-Suir

B3: N21, Fossa

2. Soft Landscape Legislation and Policy Framework

The importance of achieving landscape treatments that are sustainable, functional, safe, and that can provide added value and promote character is embedded in Policy at a European and National level. These policies are reflected in several standards and best practice guidance documents, which can be drawn upon when planning, designing and delivering soft landscape treatments on National Road projects and greenways. Key references are summarised below.

Legislation and Policy

The Policy Content of this document supports the four function themes and provides a reference guide for practitioners.

European Legislation and Policy

Activities in Ireland are governed by several EU Directives that are dedicated to the protection and conservation of the environment, including the EU Water Framework Directive (WFD), the Habitats Directive and the Birds Directive.

The EU Strategy on Green Infrastructure, the EU Biodiversity Strategy for 2030 and the EU Climate Adaptation Strategy focus on the importance of blue and green infrastructure (BGI) and nature-based solutions (NBS) as a part of their strategic visions. Healthy ecosystems can help address societal challenges associated with biodiversity loss and climate change while providing benefits to people.

The Green Deal is an EU publication which presents the overall ambition to become climate neutral by 2050. Policy areas include Sustainable Industry, Pollution, Building and Renovation, Biodiversity, Sustainable Mobility, Sustainable Food Systems and Climate Action. Ireland is responding to the Green Deal through National level initiatives.

Ireland has agreed to promote landscape protection, management, and planning, and to define landscape quality objectives, while promoting stakeholder and community engagement, in accordance with the European Landscape Convention 2000 (ELC), as detailed further in TII Publication (Technical) PE-ENV-01101 Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects – Overarching Technical Document.

Figure 2.1: Lismore, N72 - Pollinator friendly planting.

Legislation and Policy

The Policy Content of this document supports the four function themes and provides a reference guide for practitioners.

National Legislation and Policy

The Government of Ireland's "*overarching strategy to make Ireland a better country for all and to build a more resilient and sustainable future*" is captured in Project Ireland 2040 (Department of Public Expenditure and Reform (DPER), 2018). **Project Ireland 2040** is a combination of Ireland's ***National Planning Framework*** and the ***National Development Plan 2021-2030.***

The National Planning Framework is a high-level strategic plan that contains several national policy objectives (NPO), one of which is NPO 64 which focuses on **improving air quality through strategic planning of green spaces and vegetation** (Department of Housing, Planning and Local Government, 2018) . The National Development Plan sets out the overarching investment strategy and budget for the period 2021-2030 including a range of investments for different areas such as **climate action and the environment** in Ireland. One aspect this area of funding focuses on is **enhancing biodiversity** (Department of Public Expenditure and Reform, 2021).

Ireland's primary planning and development legislation, ***Planning and Development Act 2000***, as amended, permits planning authorities to preserve the landscape as stated in Section 205(1) of the Act:

The National Landscape Strategy for Ireland 2015-2025 complies with the European Landscape Convention (ELC) and principles for the **protection and enhancement of landscapes** while managing the change in a positive manner. The Strategy sets out six core objectives that have been derived from the ELC to implement the National Landscape Strategy (NLS). Some of these objectives focus on **increasing awareness of landscapes, strengthening public participation and developing landscape policies**. (Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media, 2015)

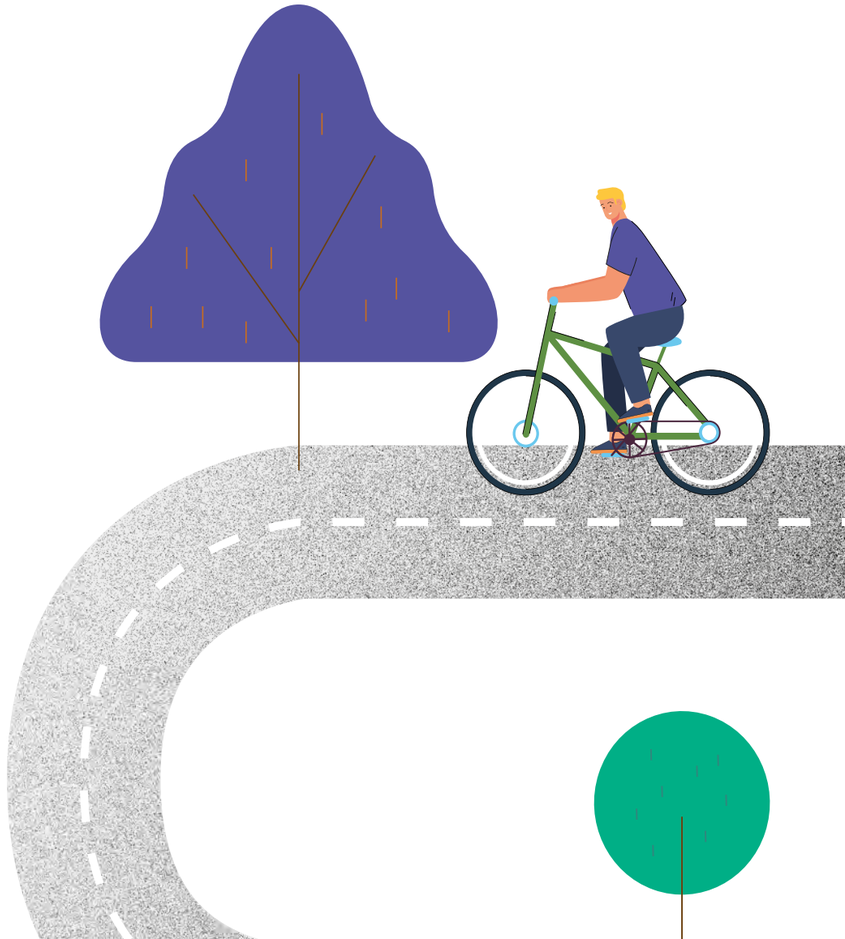
The National Biodiversity Action Plan 2023-2030 sets out five objectives to achieve Ireland's vision for biodiversity over a seven-year period, including: adopting **a Whole of Government and Whole of Society approach** to biodiversity, meeting **urgent conservation and restoration** needs, **securing nature's contribution to people**, **enhancing the evidence base** for action on biodiversity and **strengthening Ireland's contribution to international biodiversity** initiatives. (Department of Culture, Heritage and the Gaeltacht, 2024)

The Climate Action and Low Carbon Development(Amendment) Act 2021 accelerates the transition to a climate resilient and 'climate neutral economy'. The Act incorporates Ireland's national climate objective which sets out to pursue and achieve a resilient, biodiversity-rich, environmentally sustainable, carbon neutral economy by 2050 (Department of the Environment, Climate and Communications, 2021). The Act constitutes one of the actions Ireland is taking to deal with the national climate and biodiversity emergency that was announced in May 2019 by the Irish Government (Government of Ireland, 2019).

The Climate Action Plan 2023 is one of many policies and strategies **highlighting the key role played by blue and green infrastructure as well as nature-based solutions**.

"If it appears to the planning authority that it is expedient, in the interest of amenity or the environment, to make provision for the preservation of any tree, trees, group of trees or woodlands, it may, for that purpose and for stated reasons, make an order with respect to any such tree, trees, group of trees or woodlands as may be specified in the order".

(Government of Ireland, 2000)



The Plan aims to achieve a 51% **reduction in overall greenhouse gas emissions** by 2030 and **net-zero emissions** by 2050 (Department of the Environment, Climate and Communications, 2021).

The National Adaptation Framework 2018
was developed and approved in accordance with Section 5 of the Climate Action and Low Carbon Development Act 2015. The National Adaptation Framework (NAF) **addresses the challenge of climate resilience** through complementing the approach to climate mitigation. Several green adaptation measures are captured in the NAF and focus in particular on the **conservation of habitats and species** in addition to the **selection of tree species that are less vulnerable to extreme weather conditions** (Department of the Environment, Climate and Communications, 2018).

The Circular Economy and Miscellaneous Provisions Act 2022
has become law in Ireland and supports a shift to a more sustainable method of production and consumption **to significantly reduce Ireland's greenhouse gas emissions** while retaining the value of the economy's resources (Department of the Environment, Climate and Communications, 2018).

The Regional Planning Guidelines 2010-2022
(RPGs) include landscape policies **to protect, conserve and manage the quality, character and distinctiveness of the landscape** while **encouraging collaboration between local authorities** to ensure consistency within policies (Regional Planning Guidelines Office, 2010). The RPGs have been replaced with Regional Spatial and Economic Strategies (RSES) for the Eastern and Midland region (Eastern and Midland Regional Assembly, 2019), the Southern region (Eastern and Midland Regional Assembly, 2019), and the Northern and Western region (Eastern and Midland Regional Assembly, 2019), which are informed by Project Ireland 2040. Similarly, the RSES encourage collaboration between local authorities to achieve each region's vision.

TII Standards, Guidelines and Plans

TII has published sector-specific guidelines, which design teams must refer to. Key relevant documents are summarised here:

TII Sustainability Statement and Sustainability Implementation Plan (TII, n.d.).
Presents TII's vision to be the leader in developing transport networks which support economic growth, human well-being whilst strengthen resilience in addressing climate change and maintain commitment to the environment. The Sustainability Implementation Plan sets out six sustainability principles which focus on key areas for TII's sustainability agenda, reflecting the sustainable future TII envision (TII, n.d.).

TII Landscape Plan (TII, 2023)
Sets out the purpose and key objectives for what a 'landscape plan' & Sustainability Implementation Plan (SIP) should consist of and defines the broader context of TII standards, 6 guiding principles and wider government strategies and polices that should inform these plans. These plans should ensure a high standard of design and enable the development of successful long term management.

TII Biodiversity Plan (TII, 2023)
The TII Biodiversity Plan emphasizes the need to address the global Biodiversity Crisis and outlines key policy areas to integrate biodiversity into all TII operations. Recognizing the impact of transport infrastructure on biodiversity, the plan commits to promoting habitat connectivity, preventing biodiversity loss, and achieving no net loss or even a net gain in biodiversity. The objectives include increasing biodiversity capacity, updating standards, supporting research, embracing biodiversity accounting, and focusing on key biodiversity issues.

Figure 2.2: Daffodils planted in a roadside verge.

Figure 2.3: Grey to Green, Sheffield.

TII's Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network (TII, 2017).
TII's Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network was published in 2017 as part of the NAF and it sets out a requirement for statutory sectoral adaptation plans every five years, under the provisions of the Climate Action and Low Carbon Development Act 2015.

The Strategy outlines several potential climate impacts on our national road and light rail network, focusing on the effects of flooding, increased risk of landslides, pavement degradation and potential storm damage. TII continuously review and update standards to adapt to climate influences.

Pollinator Friendly Management of Transport Corridors (TII, 2019)
Pollinator Friendly Management of Transport Corridors was prepared in collaboration with the All-Ireland Pollinator Plan to improve the design and landscape management of transport corridors promoting pollinators and biodiversity in general. The Guidelines set out several actions for transport managers to effectively help pollinators, demonstrating the potential for sustainable interactions with the landscapes along transport corridors (TII, Iarnród Éireann, Translink, the Department of Infrastructure Northern Ireland, All-Ireland Pollinator Plan, 2019).

A Guide to Landscape Treatments for National Road Schemes in Ireland (NRA, 2006).
This document provides guidance on best practices related to landscaping works within the design, construction, maintenance, and decommissioning phases of rural national road schemes. It highlights how landscape mitigation aims to reduce and re-mediate adverse cultural, social, and ecological impacts on landscape quality caused by roads. Landscape treatments can make a significant contribution to biodiversity conservation, environmental aesthetics, and the retention of regional identity, landscape character, and diversity.

The guidelines promote an "Ecological Landscape Design" approach that integrates cultural, social, and ecological aspects within the landscape design, by incorporating preferred landscape features that retain regional identity, landscape character, and diversity for road users and local inhabitants.

> ***"Transport Infrastructure Ireland will contribute to the recovery of biodiversity at a local and national level while developing and maintaining a safe and reliable transport infrastructure network"***
>
> TII Biodiversity Plan, 2023

The use of native species from indigenous seed stands is promoted with the aim to produce long-term, self-sustaining landscape treatments that are underpinned by resource management. This approach aligns with national and international policies and commitments, promoting a more sustainable use of the landscape and natural resources associated with national road scheme development.

Guidelines on the Implementation of Landscape Treatment on National Road Schemes in Ireland (NRA, 2012).
This document is a supplement to "A Guide to Landscape Treatments for National Road Schemes in Ireland" mentioned above and it indicates practical steps to implement a more sustainable approach to landscape design and works across all phases of national road projects. The Guidelines on the Implementation of Landscape Treatments focus on the roles and responsibilities of all parties involved during project management, including environmental and ecological experts, designers, contractors, and others involved in executing landscape treatments. The document highlights the need to liaise with wide range of experts involved in the impact assessment and design process, as landscape treatments interact with mitigation measures for the environment, noise, cultural heritage, hydrology, geology, soils, drainage, lighting, and headlight glare. The guidelines should be read alongside the landscape treatments guide, as well as habitat classification.. Although the terminology in the document refers to design and build contracts, the guidance can generally be applied to public-private partnership contracts as well.

Other Standards, Guidelines and Plans

Design teams must also refer to:

Design Manual for Urban Roads and Streets (DMURS), 2019
This manual encourages a collaborative and interactive design process and offers a first-of-its-kind comprehensive approach to the design of urban streets throughout Ireland's cities, towns, suburbs, and villages. To improve street design, experts from many disciplines must collaborate. This document is designed to be universally accessible to all professionals associated with street design.

The Sustainable Drainage Systems Manual (SuDS Manual C753), Construction Industry Research and Information Association (CIRIA), 2015
This guidance includes sustainable drainage system planning, design, construction, and maintenance to assist with their efficient application in both new and existing developments. It considers how to achieve the crucial goal of minimising flood risk and managing water quality while maximising amenity and biodiversity benefits. Additionally, it provides supplementary data on materials, landscape design, maintenance, and community engagement.

Pollinator-friendly management of Transport Corridors - All Ireland Pollinator Plan, National Biodiversity Data Centre, 2019
This document aims to enable creation of landscapes adjacent to transport corridors that are ecologically advantageous while meeting the necessary transport safety and performance criteria.

This document provides a plan to use transport corridors to protect pollinators through provision of pollinator-friendly flora and habitats in the local landscape. The roadside landscape includes a number of components such as verges and tree belts, that can be utilized in a more pollinator-friendly manner.

Trees in Hard Landscape A Guide for delivery, Trees and Design Action Group (TDAG), 2014
This document provides guidance on integrating trees in hard landscape. It details good practice principles for urban forestry in the townscape. It also highlights the need to consider holistically the provision for private vehicles, public transport, active travel and accessibility that urban corridors must achieve. Finally, it illustrates the advantages that trees can bring to the urban environment in relation to cooling and surface water management.

Safe Routes to School (NTA, 2022)
This guide is aimed at improving safety for students walking or cycling to school. It provides technical guidelines for designing safe routes to school, including walking and cycling infrastructure, 'front of school treatments' and street design recommendations. It covers topics such as intersection design, speed limits, pedestrian crossings, and cycling facilities while also covering precedent examples of relevant schemes. The guide emphasizes the importance of community engagement and collaboration between schools, local authorities, and transport agencies. The goal of the guide is to create safe and attractive routes that encourage active travel to schools.

Improving the performance of linear assets through green infrastructure. Main guide (phase 2) CIRIA C772F, 2021
This guidance document aims to support individuals involved in linear asset-based projects to enhance their resilience by incorporating Green Infrastructure (GI) elements. It highlights the benefits of GI from strategy to delivery and maintenance; in addition, it emphasizes the importance of incorporating GI to improve the performance of linear assets while achieving environmental objectives set by both the government and other relevant organizations. It includes detailed case studies promoting good practice across different sectors whilst improving clear leadership guidance.

Local Level References

At a local level, the planning, design and establishment of soft landscape treatments in and around settlements must be consistent with local plans and strategies. Design teams must refer to:

- County Development Plans;
- Local Area Plans;
- Biodiversity Action Plans;
- Local Tree Strategies;
- Transport and Movement Frameworks;
- Public Realm Strategies;
- Local Level Strategic Masterplans and Frameworks;
- Town Centre First Strategies; and
- Tidy Towns Initiatives.

Figure 2.4: Kilmacud Luas Stop, managed for biodiversity.

3. Function and Value of Soft Landscape in Urban Transport Environments

Soft landscape, from the designed and planted, to the semi-natural and wild, has a role to play in the function, identity, and performance of places, spaces, streetscapes, and greenways in urban transport environments.

Conclusions from policy, research and best practice outline the significant, valuable, and multi-faceted roles and benefits that the successful integration of landscape treatments in urban environments can deliver.

All landscape treatments can perform a function and deliver value as categorised on the right.

These categories reflect and align with TII's Sustainability Implementation Plan, TII's Biodiversity Plan and TII's Landscape Plan to add value to circular economy, enhance air quality and biodiversity, reduce noise impact, and deliver wider societal value and cohesion.

Number of soft landscape functions along transport corridors are explored within this document. The following icons will be used throughout the document to depict these within precedent images and sample sections.

Landscape Treatments for Placemaking and Shaping

Enriching Place and it's Characteristics

Communities, Health & Wellbeing

Planet Positive Landscape Treatments

Climate Resilience and Sustainable Soft Landscape Design

Biodiversity Positive Landscape Design

Landscape Treatments for Placemaking and Shaping

Placemaking

Enhanced Journey Experience

Traffic Calming

Visual Connectivity & Sightlines

Functional Buffers

Social Inclusion

Wellbeing

Planet Positive Landscape Treatments

Pollinator Friendly

SuDS

Habitat Connectivity

Cooling

Carbon Sequestration

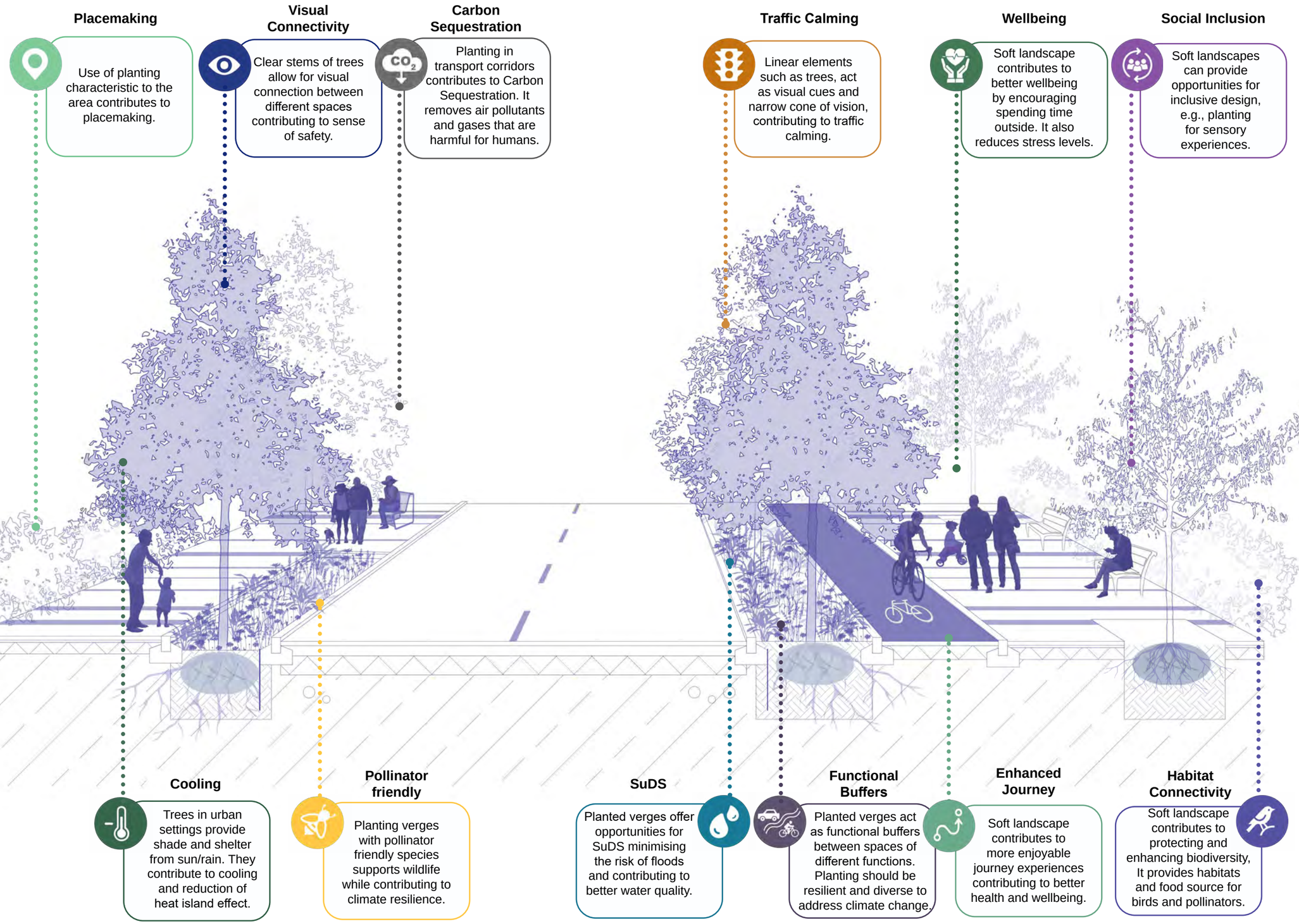


Figure 3.1: Multiple functions of Soft Landscape Treatments along transport corridors.

Figure 3.2: Pollinator friendly planting.

Ireland's National Implementation Plan for the UN Sustainable Development Goals identifies the crucial role that Local Authorities have to play in translating the SDGs into practical action at local level.

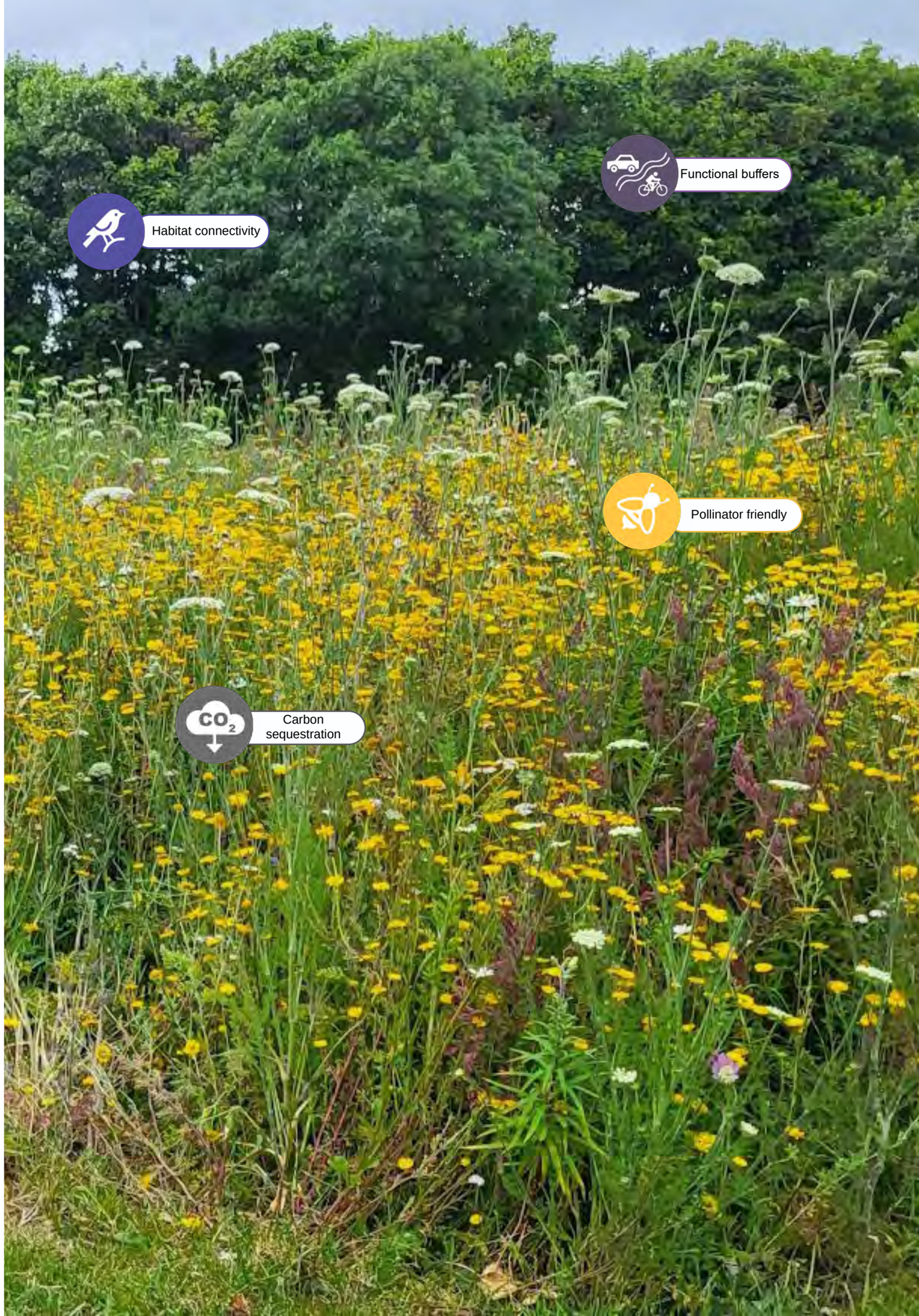
The four function and value themes listed above link to the delivery of the following SDGS through the design and implementation of landscape treatments into urban transport environments.

Placemaking and Shaping

Communities, Health & Wellbeing

Climate Resilience

Biodiversity



Placemaking & Shaping

Place-making and shaping form an ongoing series of actions and activities undertaken by a collective of key influencers from local people to local authorities. Place-shaping is a term that recognises that everywhere is somewhere and is therefore a place already. However, through our collective improvements in the design and management of the environment, we can shape how we perceive, use, remember and become attached to the environment in and around settlements.

Place-shaping, using landscape treatments, happens across a series of linked scales. At the very broadest scale, such as along lengthy stretches of streets and roads, landscape treatments might involve the extension or creation of woodlands, the connection of hedgerows or the planting of a new great avenue (road with trees on both sides) of trees that will live for hundreds of years if planned, planted, and managed well.

At the smallest scale, place-shaping needs to respond to the existing characteristics of a place, its context, and how in turn these are experienced. The following section outlines key place-shaping considerations for soft landscape treatments and how they can enrich a place and its characteristics as well as improving communities, health and wellbeing.

"A landscape that is truly functional is one that provides for breadth of use and human involvement, and planting design is an essential element in making and managing this kind of people-place relationship. Liveliness, complexity, subtlety, resilience, flexibility, and sustainability are some of the desirable qualities we can cultivate with well-designed planting. "

(Robinson, 2016)

3.1 Enriching Place and it's Characteristics

People respond to a place, how it is designed and set out, how it looks, feels and what it reminds them of. Good soft landscape design and management is responsive to 'place' and encourages positive behaviours and judgements. Conversely, poor landscape design is often misunderstood, incongruent and dysfunctional leading to the delivery of limited value to ecosystem services.

To fully understand place, Landscape Professionals need to understand its functionality, its characteristics, how it evolved over time and what value elements from the urban fabric it retains so that they can deliver successful design outcomes.

Places do not exist in isolation, and the surrounding environment plays a critical role in determining the success of any design intervention. To get a better understanding of the context, a detailed survey and analysis of the route and study area is necessary. This involves analysing the various components of the street, such as junctions, existing pedestrian crossings, street furniture, and soft landscape features (i.e. trees and hedgerows). There is also a need to evaluate the quality and composition of adjoining public realms and identify areas of poor connectivity and permeability.

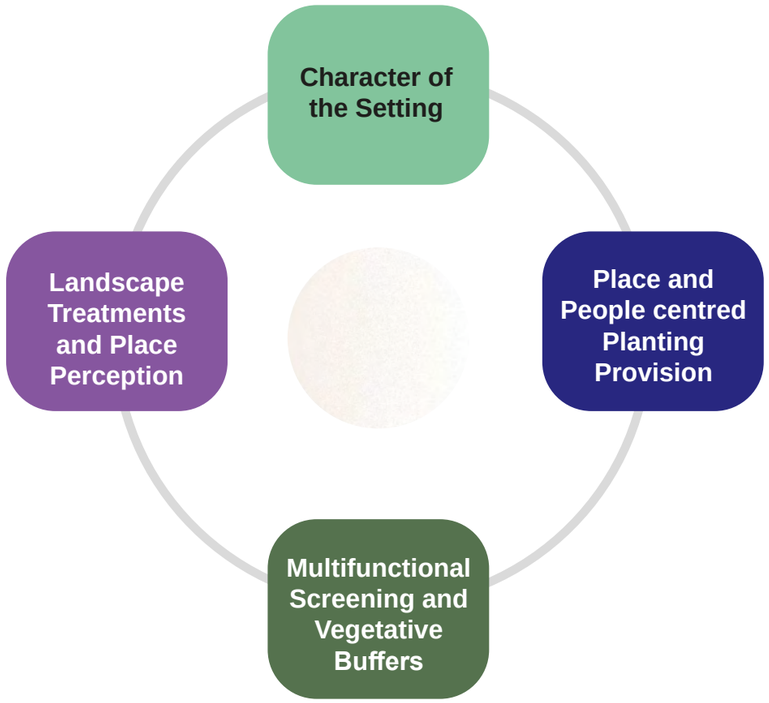
Through this analysis, it is possible to identify transition zones where the street context changes, and key areas that indicate an arrival point or a change in speed. It enables the uncovering of weak linkages along & across a place that could be improved, especially where these sit in proximity to users that are likely to be adversely impacted by roads such as close to schools, hospitals, and parks.

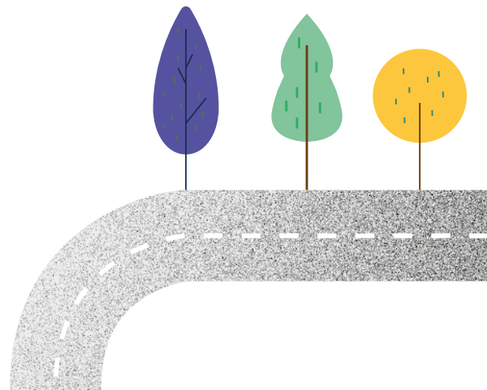
Soft landscape design strategies need to respond effectively to the assets and attributes of a place, promoting positive outcomes. Soft landscape strategies can be articulated using a series of maps, sketches and imagery and must be established prior to starting detail design stage. Soft landscape strategies will also become key components of a landscape management plan.

For details in relation to the Landscape Professional's typical inputs and outputs according to TII Project Phases refer to Section 2 in Guidance Document (GD) GE-ENV-03002.

This section focuses therefore on how soft landscape can improve the way we move in and around settlements by enhancing their characteristics and experiential performance.

These recommendations will improve how urban transport environments look, feel, and are navigated. The section includes guidance in relation to soft landscape as well as the following aspects:





3.1.1 Character of the Setting

Any landscape proposal should be developed with an awareness of the character of the setting within which it resides. This can be referred to as landscape, townscape, and streetscape character.

Landscape character may be defined as a

'Distinct, recognisable, and consistent pattern of elements, or characteristics, in the landscape that make one landscape different from another, rather than better or worse'

(Natural England, 2014) (TII, 2020).

Figure 3.3: N2, Collon to Ardee characterised by hedgerows.

Townscape is a subset of landscape and comprises 'landscape within the built-up urban area, including the buildings, the relationship between them, the different types of urban open spaces, including green spaces and the relationship between buildings and open spaces' (LI/IEMA, 2013) (LI, 2018) (TII, 2020).

Streetscape describes everything in and around the street and describes the immediate context of the urban transport environment. It is a finer grain way of looking at landscape and townscape character that reflects the scale of interventions, which can at times be very small (for example, the integration of new rain gardens or community growing beds into a scheme).

Throughout this document the term 'landscape' is also used to refer to 'townscape'.

Landscape, townscape, and streetscape character are not static. Character results from interactions between people and place. When developing a soft landscape design, it is important to understand and respond to the character of place and receiving landscape setting, to allow for innovation adapting to changing circumstances.

In Ireland, Landscape Character Assessments (LCA) are carried out, for the most part, at an individual city and county level. These LCAs have statutory standing, that is to say they need to be incorporated into county and city development plans. It is worth noting that in the absence of a national or regional landscape character assessment, LCAs' approach, detail and quality may vary significantly, particularly across Local Authority boundaries (The Heritage Council, 2006) and (The Heritage Council, 2009).

Where lack of detail or consistency is noted and where there is deficiency in the scale or detail of landscape descriptions or mapping, additional analysis (including field studies, mapping, and evaluation) are proposed to enable completion of the LCA to the standard required to facilitate the Project.

Figure 3.4: Transport corridor on a winter day. Character of a road corridor will change with the season changes.

TII Publication (Technical) PE-ENV-01101 Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects outlines a methodology for undertaking a LCA to establish the landscape baseline (expression of existing characteristics), which is used within LVIAs.

Important references for producing character assessments are:

'An Approach to Landscape Character Assessment' (Natural England, 2014) which sets out in detail the integrated multi-disciplinary and consultative processes required to undertake LCAs;

'Townscape Character Assessment' (Landscape Institute, 2018). This Technical Information Note explains how landscape character assessment's principles and general approach can be applied to townscape character assessment.

It is common for informal landscape character and townscape studies to be undertaken as part of the design process because they help with articulating shared features as well as differences in places, even if the study area focuses on a small scale. When completing these studies, the following should be analysed and recorded:

- Different project study areas;
- Extent to which landscape and visual elements contribute towards the character of the overall landscape, townscape and streetscape.

Landscape and visual elements that contribute towards the character of the overall landscape, townscape and streetscape are summarised as follows:

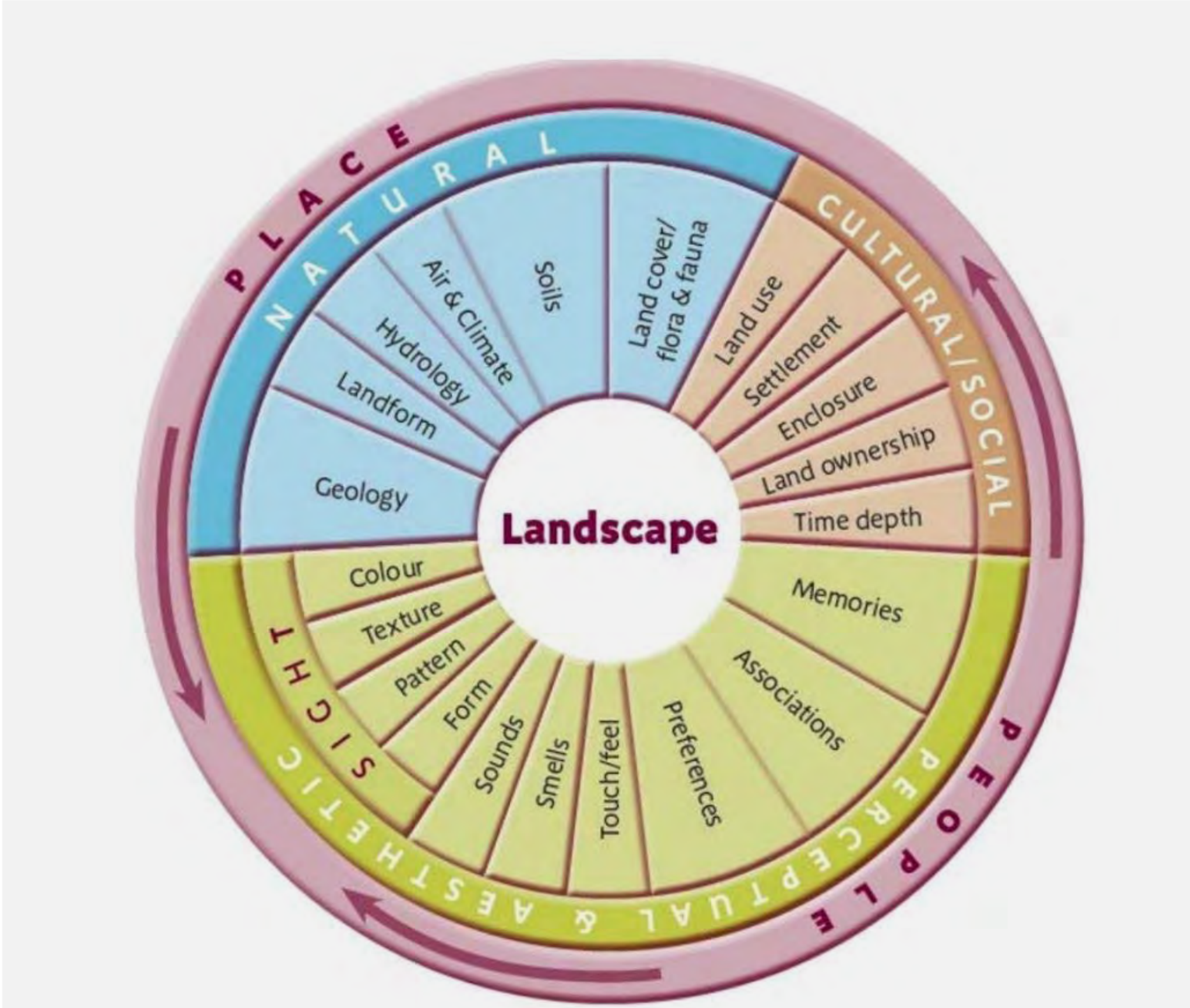


Figure 3.5: The Landscape Wheel. (Tudor, 2016)

- **Geology** e.g. solid and drift geology;
- **Soils** e.g., soil type, quality and permeability;
- **Landform and Level Changes** e.g., hills, drumlins, valleys, ridgelines, slopes, steps, kerbs etc.;
- **Blue and Green Landcover** e.g., trees, treelines, hedgerows, copses, woodlands, plantations, parklands, grasslands, lakes, rivers, canals, ornamental planting, swales and an analysis of existing species – especially those that are thriving in the area and have adapted to local microclimate. etc.;
- **Land Ownership and Tenure**; e.g., owned, leased, rented lands (as relevant);
- **Land Use and Management** e.g., arable lands, pasture lands, woodland type, industry, residential, park, educational use, retail areas, amenity, recreation, tourism, sports facilities, hotels, golf courses, energy, etc.;
- **Building Uses, Style, Materials and Age** e.g., Schools, homes and housing, community and cultural centres, religious buildings, shops, cafes, modernist, gothic, brick, stone, cladded, corten tiles, traditional, contemporary, vernacular etc.;
- **Settlement Pattern, Density and Type** e.g., town centre, high, medium and low density, edge of town, clustered, ribbon, dispersed, farmhouses, etc.;
- **Boundary Type, Style, Height, Material and Pattern** e.g., Field boundaries, hedgerows, stone walls, railings, fences, closed board, iron, ditches, enclosed, open, regular, irregular, fragmented, etc.;
- **Hydrology** e.g., rivers, streams, lakes, turlochs, swales, ditches, drains, evidence of flooding, etc.;
- **Infrastructure** e.g., carparks, crossings, roads, high voltage powerlines & pylons, rail corridors, etc.;
- **Aesthetic** e.g., how the overall place is viewed; the sense of enclosure or openness; views are panoramic or framed; key viewpoints, scenic routes, vistas, prominent features, bridges or buildings, landmarks, lakeshores, river edges, etc.;
- **Appearance and Scale** e.g., the extent and balance of the landscape (particularly arising from landform & landcover); relationship between land and sky (and skylines); landscape diversity; relationship of buildings and structures in relation to their surroundings building heights, etc.;
- **Heritage Features** e.g., ringforts, burial mounds, church & graveyard sites, castles, period houses, demesne features, bridges, etc.;
- **Seasonality** e.g., how likely is the landscape to appear different or be viewed differently in summer (full leaf cover) as opposed to winter (no leaves), etc, and;
- **Tranquility** e.g., sense of remoteness and isolation, or lack of it, within the landscape. This is often determined by the presence or absence of built development, human activity, infrastructure, and traffic. Background traffic noise can be a contributing factor to loss of tranquility.

The above list has been collated and adapted from the following sources:

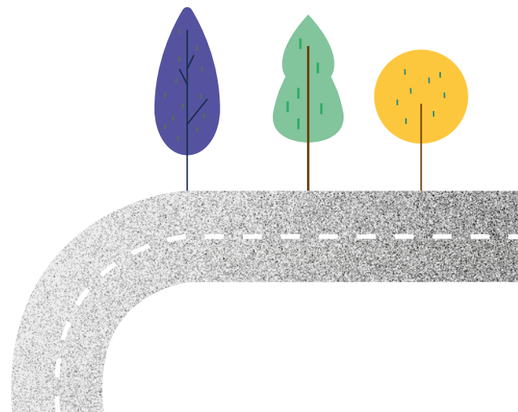
1. Tayside Landscape Character Assessment (Land Use Consultants, 1999);
2. An Approach to Landscape Character Assessment (Tudor, 2014);
3. Atlas of the Irish Rural Landscape (Aalen, et al., 2011).

For more information on LCA refer to TII Publication (Technical) PE-ENV-01101.

DESIGN CONSIDERATIONS SUMMARY

In relation to landscape, townscape and streetscape character, any planting proposals must seek to;

- Respond and enhance landscape and townscape character and the visual experience.
- Introduce variety within the roadside treatments with gaps in planting offering views to the surrounding landscape.
- Respond to place and avoid a repetitive, one-size fits all approach to planting in and around settlements.
- Enhance local features, historic boundary treatments, and sites of historic and cultural heritage value.
- Specify suitable species that tie in with the local context and trees that are already in the local landscape.
- Enhance the streetscape and define spaces by providing vegetated buffers and soft SuDs solutions between motorised and non-motorised road users and pedestrians.



3.1.2 Place and People centred Planting Provision

Places should be designed to respond to local needs. Developing a good understanding of how people actually use the space and how could do so in the future is a fundamental part of the design process, as it enables designers to shape places and create spaces that respond to the local needs. To develop this understanding, Landscape Professionals can undertake more formal studies such as a Community Provision Survey or Social Value Study, as well as applying a more holistic and integrated vision to the design process.

The following table illustrates how a series of studies as undertaken by Landscape Professionals can lead to more informed decisions related to the soft landscape design and demonstrates;

1. Why information sharing with Landscape Professionals throughout the relevant TII Project Phases is beneficial;
2. Why site visits and an understanding of the community are essential to the soft landscape design process.

Refer to Section 3.1.6 for more detail on Soft Landscape Treatments for Communities, Health and Wellbeing including inclusive design.

Figure 3.6: Astna Square, Clonakilty. Image courtesy of Cork County Council.

1 Looking at public life surveys, how people use streets and landscape	• Provision for selected user groups, for example the provision of a community orchard outside a school. Design planting to be at its peak at key points throughout the year. For example, to align with the return to school or cultural event such as Holy Communions if relevant). • Design to enhance views or access for people: for example, the provision of an avenue of trees leading towards a church. • Design to enhance access for people: for example, the provision of a mown grass path around a recreation ground.
2 Undertaking a Landscape Appraisal or Site Survey	• Design in response to local movement patterns and desire lines or trodden paths that show where people typically walk. For example, to inform the provision of mown grass paths through meadows. • Design following up from a good understanding of who are the street users and what their purposes may be. An example of this approach would be introducing an edible planting patch close to a bus stop where people tend to wait for a certain period of time, so as to encourage them to care for the planting or harvest as they wait. • Design in response to local cultural features and practice (for example, align trees to viewpoints, continue land management techniques e.g., hedge laying). • Design in response to local plant palettes to reflect on-site observations about which species are thriving or struggling to establish.
3 Engagement with local organisations and community groups	• Design in response to local aspirations (for example the provision of a community garden or supporting the local aspirations to plant more trees). • Design to accommodate and respond to locally valued assets (for example, if a particular habitat, land use, view or activity can be integrated into plans).
4 Understanding community needs and requirements	• Design to accommodate aspirations and needs of different genders, age groups and cultures, as appropriate.
5 Undertaking traffic surveys and studies	• Design to change the character of the landscape and streetscape to influence driver behaviour and slow traffic. • Design to buffer active travel from carriageway or to direct users to safer crossings. • Design to accommodate space reallocation as part of traffic engineering works and integrate SuDS and planted areas that can provide multi-functional benefits. • Design to highlight junctions and gateways, for instance by adding feature trees or bold banks of planting to draw the eye.

Table 3.1: How various studies lead to soft landscape design decisions.

3.1.3 Landscape Treatments and Place Perception

Placemaking and shaping is about designing experiences for people. Perceptions of place are hugely varied, and places become memorable (or not) for a multitude of reasons.

Sensory experiences moving through a place are processed immediately and inform judgements on how appealing or functional environments are. Research has found that people tend to absorb combinations of features rather than break them into individual parts, and yet all our senses are used to process these parts in different ways.

Within an urban environment context, road and street users travel at speeds ranging from 0-60kph depending on the chosen mode of travel, activity being undertaken and their location in relation to the four zones:

- Rural Fringe (+60km/h)
- Gateway
- Transition Zone (50-60km/h)
- Core (50km/h)

The ability to perceive complexity is impacted by speed of travel, whilst visual experience affects all modes of transport.

Visual Perception and Spatial Organisation

Space is delimited by edges: their impact vary depending on the height of surrounding structures or planting in relation to a person's eye level. Views are experienced along, over and through space and depend on the modes of travel.

Both pedestrians as well as motorists are affected by familiarity. Cars act as a filter between the driver and the outside world and emphasise visual experience. The faster the vehicle is moving, the more the driver focuses on the forward view. Contextual views are more frequently and deeply considered at slower speeds and junctions (Appleyard, Lynch & Myer (1965). Amongst other factors, such as ecological performance and integration with the landscape and townscape character, the extent and complexity of planting proposed needs to relate to the speed of the person travelling.

More complexity and change are needed in the public realm and at junctions when people are moving at slower speeds or stopping.

Vertical landscape elements such as trees and hedges can aid traffic calming and perform functions such as screening and avenue creation. When designing around road corridors, the introduction of vertical elements e.g., trees encourage drivers to slow down as their visibility is more restricted.

Field of vision at a speed of +70km/h in Rural Fringe

Field of vision at a speed of 50 - 65 km/h in Transition Zone

Field of vision at a speed of 30-50 km/h in Core Areas.

Figure 3.7: Image of N2 Collon. Planting creating a tunnel and narrowing driver's cone of vision. Image taken from Google maps.

Figure 3.8: Field of vision at various speeds on the approach to and within towns and villages.

DESIGN CONSIDERATIONS SUMMARY

Soft landscape treatments can be used to choreograph views, create a sense of space and contribute to road safety. Examples of how this can be achieved are as follows:

- Use of high hedgerows, shrubs, and trees to contain space, screen and direct views;
- Use of vertical elements to encourage drivers to slow down in response to a narrowed cone of vision;
- Use soft landscape treatments as traffic calming measures (e.g. by highlighting intersections and narrowing street width).
- Use of planting to define edges and thresholds between spaces performing different functions (e.g., change in use);
- Creation of focal points;
- Make use of plantings different characteristics such as form (i.e. the overall shape and structure of a plant or tree), line, pattern, texture, habit (i.e. the nature of the way the plant or tree grows) to introduce interest and design compositions that can be both visually appealing and engaging, to foster unique experiences. Introducing changes among planting groups with common characteristics can, in fact, break the space into sub-sections and promote a wide range of experiential patterns for users.
- Integrate soft landscape treatments along the street's centreline / axis to define the space and create a buffer zone between vehicles, pedestrians and cyclists as well as to perform SuDS and air cleansing functions.

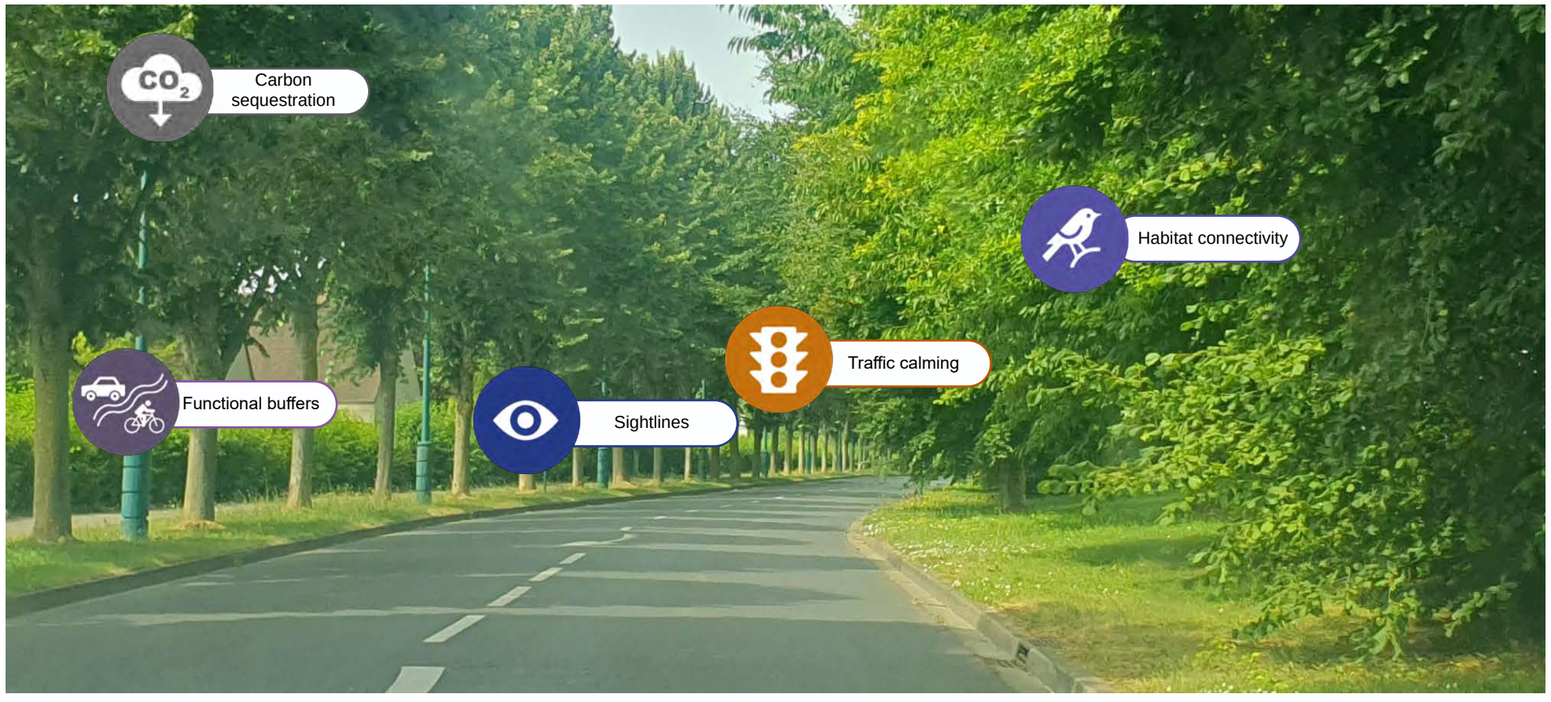


Figure 3.9: Vegetation used as a tool for spatial organisation. Hedging provides a division between the bicycle and car traffic while maintaining necessary sightlines (top) and at the bottom, trees lining transport corridors contribute to landscape character, slower speeds as well climate resilience and biodiversity. Image courtesy of Emma **Oldroyd.**

Many of these applications, designed mainly to influence the users' visual experience, also have an impact on a wide range of other landscape functions.

For example, an avenue of trees will perform different functions all at the same time, that is to say:

- Providing shade;
- Becoming a place where people would meet;
- •Creating a wildlife corridor;
- Reducing surface water run-off;
- Creating a positive multi-sensory all-year-round experience: users will be able to listen to the wind blowing through the trees, experience the change of foliage in autumn and smell their blossoms in Spring.

Figure 3.10: Image showing soft landscape treatments being used to define spaces within an urban context. In addition, provision of trees provides all year-round function – shade during a hot summer day and shelter while its raining. Apart from human benefits, planting provides for **wildlife.**

Organising Plants and Planting Style

The way in which plants are selected and grouped together alludes to the communication of a certain set of priorities – put simply, its style. Determining the right planting style for the right place is informed by an understanding of:

- Place, its characteristics and context
- Community and its needs
- How planting can complement biodiversity objectives

In turn, the planting style selected conveys a message on how people should use a place.

Section 4 of this Document on Soft Landscape Treatment Design Methodology includes guidance on how to design to create different effects and impacts.

The use of planting styles and their perception change as society progresses. Changes in attitudes towards nature have pivoted over the last century. On this point, there is a growing body of research supporting the idea that humans have a preference for natural landscapes (Rainer & West, 2015). This presents a substantial opportunity for better establishing and connecting semi-natural landscape treatments in, through and along all urban transport environments.

However, it is worth noting the establishment of semi-natural landscapes in an urban setting may be complex and to increase the chances of it being successfully implemented.

DESIGN CONSIDERATIONS SUMMARY

The following factors should be considered:

Respond and enhance landscape and townscape character and the visual experience.

- The longevity of the flowering season – particularly over the summer months;
- The integration of cues to suggest that a habitat is being managed (e.g., mowing a strip);
- That a more positive attitude towards naturalistic vegetation can be learnt through familiarity and the promotion of its value;
- The increased height of naturalistic vegetation in relation to mown grass is generally regarded more positively by the public when colour and flowers are included in the mix;
- The availability and appointment of adequately skilled, long-term management teams, e.g., Community Employment Workers or Tidy Towns Groups.

The Full Sensory Experience

Soft landscape will impact all people travelling through the urban environment including motorised and non-motorised users.

Sound-based, smell-based, and touch-based experiences of place have an impact on user comfort in our urban environments.

People are less inclined to linger, play or engage in physical activity in places where unpleasant noises, smells, tastes, and touch sensations are experienced. According to Lindstrom (2005) smell may account for up to three-quarters of people's feelings about a place.

DESIGN CONSIDERATIONS SUMMARY

Soft landscape treatments can influence the full sensory experience by:

- Providing separation from sources of noise using planted bunds, green walls, and densely grown high hedges;
- Creating habitats that encourage natural sounds and smells, promoting positive sensory experiences and reducing the negative ones;
- Creating soft landscapes that encourage conversation and laughter, positively contributing to the population's mental health;
- Planting edible species, where appropriate;
- Planting fragrant species such as Lavender, Lilac, Jasmine, Honeysuckle, Fruit trees and Magnolias, where appropriate.

Figure 3.11: Insect hotel installed along the fence to support wildlife in urban environments.

Figure 3.12: Planting next to the bus stop to encourage natural sounds and smell, promoting positive sensory experiences.

3.1.4 Multifunctional Screening and Buffers

Screens and vegetative buffers are shrubs/trees chosen for their growth habit and foliage arrangements and are placed to help limit the visual influence, usage conflicts between sites, provide connections and / or separating buffers between habitats.

On urban roads, streets and greenways, trees, shrubs, and vegetation can add to placemaking by providing visual screens, disguising noise sources and filtering odours. Existing hedgerows are an important element of Irish transport corridors. It is important that existing hedgerows are retained and enhanced where possible.

Vegetative screening and buffers can also add value by:

- Connecting and protecting sensitive habitats (see Section 3.2.9)
- Improving and protecting water, soil and air quality (see Section 3.2.6)
- Providing recreation, security and economic opportunities
- Contributing to environmental hazard reduction (land stabilisation issues). (Adapted from Woodland Trust, n.d.).

Vegetative buffers and acoustics

The guidance on noise standards published by the NRA notes a minimal effect of vegetation on acoustics while highlighting several potential positives if landscaping and vegetation are given proper consideration (NRA, 2014).

Although marginal, providing a visual screening in places subject to high noise levels, can trigger an 'out of sight out of mind' effect, distracting us from the actual source.

Figure 3.13: Raised planters in Navan.

Figure 3.14: Landscape mounds acting as a screen on N2 Ashbourne.

Vegetative buffers and acoustics

It is widely acknowledged that a vegetated visual screening is most effective where planted close to the viewpoint or visual receptor. The further away the screening vegetation is located from the viewpoint, the deeper the planting belt must be to screen views. The faster the speed of travel, the more open the screening buffer can be.

Management plans and establishment

Screening should be considered strategically as it will change over time. A management approach consisting of several layers is an example of such an approach. Dense evergreen plants may be the fastest to achieve a visual screen, however in the long term these may prove problematic. Where a primary screen may mature, a layered approach to planting may be more appropriate.

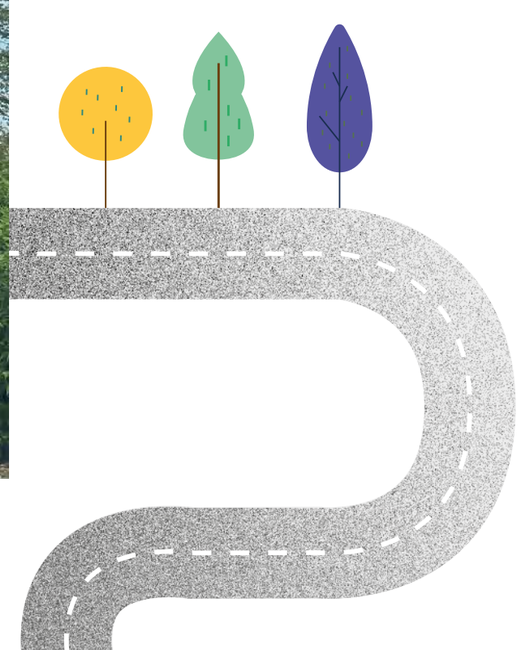
An example of this is where a fast-growing nurse species like Birch is used to support a slower-growing Pine woodland to establish.

Figure 3.15: N25, Midleton, Co. Cork. Vegetative buffer between national road and urban area.

DESIGN CONSIDERATIONS SUMMARY

Effective vegetative screening;

- Can vary in width and distribution so as to complement the landscape character;
- Can incorporate fences, walls and earth mounds (Woodland Trust, N.D..);
- Uses dense and multi-layered vegetation, particularly shrubs to screen views. Deciduous plants provide in fact 40% less visual screening than evergreens after leaf fall, so evergreens or a wider deciduous buffer may be necessary for year-round screening. Please also consider topography and width of planting belt;
- Consider vegetation and viewpoint height as part of the design.



Communities, Health & Wellbeing

3.2 Soft Landscape for Communities, Health and Wellbeing

"Our landscape reflects and embodies our cultural values and our shared natural heritage and contributes to the well-being of our society, environment and economy."

(Brady Shipman Martin, 2018)

It has been widely acknowledged since the 19th century urban parks movement in Europe that a significant correlation exists between green space, health, wellbeing and society; in recent times, this has been supported by empirical evidence. Put simply, the presence of soft landscape in our green and open spaces contributes to making people feel better, more connected and incentives them to adopt healthier lifestyles. As urban transport environments are the most frequently used spaces in our settlements, they have great potential to positively impact on people and communities.

This section will focus on the value derived by improving these green spaces for the community's health and wellbeing; it is organised in two sub-sections:

Value for Society and Community

Value for Health and Wellbeing

Value for Society and Community

Places and spaces that are accessible, attractive, and planted with well-managed landscape treatments play an important role in the community and society by enhancing street life, activities, fostering local identity and connectedness to a place. Conversely, a settlement with well-connected and attractive green spaces would offer users safe opportunities for active mobility, recreation, and sports as well as facilitating stress recovery and promoting social contact (WHO 2016).

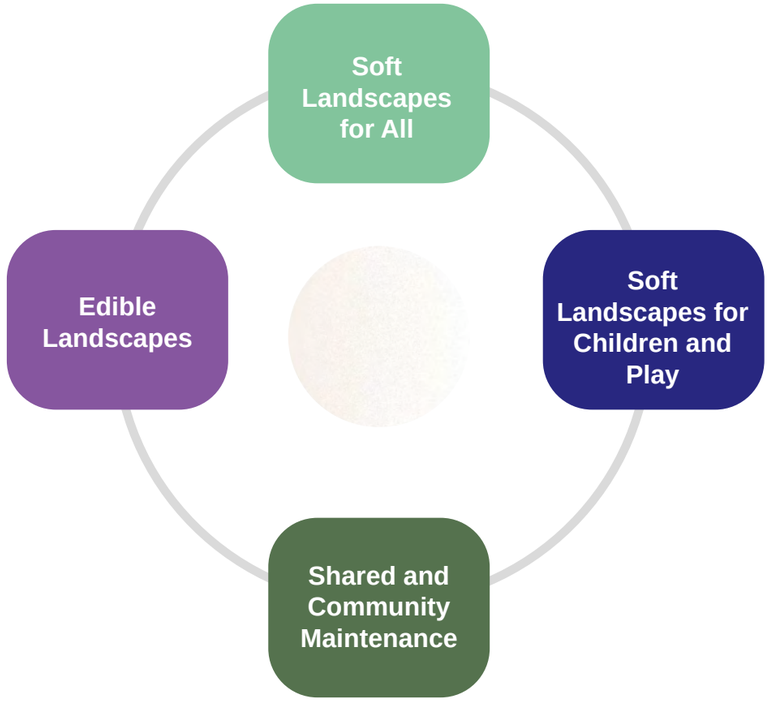
The evidence supporting the value of landscape treatments in urban transport environments applies to all society. For example, 'People living with nature nearby had better relationships with their neighbours and felt safer than those with fewer trees near where they live.' (Global Designing Cities Initiative, 2020). However, some evidence suggests that "health benefits linked with access to green space may be strongest among the lowest socioeconomic groups, including minority ethnic groups" (WHO 2016).

People are not all the same. They use and react to urban transport environments in different ways often according to gender and physical condition amongst other factors. It is critical that soft landscape treatments work for everyone in the community regardless of gender, ethnicity and age.

Settlements lacking in green and vegetated space have been linked to feelings of loneliness and lack of social support, which can evoke a sense of isolation between people and their community. Some landscape treatments are designed to induce higher levels of social interaction, for example providing a place to exercise, play, and grow food. Social interaction can also be encouraged by straightforward intervention such as a well-placed bench surrounded by attractive planting.

Once implemented, it is vital that landscape treatments are well looked after and maintained. Often times, this means working closely with local landowners and community groups to create landscape management and maintenance plans along to determining areas of commitment, standards of planting and upkeep.

The following paragraphs outline key design considerations when creating soft landscape treatments aiming to enrich society and the community with a focus on;



3.2.1 Soft Landscapes for all

Landscape Professionals shall consider how to make soft landscape proposals inclusive for all genders, ages, and ethnicities. To achieve this, designers need to be aware of the individual experiences and way of expression for each group.

For example, the traditional Sikh colours of orange and blue could be woven into planting palettes outside a Mosque. In some places in Ireland, towns use colours of their county within planting palettes.

Similarly, planting can be designed to evoke memories of a certain era, emphasise sensory experiences and define spaces that are accessible and beneficial to everyone.

Figure 3.16: Trees planted in colours of the county.

Soft Landscape through a Gender Lens

Designing urban transport environments and landscape treatments to respond to the needs of women and girls is a relatively new area of research. TII's report, Travelling in a Woman's Shoes (2020) describes how women actual safety as well as their perception of it when using roads are shaped by the design of transport and public space, cultural context, socioeconomic factors, security, confidence in reporting and emergency response mechanisms, in particular during the 'last mile' journey home.

TII Publication (Technical) GE-GEN-01007 Applying a Gender Lens to TII Public Transport Projects, includes a checklist encouraging the adoption of new perspectives to design with a gender sensitive approach. The checklist is broad in scope and covers planning, engineering and design decisions and strategies.

DESIGN CONSIDERATIONS SUMMARY

The following points are relevant to the design of soft landscape treatments:

- Integrate a sense of playfulness (this is specifically to encourage young and teenage girls to use public open space);
- Incorporate clear sight lines and options for movement within planting areas;
- Create pleasant spaces to sit (which planting could be a part of);
- Use 'visible ecology', meaning the overt use of ecological and natural materials including:
  - Vegetable gardens, flowers, herb bushes, and;
  - Efforts to compost and recycle.

More detailed design guidance to promote use of public space, and therefore urban transport environments, among girls has been explored by organisations such as Irish-based A Level Playing Field and UK-based Make Space for Girls. An improved sense of safety, playful and social seating opportunities (e.g., a hammock or other structures to sit on) encourage girls to use public open spaces (Natural England, 2009) (Landscape Institute, 2022).Sarah Flynn of A Level Playing Field, advocates a place-specific approach to design whereby, "the solutions have to be much more nuanced, and one size doesn't really fit all" (Dalby, 2022).

Understanding Who Uses Space and How

A deeper understanding of how to respond to the population needs and demands is achieved by surveying current users of the existing transport environments and adjacent spaces. In Finglas, it became apparent that dog-walking was the only activity than more women than men participated in. Anecdotal evidence collected as part of this study suggested the reason for this is that having dogs makes women feel safer when they are walking. Thanks to this analysis, providing better routes for dog walking had been identified as the first design action to be carried out: 'better' implies well-designed and choreographed planting, as well as a more effective lighting schemes supporting a series of well-connected routes.

The same research also found that groups of girls who usually congregated in a local park were likely to displaced on match days when the pitches were used predominantly by boys. The design solution proposed here included the inclusion of additional suitable places for girls to meet and sit – even when the pitches were busy. Planting can also be used to create, shape, and animate a space to support this approach.

Case Studies - Farnham Park

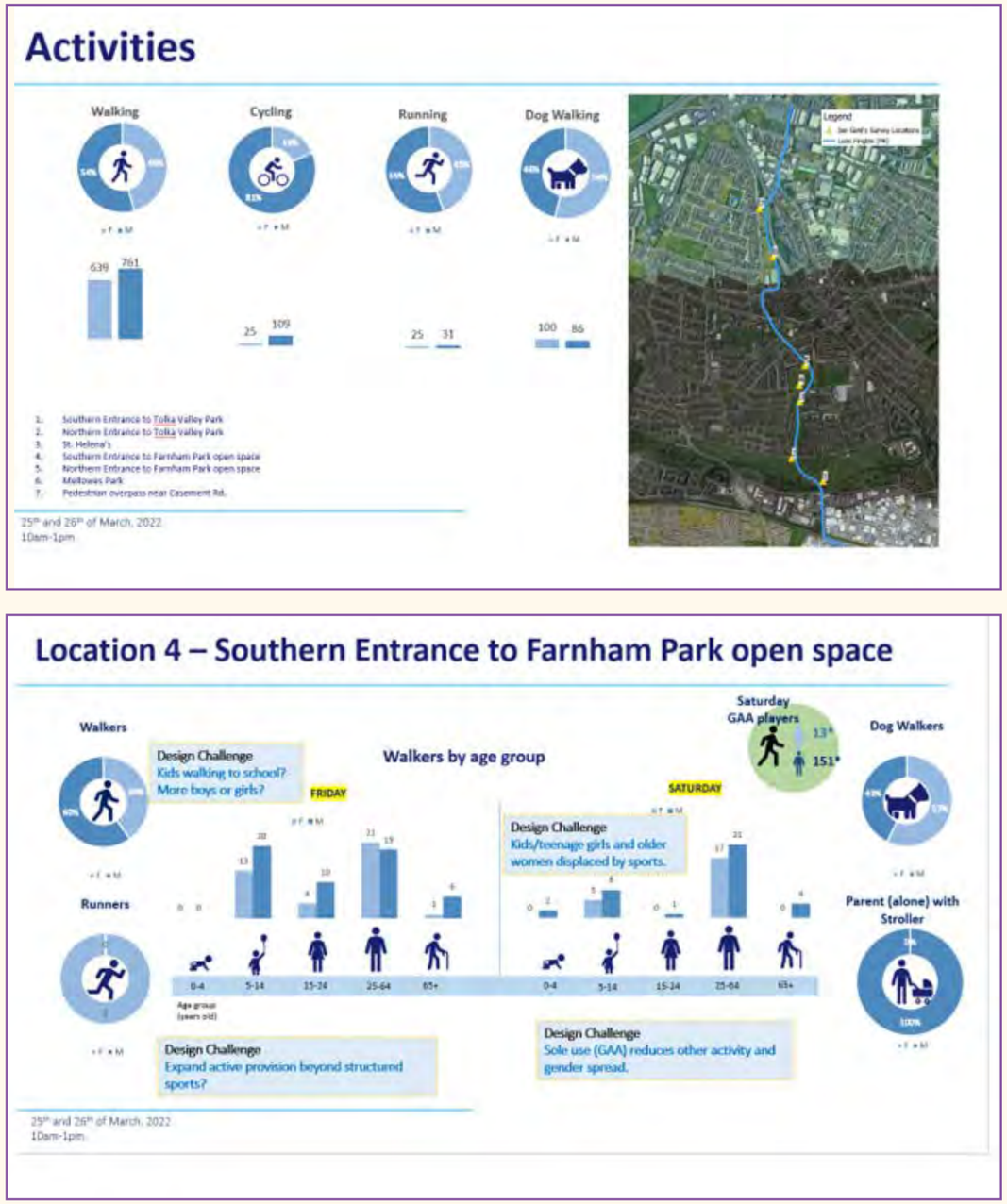


Figure 3.17: Study carried out in Farnham Park to understand the users and activities taking place.

Inclusive Soft Landscape Design

Design considerations for vegetated spaces include balancing the provision of permeability and enclosure, as well as scale and space. The nature of enclosing spaces defines the character whereby enclosure can suggest security and offer comfort. If permeability is both physically and/or visually unsuitable, the area can be rendered either too claustrophobic or too exposed (Dee, 2001). The proportion of the space transformed into an enclosure is also integral in designing suitable spaces. Human scale refers to the part of the environment which is close in size to the human body and can engender feelings of comfort, security, and orientation in the space (Dee, 2001). Perception of scale varies across the population through lenses such as gender and culture.

Everyone has the right to access the city, and being active plays an important role in physical and mental wellbeing, which then relates to having green spaces to be active in. (The Journal of the Landscape Institute, 2021). To maximise the accessibility of the public realm, a number of factors come into play, including the texture, tone and gradient of surfaces, as well as frequency of benches and places to rest and the lighting provision adequacy.

Management and maintenance strategies must also consider how to best manage vegetation to encourage access for all, for example by raising canopies and cutting back hedges to allow space for wheelchairs in key locations. All industry standards, best practice guidelines and Universal Access policies must be complied with on all urban transport schemes. In addition, an integrated and sensitive response to the above factors is welcomed, e.g., considered planting proposals.

Inclusive Soft Landscape Design and Lighting

The provision of appropriate lighting is an important element in urban transport corridors. Its fundamental function is to improve safety and the perception of safety. Lighting can also be used, often in combination with planting, to create a sense of playfulness, beauty, and distinctiveness, e.g., lighting up a feature tree and vegetation, creating lighting effects with shadows and motion-sensor lighting. These combined strategies can help improving user experience, wayfinding, and encourage a greater number of people to use the public realm.

Landscape Professionals must always refer to the guidance and requirements set out by the Local Authorities to ensure these are met, e.g., specific distance between tree centres and lighting columns. In addition to this, it is important to consult the Project Ecologist over lighting fittings selection and placement, so as to avoid negative impact on existing biodiversity and animal population. Section 5 includes further specific guidance on integrating services and trees within transport environments.

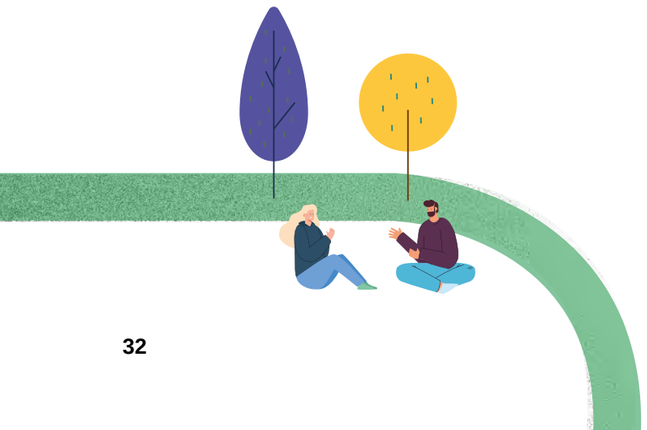


Figure 3.18: Seating in urban environment, Clonakilty. Image courtesy of Cork County Council.

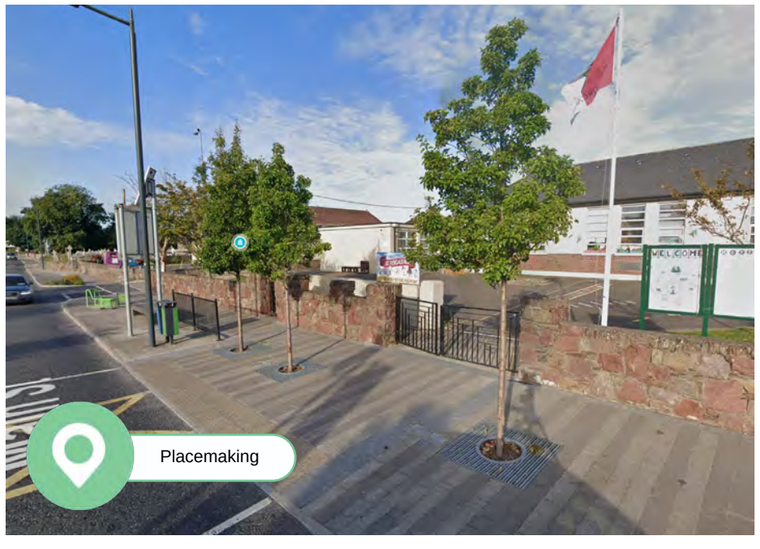


Figure 3.19: Use of trees and materiality to indicate school entrance in Killeagh, Cork. Image from Google Maps.

DESIGN CONSIDERATIONS SUMMARY

As a recap for inclusive design, Landscape Professionals should consider:

- Provision of places and spaces to meet;
- Provision of spaces for girls and women, boys, and men to be active and sociable;
- Use of planting to create a sense of enclosure, familiarity, and interest – which typically allow for increased levels of user comfort, while retaining good levels of permeability;
- Consider incorporating edible, sensory, symbolic, nostalgic and wildlife planting and habitats;
- Integration of playfulness into soft landscape designs (see Section 3.1.7.2);
- Creative integration of vegetation and lighting – in keeping with industry standards, policies, and best practice guidance;
- Incorporation of clear sight lines;
- Integration of vegetable gardens and ecological areas.

3.2.2 Planting Design for Children and

Place-making and shaping needs to encourage playfulness and escapism across all ages. Children have a playful approach when moving through places, are attracted to the details of their surroundings and curious about new and interesting experiences. However, evidence supports the idea that the potential to play, escape, be distracted and let the mind wander, is vital to everyone's wellbeing at all stages of life. According to best practice, it is recommended play opportunities, irrespective of the user's group age, should be located away from idling traffic.

Figure 3.20: The play park in Tim Smythe Park, Ennis is located adjacent to the moving traffic.

The presence of plants sparks creativity in children and encourages their interaction with nature. In fact, '*children, with more trees and greenery in their neighbourhoods, have better brain development and improved cognitive functions, ability to focus, and motor skills. Places with trees also encourage more creative play behaviours*' (Global Designing Cities Initiative , 2020). Children are more likely to notice planting that is located closer to where they walk and climb and they tend to pay more attention to species that are at ground-level than adults. It is important to consider planting from a child's perspective when designing the public realm and urban streets. The height of an average three-year-old is 95cm and three-year-olds move slower than adults and generally perceive safety and the world in a different way comparing to grown-ups.

Successful playful urban and street environments:

- Feel safe and contribute to creating well-proportioned spaces;
- Encourage interaction;
- Encourage integrated playable experiences;
- Integrate nature and habitats (including insect hotels);
- Locate trees for shade close to places to stop, rest and play;
- Celebrate and reflect the identity of a place.
-

'Children, with more trees and greenery in their neighbourhoods, have better brain development and improved cognitive functions, ability to focus, and motor skills. Places with trees also encourage more creative play behaviours'

(Global Designing Cities Initiative , 2020)

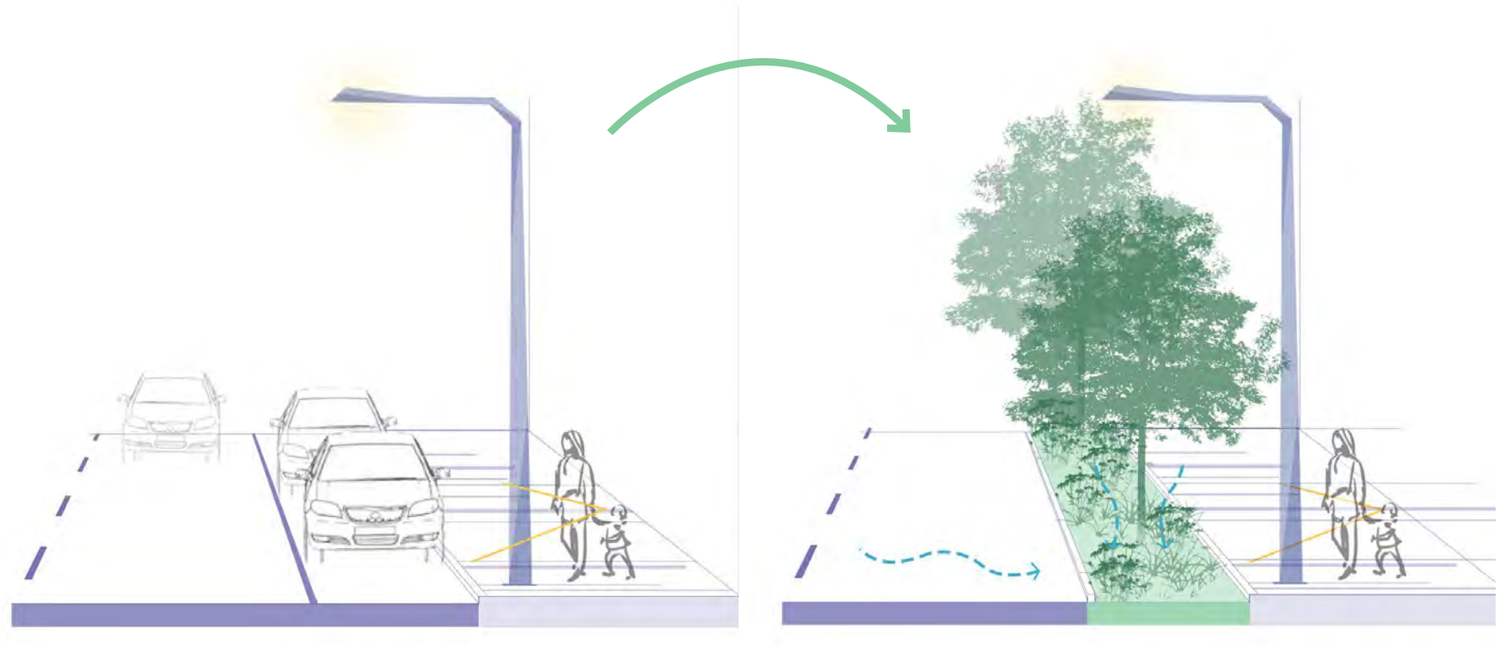


Figure 3.21: Designing soft landscape for child's eye level. The average 3yearold child is 95cm tall. Designing soft landscape that engages all senses and allows a child's interaction with nature enhances children's perception of public realm which would otherwise often feel overwhelming.

Soft landscape treatments that encourage playful experiences can include:

- Soft mounding and provision of slopes;
- Planting that allows children to play within the vegetation's structure – for example, maze-like hedges or grasses, trees positioned to be used as goal posts, a series of circular planting beds, or well-spaced fruit trees that children can run around;
- Trees that can be climbed and swung from;
- The provision of insect habitats and plants that attract butterflies, birds etc.;
- Planting and habitats that have been designed to include changes in colour, texture, pattern, movement, as well as promoting the experiencing of light and shade as appropriate, to complement the overall design strategy;
- Planting that blooms, blossoms and produces edible fruit, that is non-toxic and non-spiky. (National Association of City Transportation Officials, 2020)

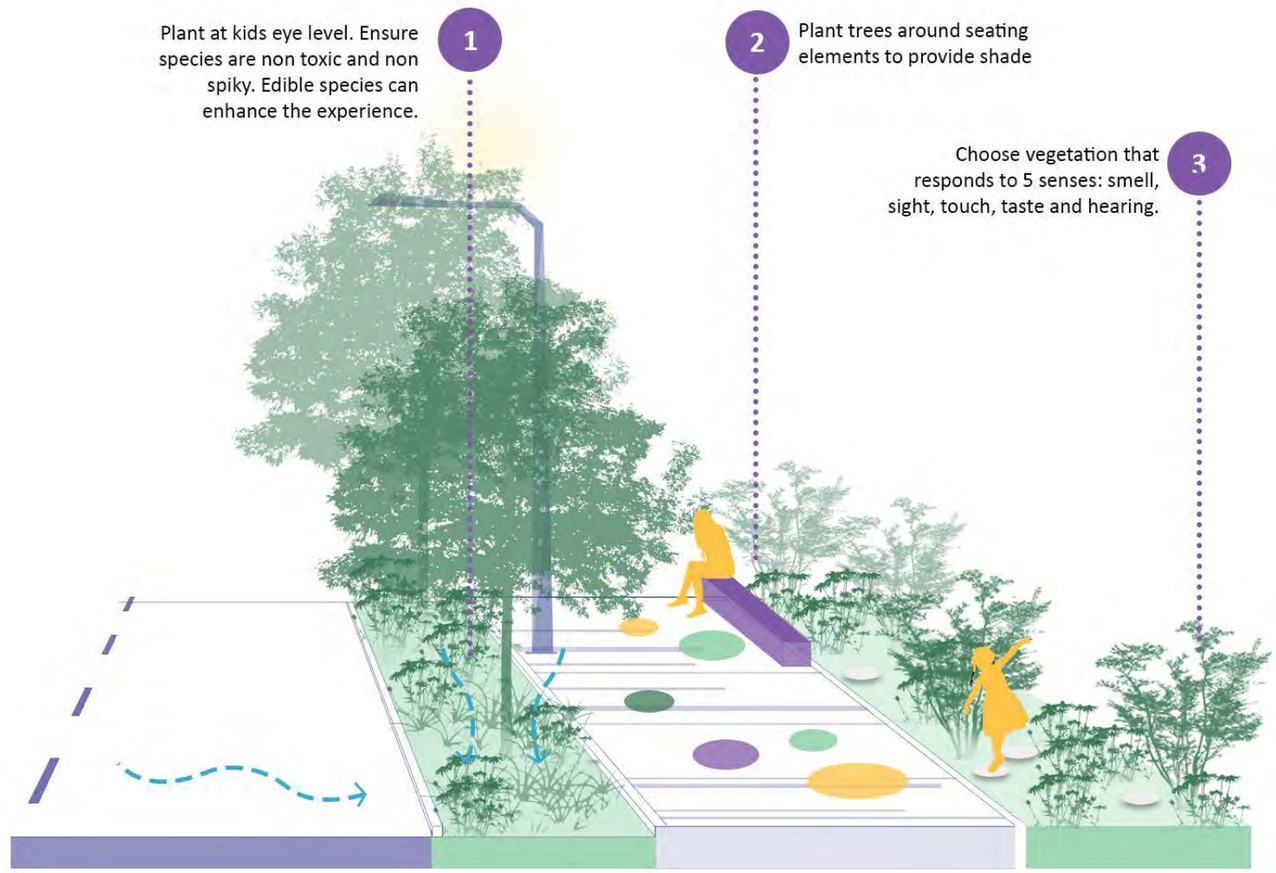
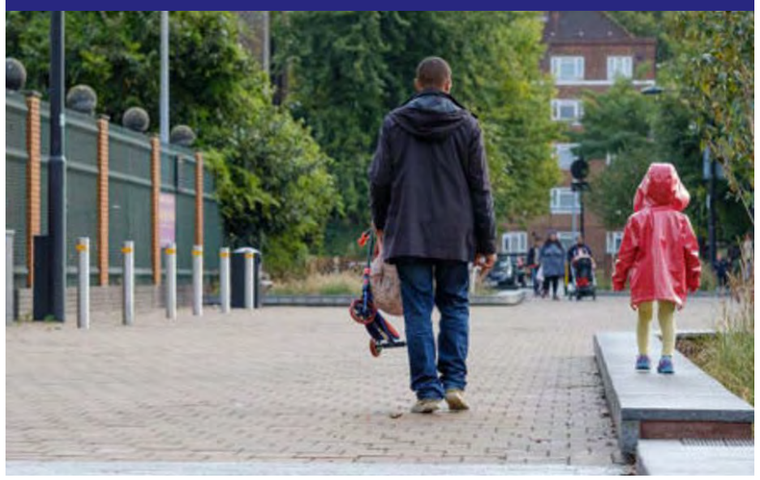


Figure 3.22: Designing soft landscape that is safe and enjoyable for children.



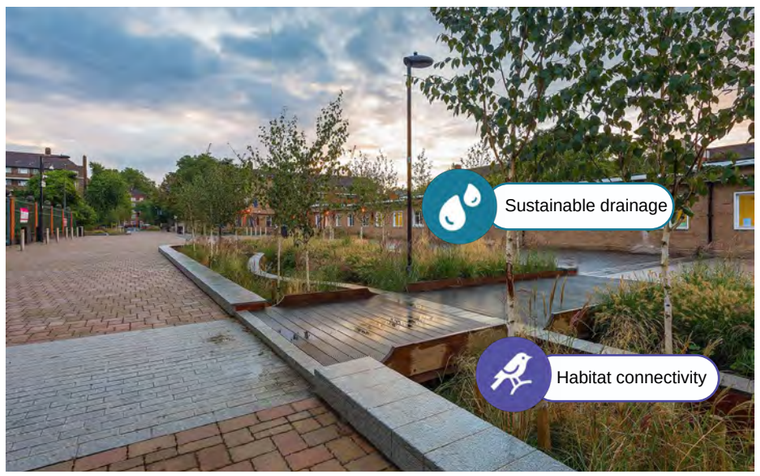


Figure 3.23: Bridget Joyce Square by Robert Bray Associates. Soft landscape treatment that encourages playful experiences. [17]

3.2.3 Edible Landscapes

Edible landscapes include places for food production through the planting of orchards, nutteries and areas to grow other fruit and vegetables. Edible landscapes play an important role in the urban environment and are now being included in development plans across Ireland. Some of the benefits of integrating edible planting into urban transport environments include:

- Potential to plant pollinating species, which along transport routes, can create wildlife corridors. These can guide pollinating insects to urban allotments and community gardens;
- Potential to make better use of vacant or leftover land, therefore promoting urban regeneration;
- Provision of a sustainable food source integration for local people that is low cost or free;
- Potential for community groups to take ownership of maintenance and management activities;
- Potential for an attractive, dynamic and adaptable, productive solution to be integrated into soft landscape treatments.

Figure 3.24: Edible Landscape designed by Felixx Landscape Architects in Rijnvliet, Utrecht. [19]

Edible landscapes give everyone in the community the opportunity to get involved and be part of activities that are both sociable and productive, while potentially expressing their local or ethnic identity. Urban food production is often associated with community involvement, particularly with regards to “groups who are often discriminated against, such as women, ethnic minorities and the elderly” (Viljoen & Howe, 2005). Therefore, its provision encourages inclusive interaction with the urban transport environment.

The provision of edible landscapes promote social participation and the creation of sustainable and better-connected communities, through:

- Community creation and management;
- Individual learning and development;
- Social inclusion and cohesion;
- Community/urban regeneration.

Figure 3.25: Edible Landscape designed by Felixx Landscape Architects in Rijnvliet, Utrecht. [19]

DESIGN CONSIDERATIONS SUMMARY

When designing and specifying edible soft landscape treatments, it is recommended to:

- Locate edible beds **away from idling traffic**;
- Ensure that any edible beds are **practically maintainable**;
- **Work with local landowners and community groups** to develop designs and plans for after-care;
- Consider **creative ways of integrating** edible trees, shrubs and plants and **combine these** in a way to **reduce ongoing maintenance**. (Viljoen & Howe, 2005)

Value for Health and Wellbeing

Open spaces and landscape treatments associated with urban transport environments from the smallest rain garden to sizable park, have positive impacts on people and their physical and mental health and wellbeing.

Urban green space exposure has a role in reducing the development of mental health disorders and in managing system severity of specific conditions ‘

(Global Designing Cities Initiative, 2020)

Landscape Professionals and the design teams they work with must endeavour to provide a framework of opportunities for activity and social interaction. This is created by:

- Providing a physical network of connected spaces of different sizes;
- Designing these to meet the needs of local people (see Section 3.1.2);
- Proposing landscape treatments that deliver physical and mental health benefits (as described in this section);
- Planning suitable management and maintenance regimes to ensure flexibility and longevity of soft landscape treatments as appropriate (Refer to Guidance Document (GD) GE-ENV-03001).

Planting for Positive Mental Health

There is now strong evidence suggesting the existence of a positive relation between people and the presence of plants and nature, critically impacting on place-preference and wellbeing.

Planting and habitats have been proven to evoke emotional responses and can deliver certain emotional and cultural benefits and services (Natural England, 2009). Responses linked with typical characteristics associated with landscape in and around Ireland are summarised below:

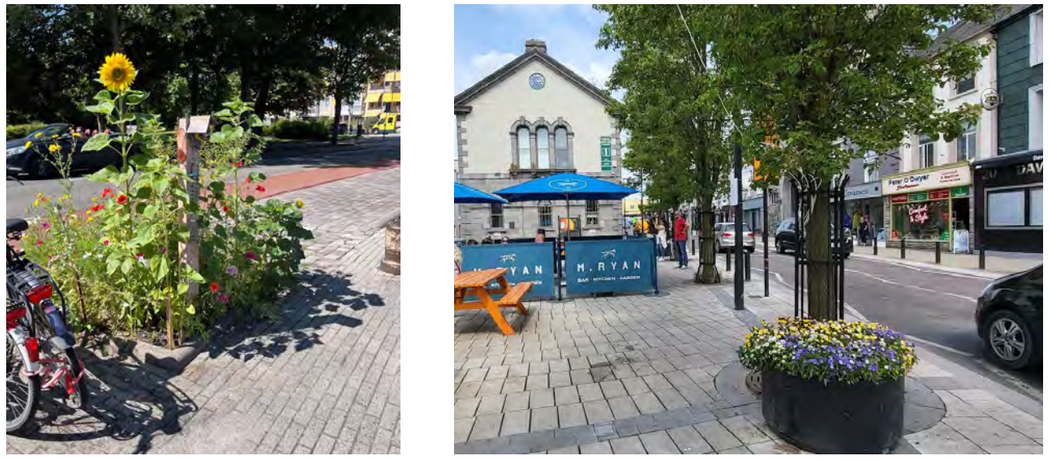


Figure 3.26: Tree pits accompanied by flowering vegetation.

Feature	History	Place	Inspiration	Calm	Activities	Spiritual	Learning	Escape
Water, rivers & streams	Low	Medium	High	High	High	High	Medium	High
Bogs & marshes	Low		Low		Medium	Low	Medium	
Grassland	Low		Low		Low	Low		
Woodland & trees	Medium	Medium	High	High	High	High	Medium	High
Fields systems	High	High	Medium	High	Low	Low	Low	High
Hedges, walls, lanes	High	High	Low	High	Medium	Medium	High	

Table 3.2: Table edited from ‘The Delivery of Cultural Services by Different Landscape Features’ (Table 10.3 in Natural England, 2009)

DESIGN CONSIDERATIONS SUMMARY

The design of soft landscape treatments best creates environments for positive mental health when:

- It changes through the seasons;
- It is legible at a human scale and appropriate to speed of movement (i.e., more detailed palettes and more change where people are moving through space at slower speeds);
- It is physically permeable and includes choices of route;
- It encourages social interaction;
- It captures the imagination and encourages play;
- It is designed with inclusivity in mind;
- It intentionally triggers sensory responses;
- It integrates water;
- It encourages a connection with nature through the provision of a diverse range of habitats and palettes (as appropriate);
- It encourages a connection with the landscape / place using vegetation can be used to frame or direct views or other sensory experiences.

Nature Positive Landscape Treatments

It is now widespread knowledge that many species are disappearing at an alarming rate, leading to a reduction in genetic diversity, ecosystem stability, and ecosystem services. Recent studies have shown a decline of 56% in Irish native species (Lee, 2023), which prompts to take action to prevent further biodiversity loss. National Biodiversity Action Plan, COP15 Biodiversity Targets, the newly proposed European Nature Restoration Law, all emphasise the need to protect, restore and enhance biodiversity. TII's Environmental Strategy recognises biodiversity as an important asset and therefore focuses on long term preservation and enhancement of biodiversity within the Irish landscape (TII, 2019).

Biodiversity loss and climate change are two major global issues that are intricately linked. The loss of biodiversity refers to the decline in the variety of living organisms on Earth, while climate change refers to the long-term changes in the Earth's climate, primarily caused by human activities that result in increased levels of greenhouse gases in the atmosphere. Both these issues have a profound impact on the functioning of ecosystems, and their effects are widely felt across the planet. Biodiversity loss and climate change are also negatively impacting on human well-being, economic prosperity, and social stability.

Climate change has already started to have severe impacts on Ireland's environment, economy, and society. Climate projections for the next century indicate that current climate trends will continue and intensify, with some impacts already being unavoidable. These impacts include changes in wind speeds and storm tracks, an increased likelihood of river and coastal flooding, changes in the distribution and phenology of plant and animal species, as well as negative effects on human health and wellbeing (EPA, 2022).

The consequences of biodiversity loss and climate change are also closely linked in Ireland. Changes in temperature and precipitation patterns can lead to changes in the distribution of species, making some more vulnerable to extinction. In addition, the loss of biodiversity can reduce the resilience of ecosystems to climate change, making them more prone to be further damaged (Sweeney, et al., 2007). Existing and proposed habitats and soft landscape treatments play an important role in addressing these two critical environmental and planetary crises.

This section includes guidance on designing soft landscape that is climate resilient and sustainable and how to achieve increased levels of biodiversity.

The following SDGs apply to Planet positive Landscape Treatments:

Climate Resilient and Sustainable Landscape Design

Biodiversity

3.3 Climate Resilient and Sustainable Soft Landscape Design

'Nature offers a lot of untapped potential, not only to reduce climate risks, and deal with the causes of climate change, but also to improve people's lives'

(IPCC , n.d.)

The effects of climate change including extreme heatwaves, air pollution, and climate extremes such as erratic heavy rainfall put significant pressure on urban transport environments. These is turn impact wider systems and resources, e.g. water quality and quantity as well as energy distribution. Soft landscape treatments can play an important role in promoting climate resilience and adaptation, by:

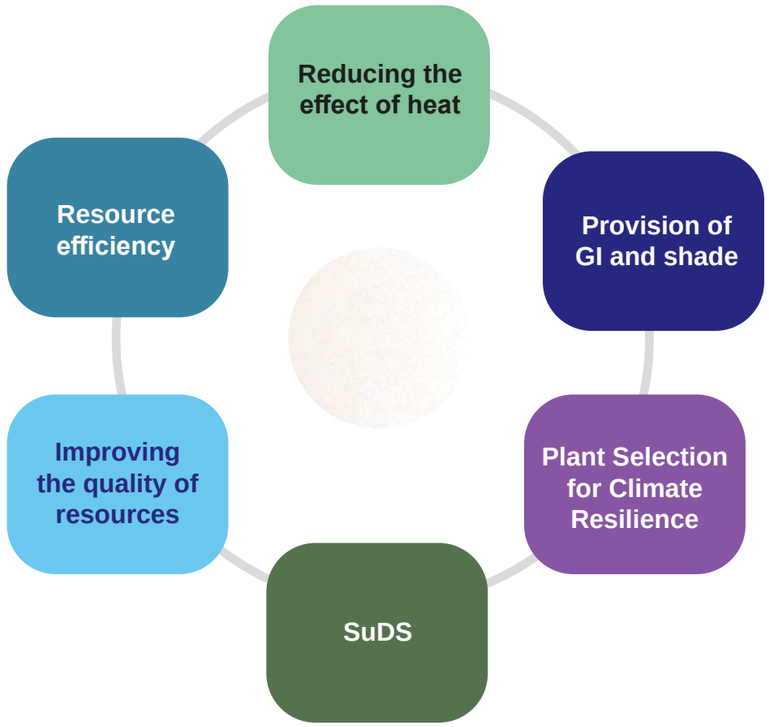
- Reducing the urban heat island effect, facilitating urban cooling and providing shade;
- Slowing the flow and improving the quality of water through sustainable drainage systems;
- Sequestering carbon;
- Improving the quality of air and soil, and;
- Conserving, enhancing, restoring, and transforming habitats and the biodiversity that they support.

Additionally, it is of key importance to make informed decisions throughout the soft landscape treatment project life, that is to say from design to implementation and maintenance.

This includes a responsible selection and use of resources, considering those embodied in the construction process as well as those required in the long term (e.g. during maintenance).

Working through the planning, design, construction and implementation process adopting a circular economy perspective enables us to address what would be otherwise considered a waste as useful resources. In keeping with a sustainable approach to construction, it is possible to consider the re-use of waste materials from other dismantled schemes, as appropriate and in line with all relevant industry standards.

The following section outlines key considerations for climate resilient soft landscape treatments in and around settlements, organised according to the following categories:



3.3.1 Reducing the Effect of Heat

Air temperatures are rising in Ireland as they are across the globe. On average, temperatures are currently 0.8°C warmer than in 1900. Between 2041 and 2060 the average annual temperatures are projected to increase by 1–1.2°C and 1.3–1.6°C, depending on how effectively emissions can be curtailed. The consequence of the forecast raise in temperature is that the number of warm days is expected to increase and heat waves to occur more frequently. (EPA, 2022) This trend currently is and will be felt more keenly in the core of Irish villages, towns, and cities.

The Urban Heat Island effect describes the notable difference between urban and rural temperatures, particularly at night, which causes: (Scott, et al., 2022) (OECD, 2018)

- Extreme discomfort and mortality;
- The increased use of energy for cooling (and decreased demand for heating);
- Greater stress on water resources and challenges in sustaining urban vegetation;
- Declining air and water quality.

Trees and other soft landscape treatments, in urban areas, have proven to be effective countermeasures to climate change by reducing the effects of heat (TDAG, 2021) (Horváthová, et al., 2021). The planning, design and implementation of green infrastructure and soft landscape in our cities as a series of interconnected (and disconnected if appropriate) projects, have the potential to counteract rising air temperatures, among other benefits.

Existing and new soft landscapes can contribute to the reduction of urban temperatures through the following planning and design interventions:

- The provision of GI and Shade;
- Microclimatic building design for natural cooling;
- Climate resilient plant selection.

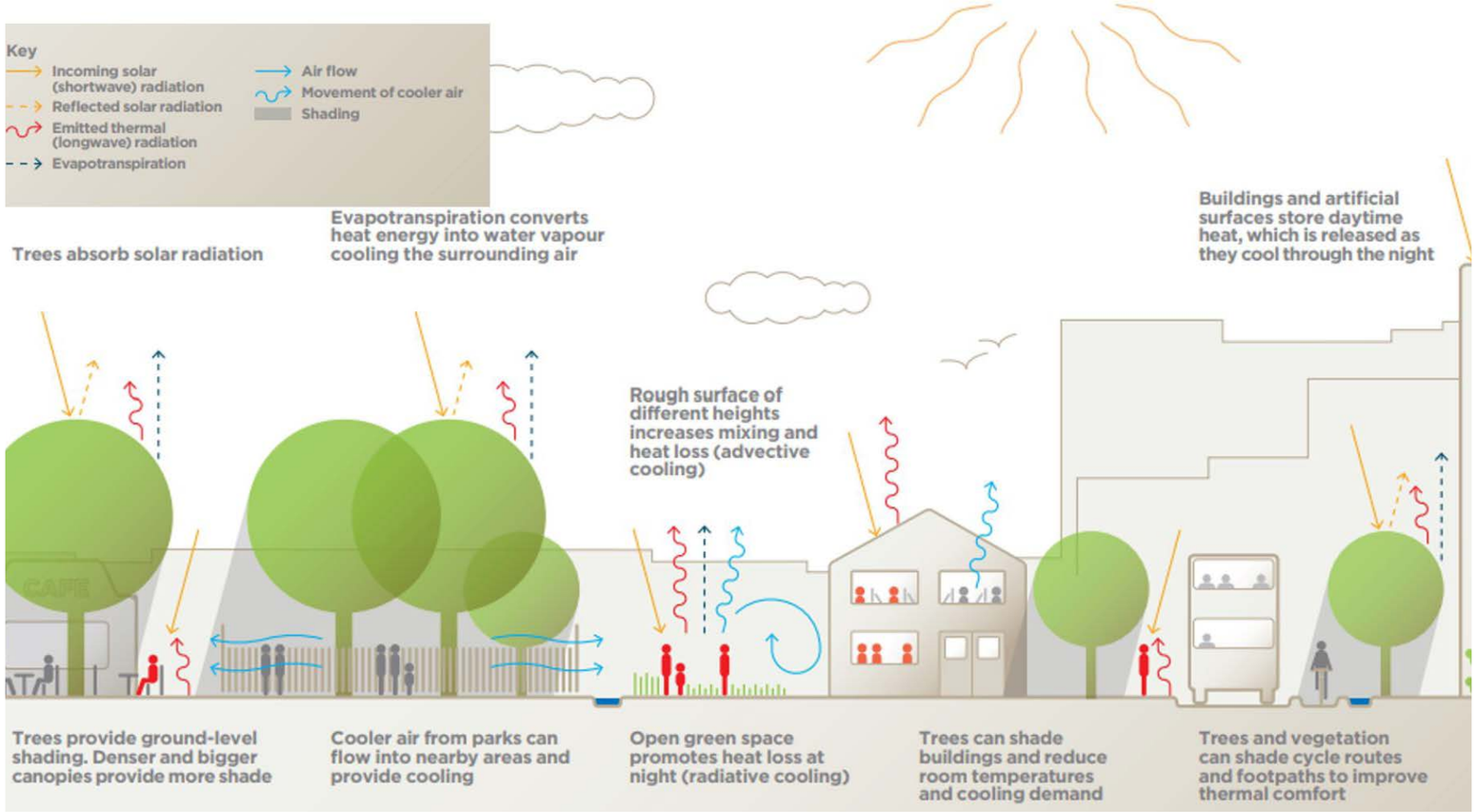


Figure 3.27: From First Steps in Urban Heat (Ferranti et al., 2021)

3.3.2 The Provision of Green Infrastructure and Shade

Research indicates that integrating soft landscape treatments within our cities has a significant impact on urban cooling (Aram 2019). The presence of parks, vegetation, water, trees, green façades and roofs can all contribute positively by:

- Reducing the heat storage capacity of urban surfaces;
- Encouraging warm and cool air to mix;
- Reducing air temperature through shading and by absorbing solar radiation; cooler air would then flow into the surrounding streetscape; and;
- Supporting the evotranspiration of water which brings cool air into the city. (URBACT, 2021)

Research by EEA (2020) has found that different soft landscape treatments are moderately to highly effective at reducing urban heat. Trees and green space are especially effective in cooling outdoor air temperatures; green façades and green roofs are effective in cooling and protecting building materials whilst decreasing indoor air temperatures. It is worth pointing out that vegetation type and its condition impact evotranspiration rates, which are reduced if growing conditions are poor (URBACT, 2021).

Design guidelines for the implementation of GI and soft landscape treatments encouraging urban cooling are aiming to:

- Develop interconnected green spaces, including our roads and streets;
- Plant trees in the city;
- Specify larger, faster growing trees (rather than smaller, slow-growing species) to create a higher impact on urban cooling (Rahman & Ennos, 2016);
- Keep cool air open corridors on the side of the space facing prevailing winds, to encourage movement of air;
- Plant and establish soft landscape treatments and make sure they are well-managed and maintained over time.

Shade has several environmental, economic, experiential and health benefits. Providing shade, adapting and reflecting solar radiation (i.e., evapotranspiration) (Dublin City Council, 2016; (Horváthová, et al., 2021) not only improves user experience and thermal comfort, encouraging outdoor activity as a result (Dublin City Council, 2016), but has been scientifically linked to reduce risks of skin cancer (Dublin City Council, 2016). Trees are excellent providers of shade, and simultaneously deliver placemaking, biodiversity and climate resilience benefits. Evergreen trees provide shade all year round while deciduous trees provide shade in spring through to autumn, letting light into space during the darker Irish winter months.

In a study across 293 European Cities, trees were found to have the potential to cool the land surface temperature of cities by up to 12°C (Nature Communications, 2021). Research undertaken in Amsterdam found a reduction in physiological equivalent temperature between 12 and 22°C in spaces shaded by trees compared to sunlit areas (International Journal of Biometeorology, 2018).

Landscape Professionals need to be mindful of the wider context when suggesting additional trees are planted, as there may be instances where shade is not beneficial. Additional shade provision might need to be re-considered if:

- It creates perception of risk;
- It limits solar gain and inhibits the health, longevity, and function of other landscape types e.g., grassland.

However, research shows that carefully selected and located deciduous trees can provide welcome shade in summer whilst facilitating solar gain in winter (Smith, et al., 2007).

Figure 3.28:
Mature tree planting providing shade.

DESIGN CONSIDERATIONS SUMMARY

Research suggests that streets and urban transport environments are better shaded when:

- Gradients of open areas and shade are developed: typically, edges between sun and shade are popular places for visitors in parks as these interfaces allow for; opportunities to adapt to diverse thermal conditions.
- Consider the provision of a ratio of 40% sun, 20% half shade and 40% shade (Klemm, 2018).

3.3.3 Plant Selection for Climate

The selection of a robust planting palette that can withstand rising temperatures is critical, particularly in the Core of settlements where temperatures will rise higher and water resources will be scarcer compared to around the edges of settlements and towards the Rural Fringe.

Urban planting needs to be increasingly coordinated with sustainable drainage systems (see Section 4.2.1) and therefore must be able to withstand surges of flooding as well as drought.

Soil conditions need to provide the right environment for plants to survive more frequent heatwaves, without reliance on water and irrigation.

Techniques for providing such an environment include:

- The provision of the right kind and extent of soil;
- Top dressing using organic or living mulches (ground-cover plants) which results in higher rates of water retention than bare soil (Kacinski, 1951);

Disadvantages related to the introduction of top-dressing and the use of mulches are:

- additional Project expense;
- potential introduction of new weed seeds;
- potential regeneration fail of desired seedlings.

Therefore, the specification of a multi-layered planting scheme negates the need for top-dressing except in the following situations:

- Need to provide additional organic nutrients to planting;
- Requirement to retain soils on slopes until plants become established (i.e. using a temporary hemp / net mulch when planting rain gardens);
- Need to establish a temporary, annual cover crop such as

Trees and plants selected must be able to accommodate predicted changes in the climate. Ireland has 28 native trees (Tree Council of Ireland, 2022) which have adapted perfectly to growing in and amongst the country's native landscapes and within the prevailing climate. Not all these species are appropriate for use in the public realm and streetscape.

These places present significantly more challenging conditions for growing and will be more acutely affected by the heat island effect as temperatures rise. Where the receiving environment is not sensitive and there is no long-term plan to create semi-natural habitats, Landscape Professionals should look to diversify the planting palette to include non-invasive, non-native trees, plants, and shrubs where appropriate.

Figure 3.29: Planting island in Amsterdam, Netherlands.

Figure 3.30: Planting for Pollinators. Midleton, Co. Cork.

Figure 3.31: The Tree Design Action Group published a Tree Species Selection for Green Infrastructure (2019) which targets how to improve species selection for urban resilience.

DESIGN CONSIDERATIONS SUMMARY

The following best practices should be considered when selecting plants and trees responding to climate resilience:

- Create or mimic habitats and ecosystems by designing planting in layers that help sustain one-another (i.e., ground flora, field layer, specimens), rather than planting a series of single plants in soil. This will increase heat absorption and reduce water use:
- The natural regeneration of the seed bank provides the most robust planting solution: this can managed to complement surrounding interventions;
- Select plants and trees that will thrive with the predicted weather extremes, considering each environment on a case-by-case basis;
- Consider organic and living mulches to retain water;
- In areas that are not ecologically sensitive, consider specifying non-native trees and plants that have adapted to warmer temperatures and extreme weather conditions.

3.3.4 Sustainable Drainage Systems

Recent Irish weather records show a national trend towards an increase in winter rainfall and decrease in summer rainfall, leading to issues of both flooding and drought. These records demonstrate an increase in the length of wet spell days across the country (EPA, 2020). Alarming statistics and headlines illustrate and evidence this. In particular:

- Annual precipitation increased by 6% in the period of 1989-2018
- The decade from 2006-2016 proved to be the wettest since the records commenced in 1711 (EPA, 2020).

In urban contexts where natural infiltration is reduced, rainfall runoff was calculated to be 400% greater in volume than in rural areas, creating conditions for extreme floods in severe rainfall events (LAWPRO).

In the 1990s, the idea of better managing rainfall runoff gained momentum in Ireland and started influencing design and planning thinking (SDCC, 2022). Although still a relatively recent concept, there has been a significant increase in number of publications and policies that identify issues with traditional drainage and propose sustainable drainage systems as an alternative option (SuDS) (SDCC, 2022).

Sustainable Drainage Systems (SuDS) are a collection of techniques and practices that can help managing excess rainfall through engineered and soft landscape treatments. SuDS are designed to mimic natural drainage systems, seeking to improve water quality and reduce quantity of water entering the drainage system.

Simple changes to urban transport corridors such as reducing the area of sealed and hard surfaces together with the reallocation of hard space to create permeable soft landscape areas should be the seen as a priority for SuDS implementation in any scheme. Tree planting also serves a SuDS function, firstly by intercepting rainfall through their canopies and by promoting local infiltration thanks to their root system.

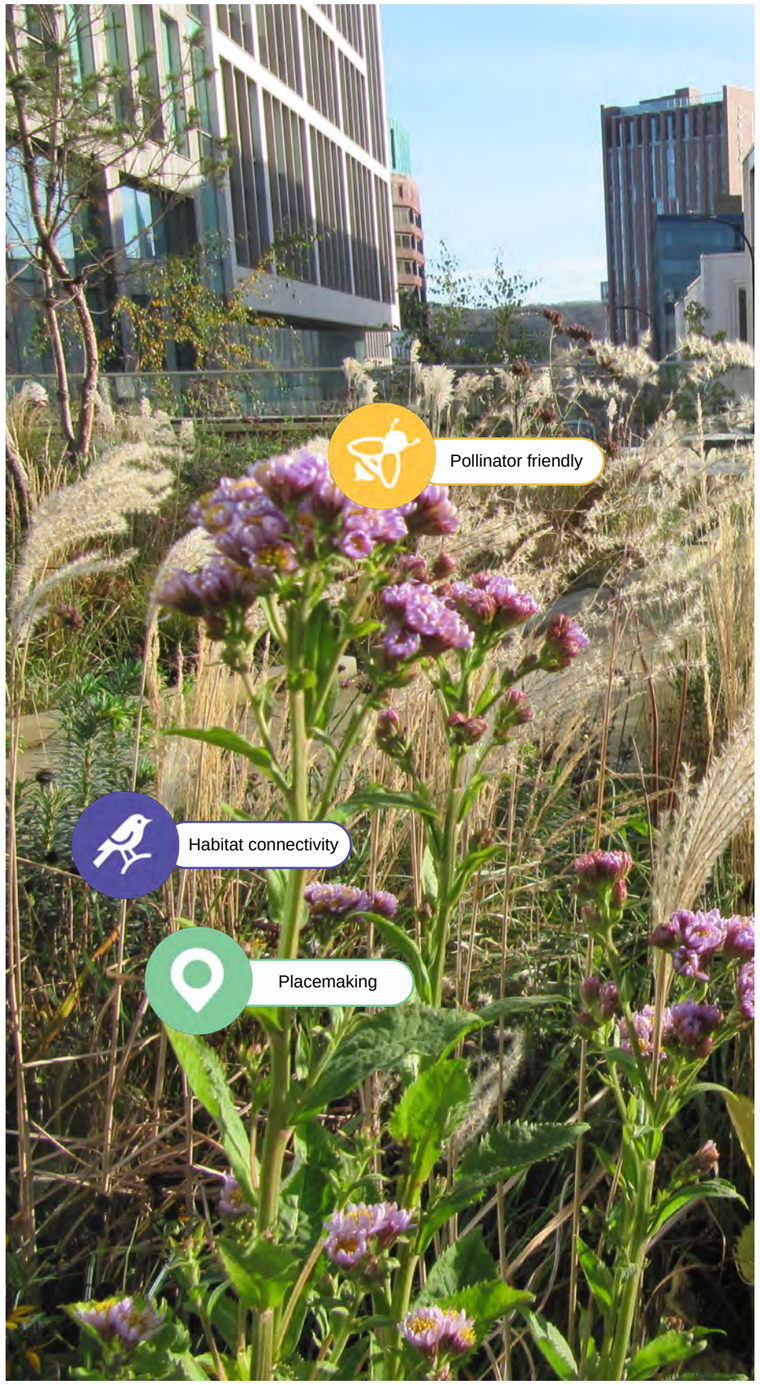
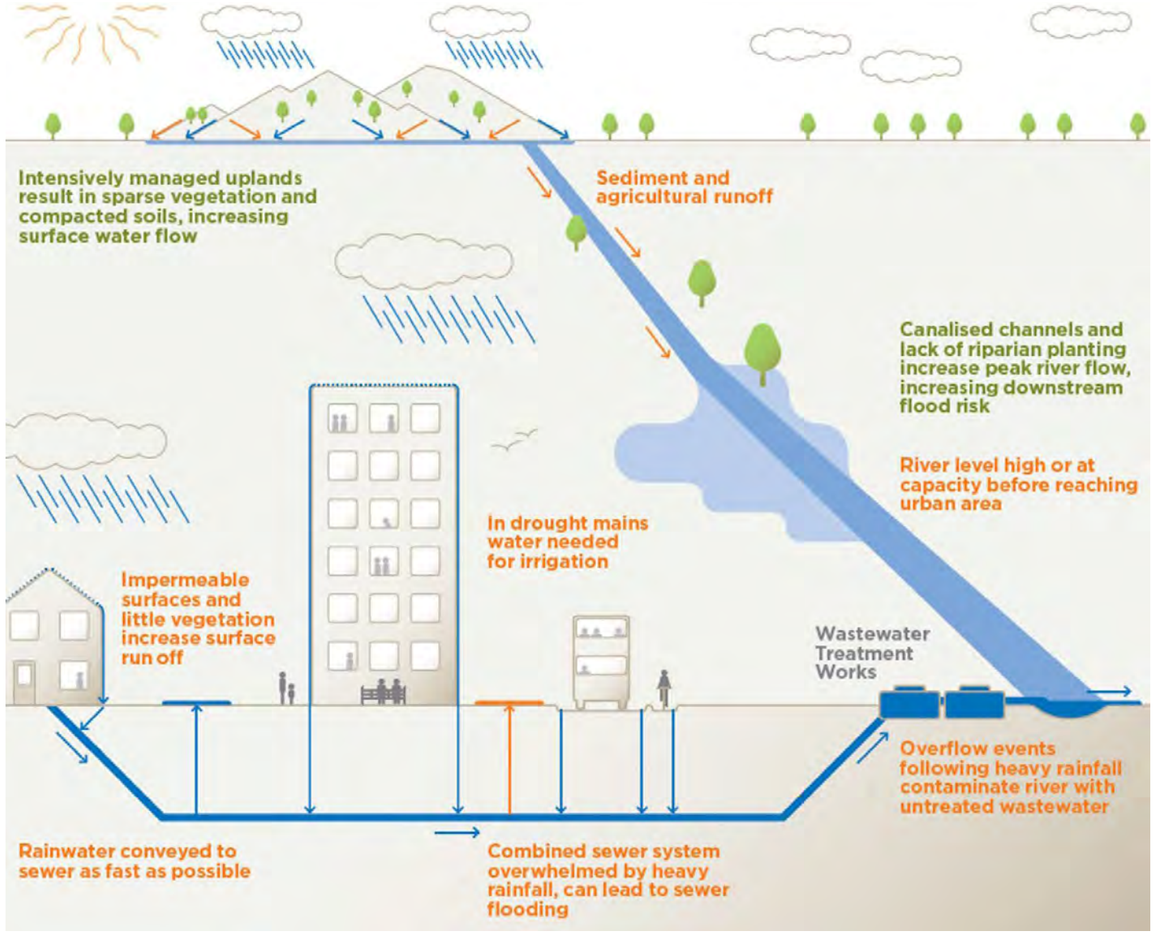


Figure 3.32: Sheffield Raingarden in Autumn. Image courtesy of Zac Tudor.



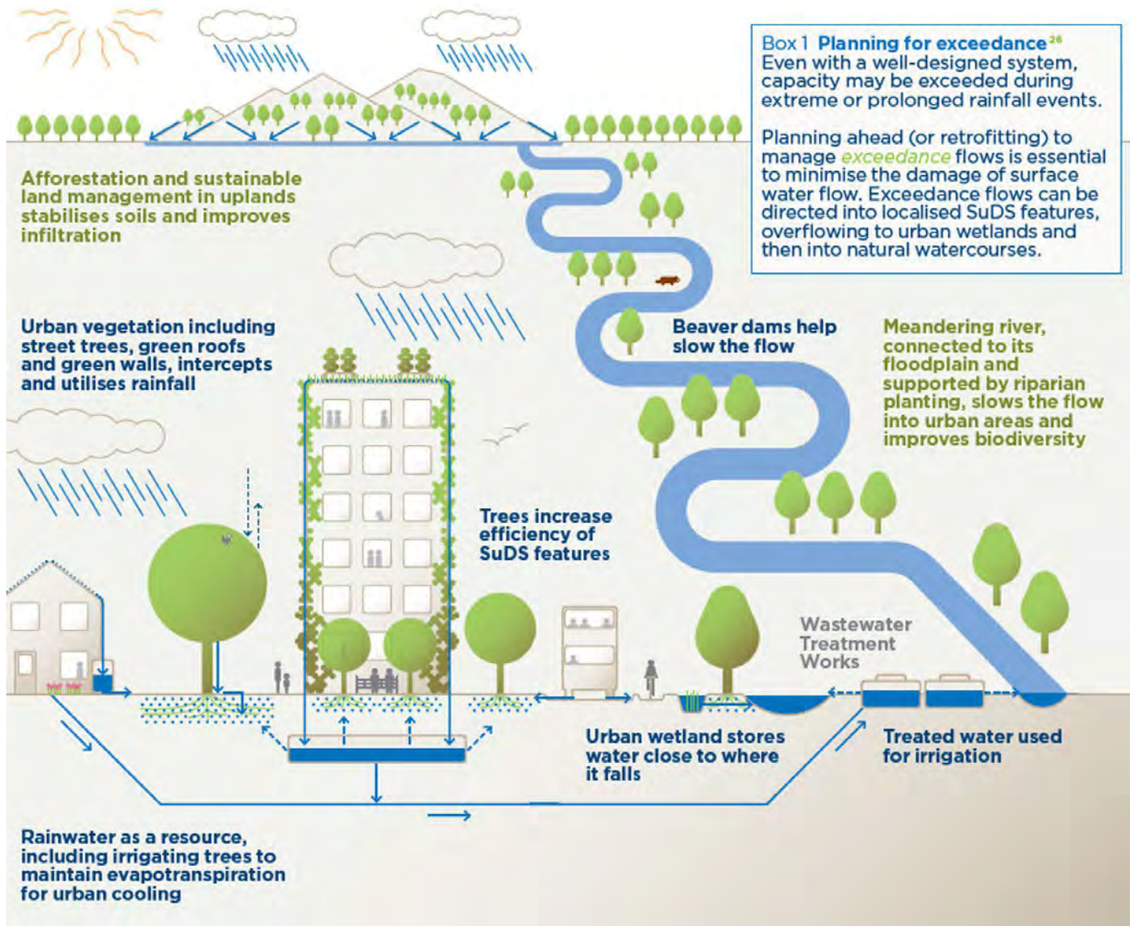
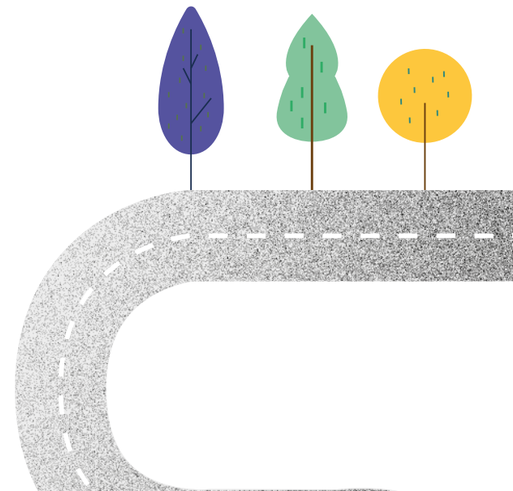


Figure 3.33: From First Steps in Urban Water: Managing Water as a Resource (2023).



Project Summary

40,000m³	108	1st
surface water removed from the public sewer network annually	*rain gardens created and 130 trees planted*	*'bicycle street' in Wales*

Figure 3.34: Greener Grangetown, Arup.

SuDS can also provide additional value by:

- Creating new habitats for biodiversity;
- Creating amenity spaces for the public,
- Helping improve air quality;
- Allowing for educational opportunities;
- Enhancing urban place making, and;
- Adding to the character and perceived safety of the street.

(DCC, 2016, 2021).

DESIGN CONSIDERATIONS SUMMARY

Key prompts for soft landscape incorporation within SuDS schemes are as follows:

- How can the creation of a SuDS scheme contribute to maximising biodiversity and placemaking opportunities;
- Consideration over management strategies and maintenance commitments;
- Limitations impacting the height of plants in relation to safety regulations
- Infrastructure cost (e.g., the cost of building a bio-retention tree-pit using engineered products versus a small-scale, multi-layered urban woodland);
- Appropriate plant selection, including species that will tolerate both long periods of drought and significant rainfall;
- Specification of a suitable permeable growing medium e.g. with voids, as appropriate.

Integration of SuDS systems need to be considered as part of the wider drainage strategy from Project inception by a multi-disciplinary team, as outlined in Section 1.2.1.

SuDS can be realised in a variety of ways, ranging in size and scale from narrow filter drains and single bio-retention tree-pits to larger rain gardens, swales, or retention ponds.

The solution adopted needs to ensure efficient drainage delivery and effective use of available surface.

Table shown in Figure 3.27 is based on material published in Our Green Region (Southern Regional Assembly, 2022) and it illustrates which SuDS interventions are best suited based on their contexts in and around settlements:

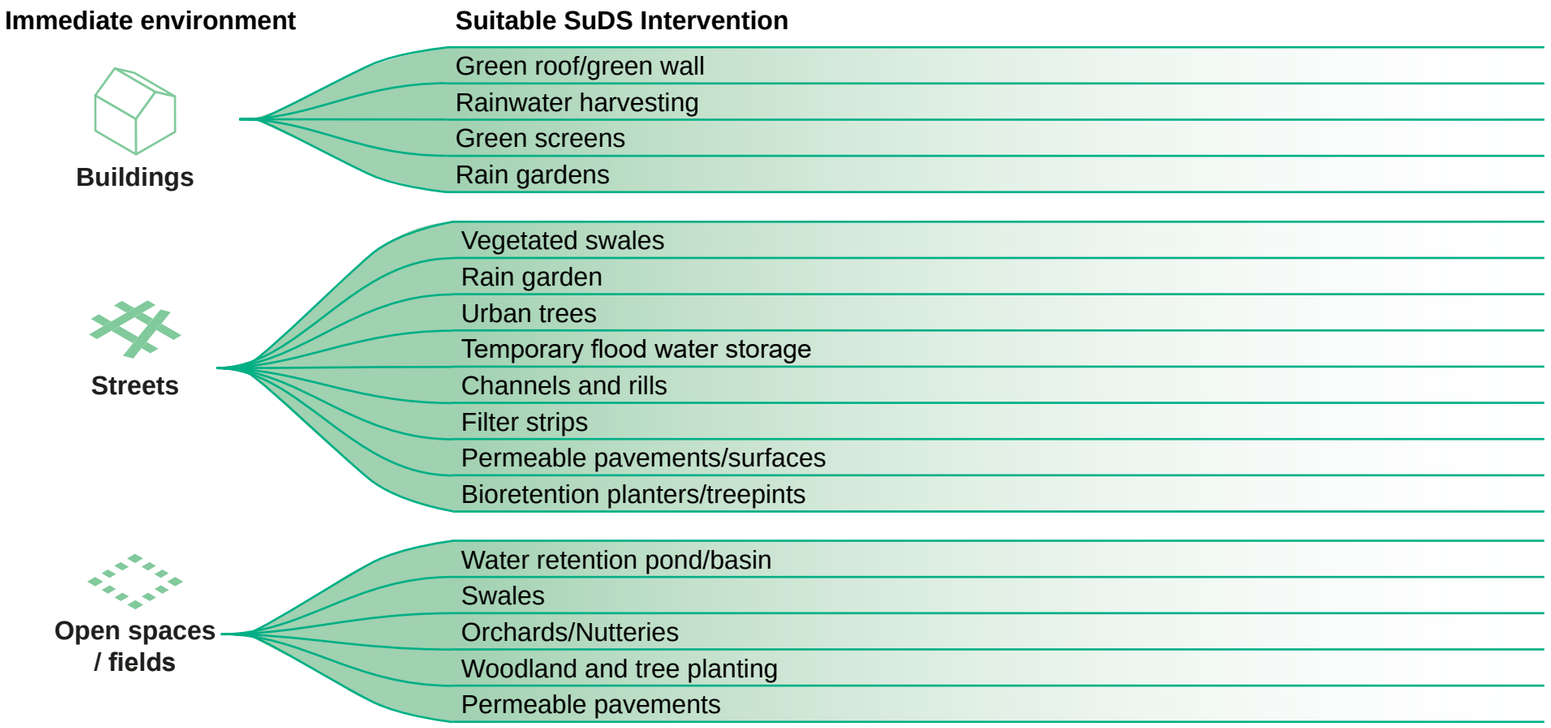


Figure 3.35: Suitable SuDS Interventions (Southern Region Assembly, 2022).

3.3.5 Improving the Quality of Resources

Low-quality and poorly designed urban environments can be a challenging place, making it difficult for communities and nature to thrive. However well-designed soft landscape treatments can improve:

Air Quality

Water Quality

Soil Quality

These impacts along with actions that relate to the design and specification of soft landscape treatments are presented in this section.

Air Quality

Air pollution is the biggest environmental risk to health. Globally, nine out of ten people live in a city that does not comply with WHO air quality standards.

It is worth noting that the identification of the right kind of soft-landscape treatments and species needs to be location specific. Although urban trees are known to reduce air pollutants, there are other influencing factors such as the wind, street arrangement and orientation, tree species, and canopy that need to be considered.

Figure 3.36: On Dominic Street and as part of the LUAS scheme, Pine trees were selected for their year-round impact on air pollution. Image taken from Google Street Maps.

Air Pollution and Tree Species

Research has shown vegetation species selection impacts on PM air pollutants' reduction. (Ferranti, 2019) clarifies that:

- Coniferous and evergreen trees can tackle air pollution all year-round; however, coniferous trees in particular may not be the best choice for planting near sources of air pollution due to their sensitivity to salt levels in soils and ability to block the sun in winter;
- Small, stiff, and complex leaves tend to be more effective than larger, less rigid and less complex leaves (Barwise & Kumar, 2020).

The Location of Soft Landscape Treatments and Air Pollution

The location of green spaces and soft landscape treatments in relation to sources of air pollution can significantly reduce the latter. Research has found that the green spaces can remove PM when particles are wither deposited on leaves or in the soil. Vegetation also creates a rough surface that encourages air to mix (Ferranti, 2019).

Water Quality

Ireland has experienced a 4.4% decline in its surface water quality since 2015: only 53% rivers and 50.5% lakes were in a good ecological condition in 2019 (EPA, 2020). However, Ireland's groundwater and coastal water bodies have retained their high quality and are relatively doing much better than the European average (EPA, 2020).

Trees help increase water infiltration rates and bind the soil together, reducing runoff and inhibiting sediment deposit in water bodies (Woodland Trust, 2012). Moreover, trees act as nutrient sinks by trapping pollutants through their soil and leaf litter.

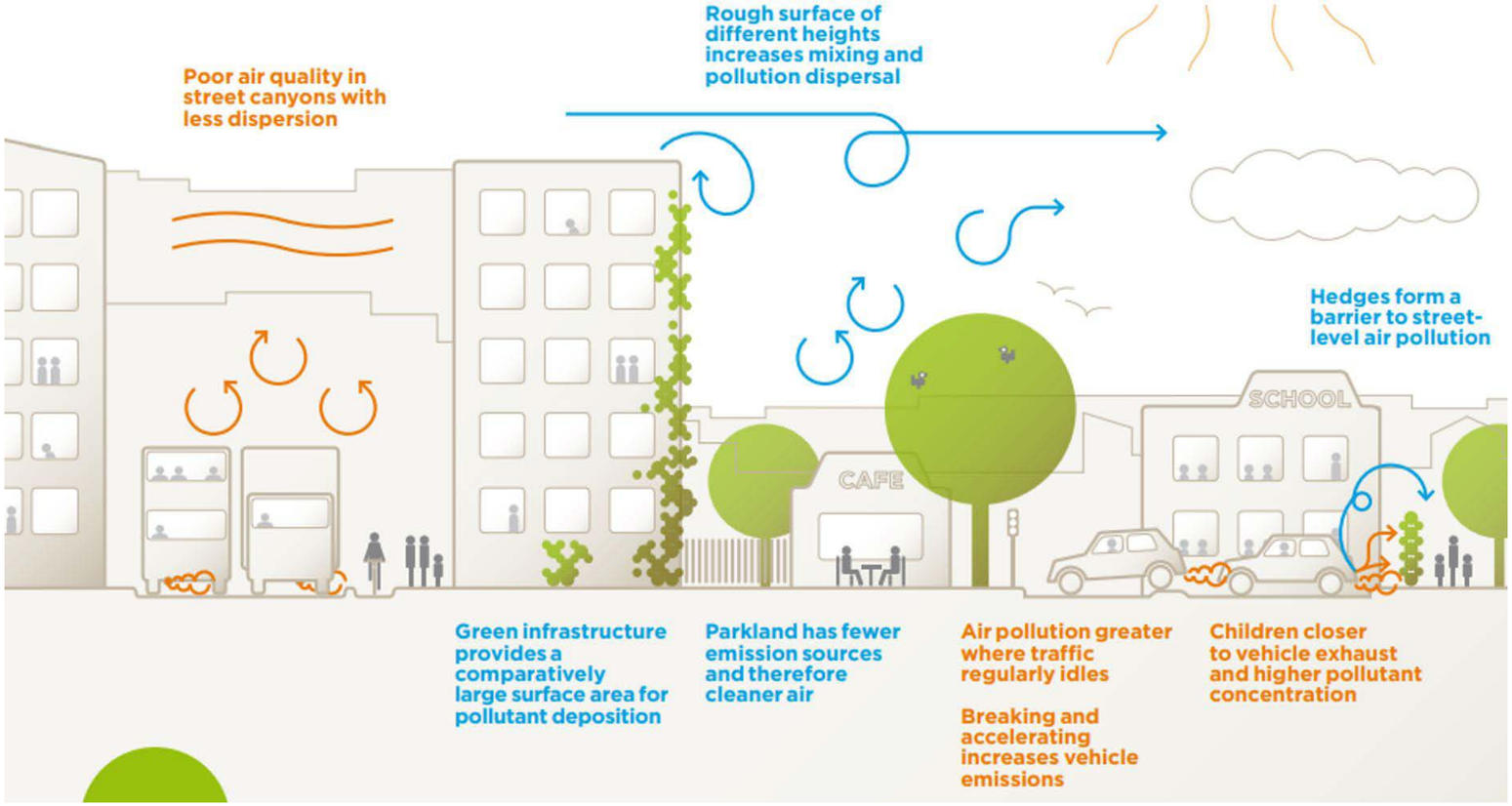


Figure 3.37: Diagram from First Steps in Air Quality. (Ferranti et al., 2019)

Trees, sustainable drainage systems and vegetation can be employed as buffers near areas most vulnerable to runoff. To increase their effectiveness, that is to say to encourage the slower passing of water through vegetative buffers increasing its cleansing properties, Landscape Professionals should consider the following:

- The size of the buffer, e.g. *A bigger buffer would typically deliver greater benefits;*
- Appropriate use of gradients, e.g. s*lopes steeper than 7 degrees do not act effectively as buffers as water would flow too fast;*
- Soil type and permeability, e.g., *porous soils encourage quicker movement of water, while clayey soils heavily restrict water movement* (Woodland Trust, 2012).

Figure 3.38: Rock Road, Dublin. Before and after implementation of a rain garden to replace the hardscaped island. Image taken from Google Street Maps (December 2022 and June 2023).

Figure 3.39: SuDS in Grey to Green, Sheffield. Image by Zac Tudor.

Soil Quality

Healthy soils are biodiverse and can sustain plants, animals, and communities. Soil microbes ensure the soil ecosystem correct functioning and ensure it retains nutrients, holds water, filters pollutants, and absorbs carbon.

Soil health is frequently overlooked although healthy soil has the potential to absorb three times the amount of carbon compared to vegetation. Conversely, poor quality soil can damage ecosystem health. Soil is a critical asset and therefore an element included within the EIA process.

Planting is essential to soil health as plants are able to feed absorbed carbon into the soil through their roots: carbon in turn supports soil microbes and protect against erosion.

Soils have physical, environmental, and chemical characteristics. These characteristics include structure, texture, density, nutrient composition, pH, organic matter content, microbiota abundance and diversity, and density.

Soils can be degraded if compacted or poorly mixed: if the damage is not irreversible, that is to say if its natural porous structural make-up is not impacted, soil may still take years to recover. Soil's natural structure enables aeration, drainage, and biodiversity health. Where possible, natural topsoil should not be overrun by site machinery insofar as possible.

Where natural soil must be traversed the following actions are recommended:

- Restrict works to smallest footprint possible;
- Only traverse soil when conditions are dry;
- Use ground protection mats and mulches (bark or woodchip) to protect soils during works;
- Carefully lift, store and reinstate soils;
- Minimise exposure of bare soils – to prevent run off, and;
- Divert water from newly top-soiled areas.

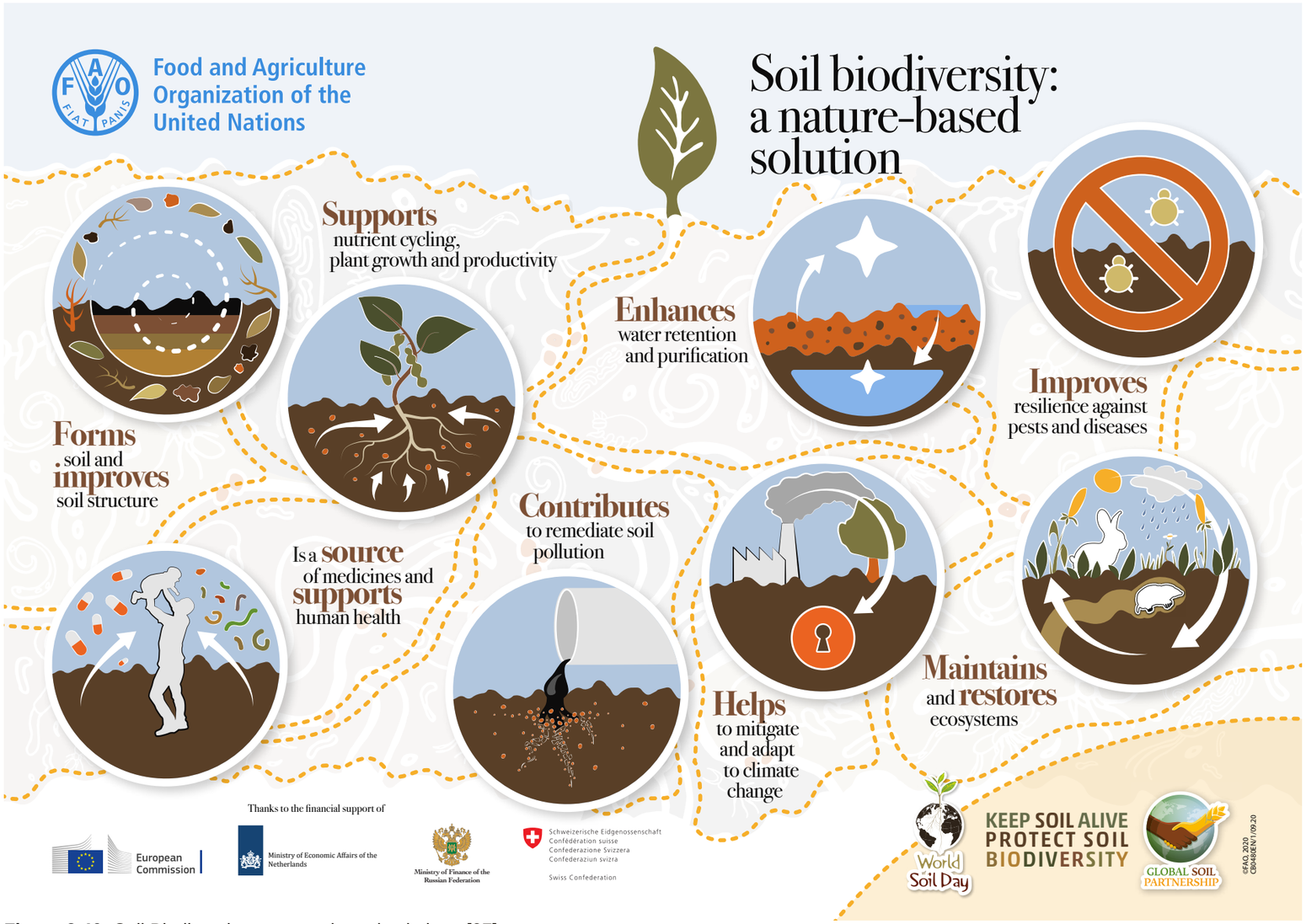


Figure 3.40: Soil Biodiversity: a nature-based solution. [27]

DESIGN CONSIDERATIONS SUMMARY

To safeguard and contribute to improve soil quality Landscape Professionals need to:

- Understand the existing soil quality to determine whether it should be protected, restored or re-used;
- Collaborate with ecologists to determine an appropriate rewilding or planting strategy to achieve desired actions;
- Collaborate with design and construction teams to plan for the effective safe-guarding and re-use of soils across all project delivery stages.

In addition to this, the native tree species shown below positively impact on soil quality:

Alder *(Alnus glutinosa)*:
helps fix nitrogen, however their quantity needs to remain in check as large scale planting can risk acidification.

Willow *(Salix ssp.)*:
good nutrient sink with fast growth rate.

Poplar *(Populus ssp)*:
good nutrient sink with fast growth rate; although on one hand it provides a strong filtering and stabilising effect (Woodland Trust, 2012) as it is not a strong tree it will need to be replaced in the long term.

Figure 3.41: Selection of native tree species which have a good impact on soil quality.

3.3.6 Resource Efficiency

The need to optimise the use of resources has never been more pressing, with increasing strains deriving from climate change, population growth, mobility, natural materials use, and lifestyle choices. This is leading to a scenario where planetary boundaries are being exceeded in several areas, including the annual over-production of materials and the depletion of the available water resources (Stockholm Resilience Centre, n.d.).

The term circular economy is used to describe

"An economy which is restorative and regenerative by design, and which aims to keep asset components and materials at their highest utility and value at all times. The circular economy involves separating growth from the use of scarce resources through production models based on long life products that can be renewed, reused, repaired, upgraded or refurbished and requires significant changes from product design to new business and market models, new ways of turning waste into a resource to new modes of consumer behaviour"

(TII, 2022).

The widely referenced 9Rs form a key basis for circular strategies and provides a simple insight into key themes. Main objectives are summarised below:

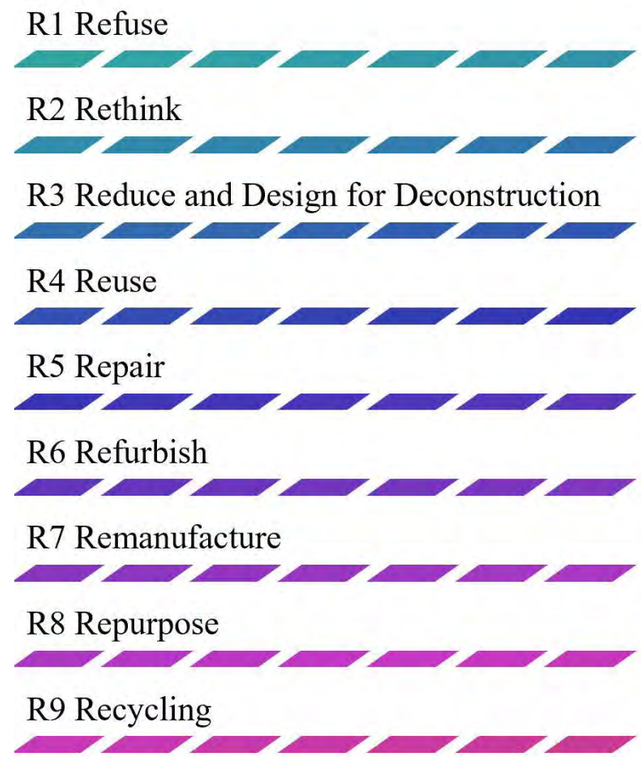


Figure 3.42: The 9Rs of Circular Strategies.

1 Re-think Traditional Solutions	• Challenge attitudes to vegetation and aesthetics; • Reduce the use of lawn other treatments that require intense maintenance and generate low levels of biodiversity; • Avoid importing topsoil where possible (Refer to Section 3.2.6 on soils and the circular economy); • Reduce the depth of tree pits and let trees share root space (Trees&Design Action Group, 2014).
2 Re-use Existing Materials	• Retain and re-use soil; • Accept low fertility soils: these for example can be used towards establishing a richer diversity of wildflowers. Further recommendations can be found in the All Ireland Pollinator Plan (National Biodiversity Data Centre, 2019); • Reuse existing and found materials such as stone, setts, hardcore, concrete, sand, timber to engineer soils: these can be in fact incorporated in elements requiring mounding build-ups across public realm and play schemes, as well as to provide street furniture and habitat creation or used as mulch (see Sheffield's Grey to Green and Dublin's Bridgefoot Street Park Case Studies below); • Use construction consolidation centres and resource sharing networks to facilitate exchanges between projects; • Reuse old rootballs either on site or elsewhere. This will contribute to strengthening banks and developing mulch.
3 Re-think Plant Selection and Specification	• Design in response to local aspirations (for example the provision of a community garden or supporting the local aspirations to plant more trees). • Design to accommodate and respond to locally valued assets (for example, if a particular habitat, land use, view or activity can be integrated into plans).
4 Understanding community needs and requirements	• Let the natural seed bank in soils colonise areas planned for vegetation (this process needs to be carefully managed in urban areas). Proposals need to refer to the All Ireland Pollinator Plan (National Biodiversity Data Centre, 2019); • Using local seed banks to establish semi-natural meadows and grasslands, e.g. using hay cut from neighbouring fields; • Sow seeds rather than specify nursery grown plants; • 'Right plant for the right place': to ensure its longevity, planting selection needs to be site specific and appropriate for the receiving environment; • Specify plants with the lowest carbon footprint possible (see Section 3.2.8); • Balance carbon emissions through good design; • Avoid the use of single-use plastics in the landscape tender specification insofar as possible; • Use alternative growing mediums to imported topsoil; • Ensuring circular concepts are embedded in the maintenance plan, e.g., use of on-site green waste facilities to generate compost (see below).
5 Establish Partnerships	• Within the Project team, explore and discuss options to re-use local 'waste' materials. For example, as part of Sheffield's Grey to Green project, residue from beet washing was integrated into soils as a natural fertiliser. This excellent example also demonstrates how local knowledge can improve circularity and reduce costs; • Check whether deliveries' packaging can be re-used locally by community groups, e.g., in art projects; • Seek opportunities for plant waste (i.e., hemp, straw, wood, chippings, leaf material) to be used for manufacturing (e.g., thermal insulation products), drainage materials or compost; • Consider potential contribution to community compost heaps or habitat reaction initiatives; • Look at ways for 'waste water' or other outputs from nearby industries / businesses to be used to irrigate plants as they become established (European Green Capital, 2018); • Engage with local Tidy Towns groups and other local community organisations on Shared and Community Maintenance for more guidance.

Figure 3.43: Approach to Circular Economy in implementation of Soft Landscape Treatments.

Soils and The Circular Economy

Providing high levels of fertility to soils has traditionally influenced soil composition and depths in urban areas. This approach sought to grow large specimen plants: while this may be appropriate to private gardens, high soil fertility generally leads to an increase in non-target (weed) species, with consequent high resource depletion (i.e., loss of soil from agricultural fields) and maintenance costs. Current practice of introducing lower fertility soils is challenging these assumptions and has led to a reissue of BS 3882, where lower fertility soils are recommended for supporting biodiverse / species rich habitats. This shift towards lower fertility soils aligns with best practices promoted elsewhere. In the UK for instance, National Highways (England) recently introduced Major Projects Instruction (MPI) 85 Low Nutrient Grassland.

In relation to The National Highways (England) Policy, Clare Warburton, Natural England's Green Infrastructure Principal Advisor, said that

"Low nutrient verges can help to reduce the likelihood of invasive species like creeping thistle, and increase native species we love to see, like oxeye daisy and bird's-foot trefoil and even rarer flowers, such as orchids, as well as being great for bees and pollinators"

(Highways England, 2020).

Using Low Fertility Soils

Lower fertility soils are typically composed of locally sourced materials, with good drainage / infiltration properties. Opting for this type of soils can promote a more efficient use of resources.

The specification of low fertility soils: relies on a good understanding of the proposed plant requirements. Conversely, a good understanding of the available soil and its properties leads to the adoption of the most appropriate re-wilding techniques.

Low fertility soil can be manufactured by engineering of existing materials found on site or in its proximity, for example:

- Waste material from old rubble and fill;
- Crushed concrete or stone aggregate from recycling old footpaths material.

These materials would then be mixed with a small proportion of loam soil and composted green waste. Careful consideration needs to be given to the material composition, with regards to grading, to ensure correct aggregate size ratio is achieved (i.e., 20mm aggregate and sand).

When preparing engineered soils, it is important for Landscape Professionals to consider and specify:

- How materials can be mixed off-site, to guarantee even distribution of the organic materials;
- Material testing regime to be applied to all elements, to ensure use of materials free of asbestos, glass or other potentially unsafe and harmful material that could pose a risk to people or animals.

Figure 3.44: Native Wildflowers growing in Lower Fertility Soils along roadside verges.

Structural Soils

Structural soils are composed of different materials, often in separate layers, resulting in better drainage properties, good structural integrity or a reduced weed growth than traditional methods (Refer to Guidance Document (GD) GE-ENV-03001 for technical information). Recycled 'waste' materials can be incorporated into structural soils.

Sterile Mulches

The inclusion of sterile mulches for perennial planting schemes can be used on existing grassed site or those that are prone to weed proliferation. Sterile mulches are composed of layers of sand, gravel, and weed-free general waste compost, typically 100-200mm thick: their composition and thickness will limit the weeds' ability to grow without the use of herbicides and will help retain water reducing therefore the need for additional watering. This approach may increase upfront costs but will prove more efficient from a maintenance perspective over the longer term.

Case Studies

Grey to Green, Sheffield - Use of sand as a sterile mulch.

Sterile mulches using reclaimed materials are detailed by Nigel Dunnett in “Naturalistic Planting Design, The Essential Guide” and may be seen in The Sheffield Grey to Green Scheme.

Photo taken from https://www.nigeldunnett.com/grey-to-green-2/

Bridgefoot Street Park, Dublin - Park composed of demolition debris.

Photo taken from https://landezine-award.com/bridgefoot-street-park/

Carbon Positive Plant Specification

Ireland is committed to net zero greenhouse gas emissions by 2050, including a 51% reduction objective for the year 2030 as laid out in the country’s Climate Action Plan (Department of the Taoiseach, 2021). This ambitious target calls for a holistic action plan and requires all sectors to make efforts towards reducing their carbon footprints.

Retaining existing stock as well as planting new trees and planting in and around settlements brings considerable benefits in reducing our carbon footprint, thanks to the vegetation ability to process carbon. Design teams should make informed decisions in relation to carbon costs and benefits on Projects.

This involves:

- Understanding the carbon cost associated with design decisions;
- Understanding carbon benefits associated with each design decision, future maintenance required, and how long it could take to achieve these goals.

Although there is no one-stop source to refer to, the Climate Positive Design App can help Project Managers understand how long it could take to offset a Project carbon footprint.

climatepositive design

Climate Positive Design **Scorecard**

Materials

Element	Total impact
Organic Mulch	0 kg
Drain Rock - Class 2 Permeable	134.2 kg
Plastic Filter Fabric	2.4 kg
Subtotal	**137 kg**

Plants

Element	Total impact
Perennials	1,588 kg
Deciduous Medium trees	2,580 kg
Subtotal	**4,168 kg**

Operations

Element	Total impact
Volume of Soil Imported	467.6 kg
Subtotal	**468 kg**
Net Impact over 50 Years	3,564 kg CO2-eq

climatepositive design

Climate Positive Design **Scorecard**

Roadside Bed - Typical

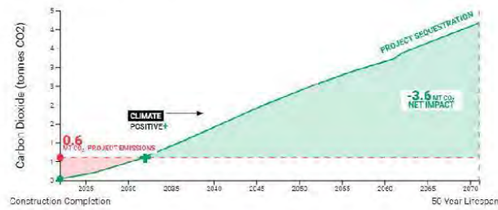
- Bed 10m x 4m

10 years to positive

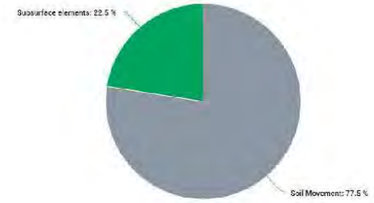
Project Name **Carrick Planter**
Type of project **Streetscape**

Net Impact over 50 years	**-4 Metric Tons**	**Total Area**	**40 sq metres**	**0 hectares**
Total Material Emissions (Embodied Carbon)	137 kg CO_2-eq	Planted area	0 sq metres	0% of total area
Total Plant Sequestration	4,171 kg CO_2-eq	Emissions per area	15.1 kg per m2	
Total Operational Emissions	469 kg CO_2 eq	Sequestration per area	104.3 kg per m2	

Net Project Impact



Project Emissions



Version Stats

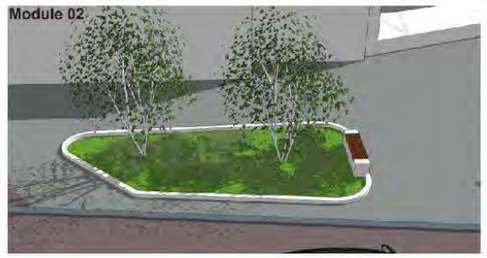
Your project will sequester **3.6 tonne** more carbon than it emits in its estimated lifespan

Your project is expected to reach climate positive in 10 years, in 2032.

Your positive score is in the upper 56th percentile of projects in our database.

OPTION 1

- 2 medium deciduous tree
- low perennial
- 40m3 imported topsoil
- 150mm drainage layer
- 40m2 Filter membrane
- Mulch 50mm



The following sections provide additional information on the carbon footprint and carbon sequestration rates on different soft landscape treatments.

Carbon Footprints of Soft Landscape Treatments

Each planting type has a carbon cost associated with its production, growth, packaging, and transportation. The carbon footprint of soft landscape treatments can be calculated based on a whole lifecycle assessment (Dewayne & Fernandez, 2012). This knowledge can inform design decisions and the selection of appropriate soft landscape treatments and species.

This approach comes with its own set of challenges. At present, it is difficult to collect accurate data due to the variables associated with accounting direct and indirect emissions. Direct emissions associated with particular processes are easier to calculate – for example energy and materials used during the production and transportation of plants. Indirect emissions associated with the supply chain are ambiguous and necessarily included in carbon calculations.

Life cycle assessment (LCA) is an effective and internationally accepted methodology used to estimate the cumulative carbon footprints of products. The LCA method, an analysis technique which assesses environmental impacts associated with all the stages of products life, including the production, maintenance, and disposal of a type of vegetation. Identifying such steps can provide better insight into the environmental impacts of the various processes involved and help reduce the carbon footprint where possible through an informed approach.

The table below shows carbon footprint (a term sometimes used interchangeably with Global Warming Potential (GWP)) related to the production systems for typical nursery grown vegetation types. Figures provided in the table are expressed in kilograms of CO2-equivalent, meaning that the amount of C02-equivalent shown in the table represents the CO2 amount that would have the same global warming potential as the given vegetation when measured over 100 years. The carbon footprint calculation includes variable costs involved in the stock production, such as heating, electricity, fossil fuel combustion related to the equipment used for maintenance and the transplantation processes. Finally, the research shows that nursery grown trees have a significantly higher carbon footprint than herbaceous perennials.

It is important to consider carbon footprint and production impacts in relation to sequestration rates. Evergreen trees, for example, have the highest production impacts but they also sequester the most carbon. Sequestration benefits can easily be lost through poor maintenance if trees fail to establish and must be replaced.

Figure 3.45: Roadside verge in Trim, Co. Meath planted for biodiversity.

Carbon Sequestration properties of Soft Landscape

Carbon sequestration is the process of capturing and storing atmospheric carbon. Vegetation is often used to justify carbon-intensive interventions on Projects. Hence, Landscape Professionals need to carefully consider how effective different types of vegetation are in relation to carbon sequestration.

A summary of carbon sequestration and storage capacity for different habitat types is presented below (Gregg, et al., 2021).

Habitat	Carbon Performance
Native woodlands	Native woodlands sequester the highest amount of carbon amongst all semi-natural habitats. Variation is noted according to species, soil type and climate. Carbon Sequestration continues for centuries. The rate of sequestration declines over time, but native woodlands are important carbon stores.
Peatlands	Peatlands sequester carbon slowly but can continue indefinitely making them the most effective carbon sinks after woodlands
Salt marshes	Saltmarshes possess strong sequestration and storage potential but are vulnerable to erosion and rising sea levels
River, lakes and wetlands	Complex interactions within water bodies make it difficult to measure carbon sequestration rates. Yet water bodies are an essential part off the carbon cycle. The sediments within lakes sequester carbon whilst wetlands have large carbon storage capacity. There are gaps in the research on marine sequestration.
Heatherlands & semi-natural grasslands	Grasslands sequester less carbon than salt marshes, peatlands and woodlands but achieve short-term gains. Grazing also reduces carbon storage capacity

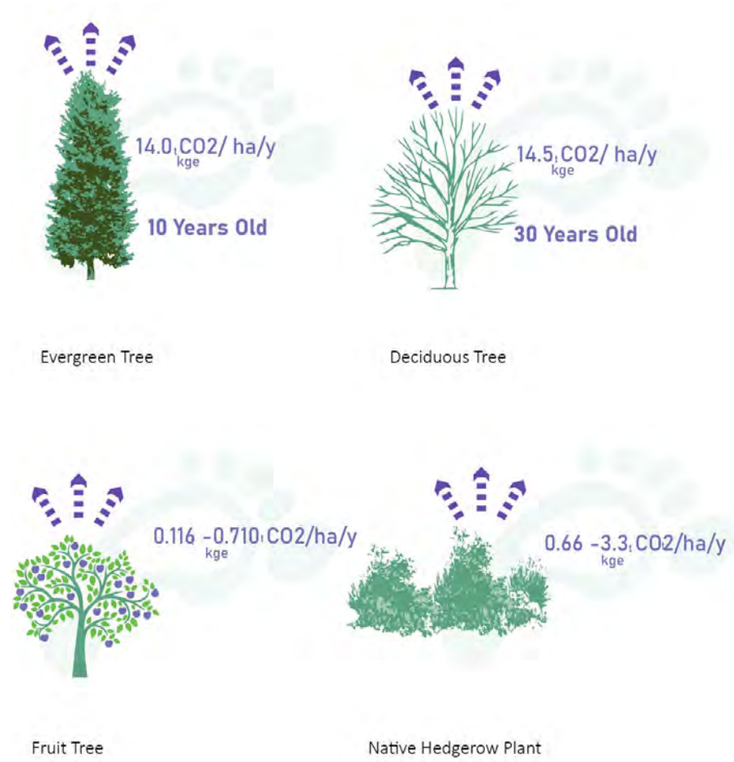
Highest

Less high

Figure 3.46: Townley Hall Woods next to N51, Slane.

The combined effect of habitats on carbon sequestration is more common and better documented, however gaps remain in the research with inevitably some habitats and species being studied more than others.

There is limited information available regarding the overall impact of their independent effectiveness. The table below indicates the amount of carbon sequestered by single plants over their lifetime. Estimates are provided in metric tonnes of Carbon Dioxide Equivalent per hectare every year (kge). These figures do not factor in potential emissions from management and maintenance procedures, or the original carbon footprint associated with production.



It is worth noting that a ten-year-old evergreen tree absorbs 14 kg of carbon dioxide per year, meaning 178 evergreen trees are required to absorb 2.5 tonnes of carbon dioxide. To put this in perspective, a typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year (EPA, 2018).

Simple ways to reduce carbon footprints and sequester more carbon using soft landscape treatments would include:

- Limit grass cutting and ornamental tree pruning (to maintain pleached trees for example), to reduce the amount of fuel used;
- Convert grass lawns to semi-natural plant communities or shrub areas;
- Plant more trees;
- Make space for roots which are effective at storing carbon.

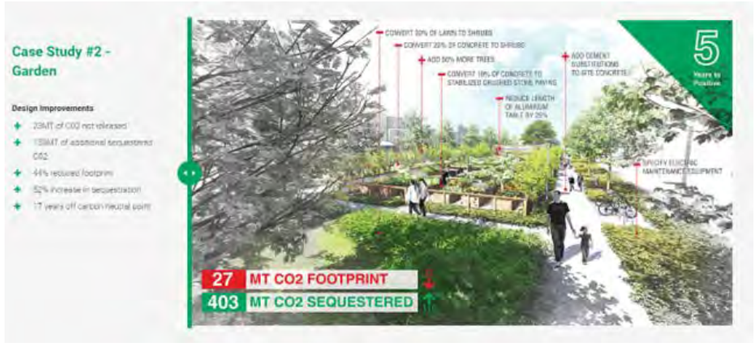


Figure 3.47: Tree planting along N71, Clonakilty.

3.4 Biodiversity Positive Soft Landscape Design

"Biodiversity is essential to our way of life, and plants, birds, insects and people can prosper here – and support one another to prosper"

(Grey to Green Sheffield, n.d.)

Biodiversity can be summarised as the variety of life that the world supports, and it is a measure for the health of our ecosystems. The intrinsic value of implementing biodiversity positive schemes benefits people as well as nature. Ireland's biodiversity ranks low in global terms, depleted over years of development and over-exploitation of natural resources, particularly in around our towns and cities. This biodiversity loss threatens the environment, cultural heritage, the economy, society, and quality of life.

The government's National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage, and the Gaeltacht, 2017) sets out objectives and measures with the aim of reversing this loss and enhancing biodiversity across all habitats. These objectives can only be achieved by organisations and individuals working in partnership. TII's Environmental Strategy ensures biodiversity is a key factor of transport corridors and strives to enhance biodiversity through suitable design and management which considers protection and nurturing of natural biodiversity as key factors in achieving long term preservation and enhancement of biodiversity in the Irish landscape (TII, 2019).

DESIGN CONSIDERATIONS SUMMARY

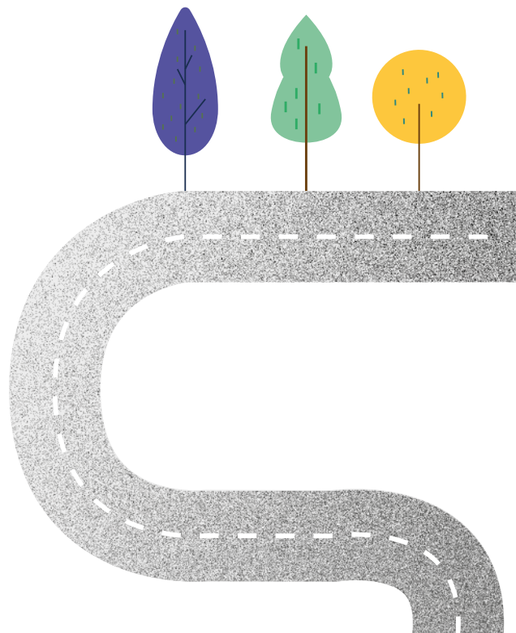
Landscape Professionals working in multi-disciplinary teams have a critical role to play in the pursuit of better biodiversity, which can be achieved in the following ways:

- Preserving existing species and habitats that are of value;
- Preserving biological cultural heritage;
- Collecting the right data to inform design, management, and monitoring;
- Defining Habitat Objectives for the Project (often achieved in consultation with the Local Biodiversity Officer);
- Developing biodiversity positive strategies;
- Developing design strategies for achieving biodiversity positive outcomes;
- Planning and monitoring the delivery and management of habitats against Habitat Objectives.
- Aligning with the local authority Biodiversity Action Plans if such in place.

Project Ecologists have a critical role in all of these stages and should be part of multi-disciplinary teams.

Figure 3.48: Shared community garden in Abbeyleix.

https://www.laoistoday.ie/2020/10/16/in-pictures-all-smiles-as-abbeyleix-climate-action-project-launched/



3.4.1 Existing Species and Habitats and their Value

Biodiversity shall be considered a fundamental part of the design process from the Project outset and shall be informed by evidence, collected and analysed by ecologists. This approach adds value to the Project by:

Minimising:

- Potential risks to existing habitats;
- The occurrence of late design changes on Projects, and;

Maximising opportunities to:

- Incorporate new habitats;
- Support policy objectives;
- Connect the site to wider nature networks, and;
- Bring people and nature together.

Existing habitats can be valuable assets, in particular if they are rare or have the potential to support a wide range of species. Retaining such habitats and developing the design to integrate them can also deliver cost saving when establishing new habitats.

In contrast, there may be lower value habitats on site, which can be seen as a constraint to development. In these cases, compensation can be used to support higher levels of biodiversity in the future.

Ecologists can provide detailed studies of habitats and species on site to inform the spatial arrangement of layouts, plant specifications and management prescriptions. The starting point for any survey on existing habitats and species is likely to be desk-based, and can be carried out for example by reviewing information held by the National Biodiversity Data Centre. This includes a review of Biodiversity Maps (Biodiversity Maps, 2022), a national portal that compiles biodiversity data from multiple sources and publishes it on-line.

Figure 3.49: The Best Practice Guidance for Habitat Survey and Mapping published by The Heritage Council in 2011.

The Heritage Council has published Best Practice Guidance for Habitat Survey and Mapping (Smith, et al., 2011), providing comprehensive information on how to classify and assess the value of existing habitats and record the related data. Five main steps are recommended:

- Step 1: Planning the scope and execution of the habitat survey in line with survey objectives;
- Step 2: Review of desktop information to assist field survey work;
- Step 3: Field-based habitat survey and mapping, and compilation of additional information dependent on study objectives;
- Step 4: Compilation of the final habitat survey GIS database, other data and project report;
- Step 5: Interpretation of the results of the habitat survey and ecological studies beyond habitat surveying.

In addition to habitat surveys, if existing trees are likely to be affected, a tree survey should be carried out by a professional Arboriculturist prior to any design work, in accordance with BS5837 (2012) (Refer to Section 5.1.1). In most cases, Planning Authorities in Ireland would require Arboriculturist's inputs in planning applications.

3.4.2 Collecting the Right Data

It is particularly important to identify any protected habitats or species that may have legal protection.

Data plays an increasingly important role in the design process and where possible, data should be recorded in a format that can be used in a rich data environment, e.g. Geographical Information Systems (GIS) or Building Information Systems (BIM). Data from site surveys should be recorded by a suitably qualified professional in accordance with the National Biodiversity Data Centre biodiversity recording standards so that it can be shared with stakeholders. This information can help designers understand the current condition and distinctiveness of the existing habitats on and around the site.

3.4.3 Defining Habitat Objectives

Ecological surveys' analysis informs the definition of preferred Habitat Objectives for the existing habitats within the site: these objectives is turn can guide future management strategies and can be used to measure project success. These objectives should consider the value and condition of the habitat and any operational constraints.

DESIGN CONSIDERATIONS SUMMARY

Objectives for existing habitats can be broadly defined as:

- Conserve – Managing the habitat so it continues to function as its current habitat type;
- Enhance – Undertake management or intervention to improve the habitat's condition and ecosystem service functioning;
- Restore – Managing to assist recovery of habitat that has been degraded, damaged, destroyed or has naturally transitioned into another habitat type;
- Transform - Process of establishing a primary habitat different to that occurring at present due to health and safety or operational constraints (NetworkRail, n.d.).

Rich biodiversity can help provide and support a range of ecosystem services, the benefits the natural environment can provide to humans. Baseline environmental information can help designers understand the existing and potential ecosystem services that could be delivered, e.g., grassland which can also provide flood attenuation. The design should always seek to maximise biodiversity. For instance, smaller scale interventions such as individual street trees can still support winter bird feeding or can be positioned to provide shelter, etc.

Best practice demonstrates the benefits provided by a detailed understanding of the ecology and biodiversity of a site and its context, which include:

- The identification of any protected habitats or species, which must be considered; Retention of existing habitats with high biodiversity value, maximising the site's contribution towards the environment's health and minimising cost;
- Understanding the basis of ecosystem services' delivery.

Figure 3.50: Diagram outlining the benefits received from our environment (NatureScot, 2020).

3.4.4 Developing Biodiversity Positive Strategies

It is important to consider a specific site contribution to the wider nature network. For example, if a site is located between two key habitat areas, it could act as a stepping stone in connecting them.

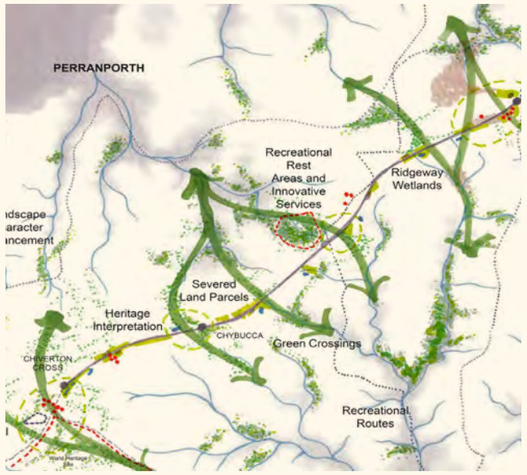
Research should therefore include a review of national, regional, and local strategies to consider how the project could contribute to the delivery of their objectives at an appropriate scale. Examples of this include Green and Blue Infrastructure Strategies, which establish frameworks for the development and management of multi-functional green spaces.

Within this context, it is important to consider whether the site presents opportunities for habitats which are rare or declining or for strengthening existing networks of habitats, e.g., connecting woodland with hedgerows, or expanding areas of species rich grassland.

All design initiatives along transport corridors should be in line with TII Biodiversity Plan and TII Landscape Plan.

Case Studies - Keyn Glas, Cornwall, UK

Arup devised the Keyn Glas project to find ‘beyond business as usual’ ideas for Highway England’s Environmental Designated Funds. It delivered an unprecedented and innovative programme of 15 landscape-scale projects covering 50km2 of central Cornwall. The aim was to re-connect and enhance the fragmented countryside either side of the A30. Collectively the projects delivered benefits to the landscape, wildlife and communities, much greater than the sum of their parts. Three of these projects, known as Green Ribs exemplify the landscape scale approach taken each Green Rib delivered over 90% Net Gain in biodiversity.



Project Summary

5,000ha
site area

100-250%
biodiversity net gain in habitats and hedgerows

10year
land management plan

3.4.5 Design Approaches to Achieving Biodiversity Positive Outcomes

Landscape Design and Soft Landscape Treatments can be a key tool in allocating space to existing and proposed habitats and vegetation.

DESIGN CONSIDERATIONS SUMMARY

Approaches to achieving biodiversity positive outcomes should be agreed at the outset of a project. Design strategies must:

- Consider the whole site as a series of habitats – determining the value of each habitat as occurring on site, then replacing low value habitat with high value, therefore delivering greater levels of biodiversity.
- Always design to maximise biodiversity – striving to design for biodiversity enhancement through long term preservation, management and protection of natural resources. (TII, 2019) Understanding the ecological baseline will facilitate the adoption of the most appropriate intervention, so as to maximise biodiversity, e.g., provided the best suited species is selected.
- In seeking to minimise impacts of a development on biodiversity, consideration should be given to phased interference in a habitat. Compensatory planting may mitigate habitat damage or loss likely to occur through the proposed works.

The approach to interventions should follow the Habitat Objectives as agreed with the Project team. Within this structure, several design approaches for achieving biodiversity positive outcomes are available. Broadly, these can be captured under the following three headings:

- **Nature inspired design:** Landscape design approaches mimic properties of more natural plant communities in one or more ways - such as: vegetation structure, colour palette, texture, form, habitat type. Maintenance will be required to retain the results obtained;
- **Ornamental regenerative design:** Planting proposals use ornamental and wild plants to create a clearly identifiable designed landscape that benefits biodiversity, e.g., flowering plants which attract pollinating insects;
- **Natural colonisation and rewilding:** This is the process of allowing vegetation to naturally colonise a site from the seedbank or surrounding habitats. It may be particularly suitable for Open Mosaic Habitats (OMH) or 'Recolonising bare ground'. According to Fossitt's Guide to Habitats in Ireland (2000) these are often the most biodiverse habitats in urban areas. These habitats establish themselves on disturbed sites, are at least 0.25ha in size and contain 50% vegetation as a minimum (Fossitt, 2000 and JNCC, 2010). During rewilding, vegetation that is adaptable to site conditions would establish and could also extend semi-natural habitats: managing the type of soil and its fertility is therefore crucial. It is important to note this method can be unpredictable, and its implementation takes time; careful monitoring and reactive maintenance is also required. Natural colonisation and rewilding are particularly risky in urban areas, where aggressive weeds can easily find their way to the seedbank. Another option is for natural colonisation to be used in conjunction with seeding, by leaving patches of bare ground. Finally, rewilding can be encouraged by planting parent species.

The three design approaches just described cover a range of iterations and scenarios which have the potential to contribute to biodiversity in different ways.

The time habitats would take to establish and mature to reach their target condition generally varies. It is important this is considered as part of the design process and established in the site's landscape and ecology management plans. Even the best designs can fail if maintenance is poorly planned, funded or executed. Regular monitoring carried out by competent professionals such as landscape professionals, ecologists and arboriculturists is therefore crucial.

The table that follows provides an indication of the inputs and outputs required to achieve the three design approaches aforementioned.

	Inputs & Outcomes	Estimated inputs			Time considerations		Biodiversity outcomes	
		Implementation	Maintenance	Management	Estimated time until established	Estimated longevity	Habitat potential	Pollinator Potential
Biodiversity positive planning design approaches	Nature inspired biophilic design	Medium	Low-Medium	Medium	1-20 years	1-30 years	Medium - high	High
	Ornamental regenerative design	High	Medium	Low (short term solution to be retained and re-peated	0-1 years	5-40 years	Low - Medium	High
	Natural colonisation & rewilding	Low	High	High	1-20 years	5-500 years	High	High

Definition of input scale

Zero – No action required

Low – Occasional limited inputs

Medium – 50% scheme required inputs

High – Completely reliant on inputs

Table 3.3: *Inputs and outputs required to achieve nature inspired biophilic design, ornamental regenerative design and natural colonisation and rewilding.*

3.4.6 Threats to Beneficial Habitats

Biosecurity and Invasive Alien Species and the use of pesticides are a major threat to global biodiversity. These aspects will be explored in more detail in the following sections.

Biosecurity and Invasive Alien Species

Biosecurity is a major threat to ecosystem resilience and, 'Ireland needs to develop more biological and environmental resilience to pest and disease challenges.' (DAFM, 2019)

Pests and diseases spread easily in our interconnected world: in a short period of time, they can cause extensive damage to vegetation that has taken many years to establish. This can have a detrimental impact on the environment, the economy and society. An example of how widely diseases may spread across the landscape is the Ash Dieback: caused by the fungal pathogen Hymenoscyphus fraxineus, it led to significant mortality of Ash (Fraxinus spp.) throughout Europe, making necessary the removal of over 2.1 million trees in Ireland alone. Such diseases not only have a negative impact on commercial and amenity planting but are also particularly damaging on the Irish landscape and its character, as it can lead to the destruction of parts of its green infrastructure network. (DAFM, 2019)

New pests and diseases that have been discovered across Europe in recent years include:

- Box tree caterpillar (larvae of the Cydalima perspectalis moth), affecting Box plants (Buxus ssp.);
- Brown-tail moth (Euproctis chrysorrhoea), found on Oaks (Quercus ssp.), Blackthorn (Prunus spinosa) and Hawthorn (Crataegus ssp.);
- Ceratocystis platani and Massaria Disease, affecting Plane trees (Platanus ssp.);
- Green spruce aphid (Elatobium abietinum), affecting Sitka Spruce (Picea sitchensis) and Norway Spruce (Picea abies);
- Oak Processionary Moth (Thaumetopoea processionea), affecting Oaks (Quercus);
- Pine Wood Nematode (Bursaphelenchus xylophilus), affecting Pine trees (Abies ssp.);
- Phytophthora, a fungus present in several strains, affects many different plant species. Phytophthora ramorum is one of the most damaging Phytophthora species world-wide;
- Sawfly larvae, affecting several species including Oak (Quercus ssp.), Pear trees, Roses, Elm (Ulmus) and Pine (Abies ssp.);
- Sweet Chestnut Blight (Cryphonectria parasitica), affecting Sweet Chestnuts (Castanea ssp.);
- Thousand Cankers Disease: a fungus (Geosmithia morbida) affecting Walnut trees (Juglans ssp.);
- Xylella fastidiosa: bacteria with the potential to infect up to 650 plant species. Symptoms include leaf scorch, wilt and dieback, ultimately leading to plant death.

More information on Ireland's most commonly spread pests and diseases is available on the Teagasc website (The Agriculture and Food Development Authority).

The Department of Agriculture, Food and the Marine provides an online Tree Check form aiming to support in the identification of pests and diseases.

Key legislation relating to plant health is available at www.gov.ie.

Green infrastructure has a critical role to play in improving resilience to pests and diseases. Risks to planting have increased significantly over the last couple of decades, mainly due to:

- Globalisation – A sharp growth in trade and travel across the world, led to an increase in the volume and diversity of imported plants as well as a broadening of the supply chain these plants could be sourced from. Imported species are one of the main ways pests and diseases may evolve and spread;
- Airborne threats – Global trade can also increase airborne threats. Ash Dieback is one example of diseases evolved by trade and conveyed through airborne spores;
- Evolution of crossbreeding of pests and pathogens – Pests and diseases can evolve through cross-breeding, which can produce even more harmful diseases;
- Neglect – Lack of planting management and maintenance can lead to the spread of pests and diseases. (Department for Environment Food & Rural Affairs, 2018).

The Tree Health Resilience Strategy (2018) explains how plant resilience can be built into schemes, as represented in the resilience cir

Figure 3.51: Actions to Improve Biosecurity in Trees (Department for Environment Food & Rural Affairs, 2018).

The three key components for protecting Natural Capital are:

- Resistance – all actions that should be taken to reduce the chances of the risk occurring, including activities along the biosecurity continuum (i.e. pre-border, border, inland);
- Response and Recovery – appropriate response and effective management when threats materialise. Prompt actions should be taken;
- Adaptation – includes long term adaptation to already existing pests or diseases.

It is crucial that the three components just described are always considered holistically and addressed in all projects (in particular through appropriate planting specification), so as to encourage and enhance plant resistance.

Landscape Professionals must consider the negative impacts of pests and diseases throughout the Project by embedding 'a risk-based approach to biosecurity into all project stages.' (Watkins, 2018).

Landscape Professionals working in multi-disciplinary teams have a critical role to play in:

- Specifying for diversity;
- Dealing with invasive species;
- Promoting more robust specifications.

Figure 3.52: The Landscape Institute's Technical Guidance Note on Plant Health & Biosecurity is a useful reference and highlights tangible issues and opportunities that landscape consultants should consider in undertaking their work.

Specifying for diversity

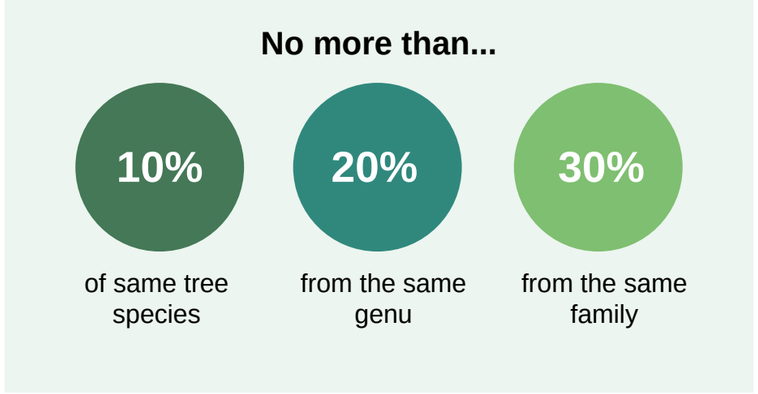
There is a case for expanding the planting genetic pool to increase resilience to climate change, pests and diseases. This can be achieved by:

- Specifying a broader range of species – promoting diversity;
- Encouraging biodiversity.

Diversifying plants' species and woodlands' age class can reduce threats from pests and diseases. Conversely, monocultures are the environments most prone to uncontrollable pest and disease outbreaks.

A prudent approach applicable to tree strategies suggests that no single species should account for more than 5-10% of any single intervention / proposal (range varies depending on the strategy's objectives).

An alternative 'rule of thumb' recommends planting:



This is general best practice and is embedded within Dublin City Council's Tree Strategy (2016).

Dealing with Invasive Species

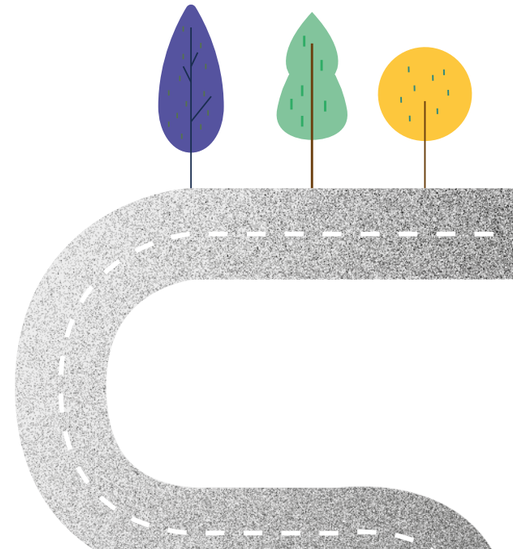
Invasive species exist across all Ireland and can pose a significant risk to semi-natural and planted habitats and schemes. The following species are classified as invasive in Ireland:

- Japanese Knotweed;
- Aquatic Weeds;
- Himalayan Balsam;
- Giant Hogweed;
- Giant Rhubarb;
- Problem and Noxious Weeds (Invas , 2021).

Further details on management of invasive species are available in TII publications listed below. Where a risk of invasive species is noted or their presence already confirmed, these documents must be complied with:

- TII Publication (Technical) GE-ENV-01105-01 The Management of Invasive Alien Plant Species on National Roads;
- TII Publication (Standard) GE-ENV-01104 The Management of Invasive Alien Species on National Roads;
- Invasive Species Ireland (2012) Horticulture Code of Good Practice to Prevent the Introduction and Spread of Invasive Non-Native Species.

Refer to Guidance document GE-ENV-03001 for information on Safe Specification of plants.



Enriching Place and it's Characteristics

The following section and tables act as summary for all design considerations listed in this section. These summaries will be followed by general guidelines for species selection in the next section.

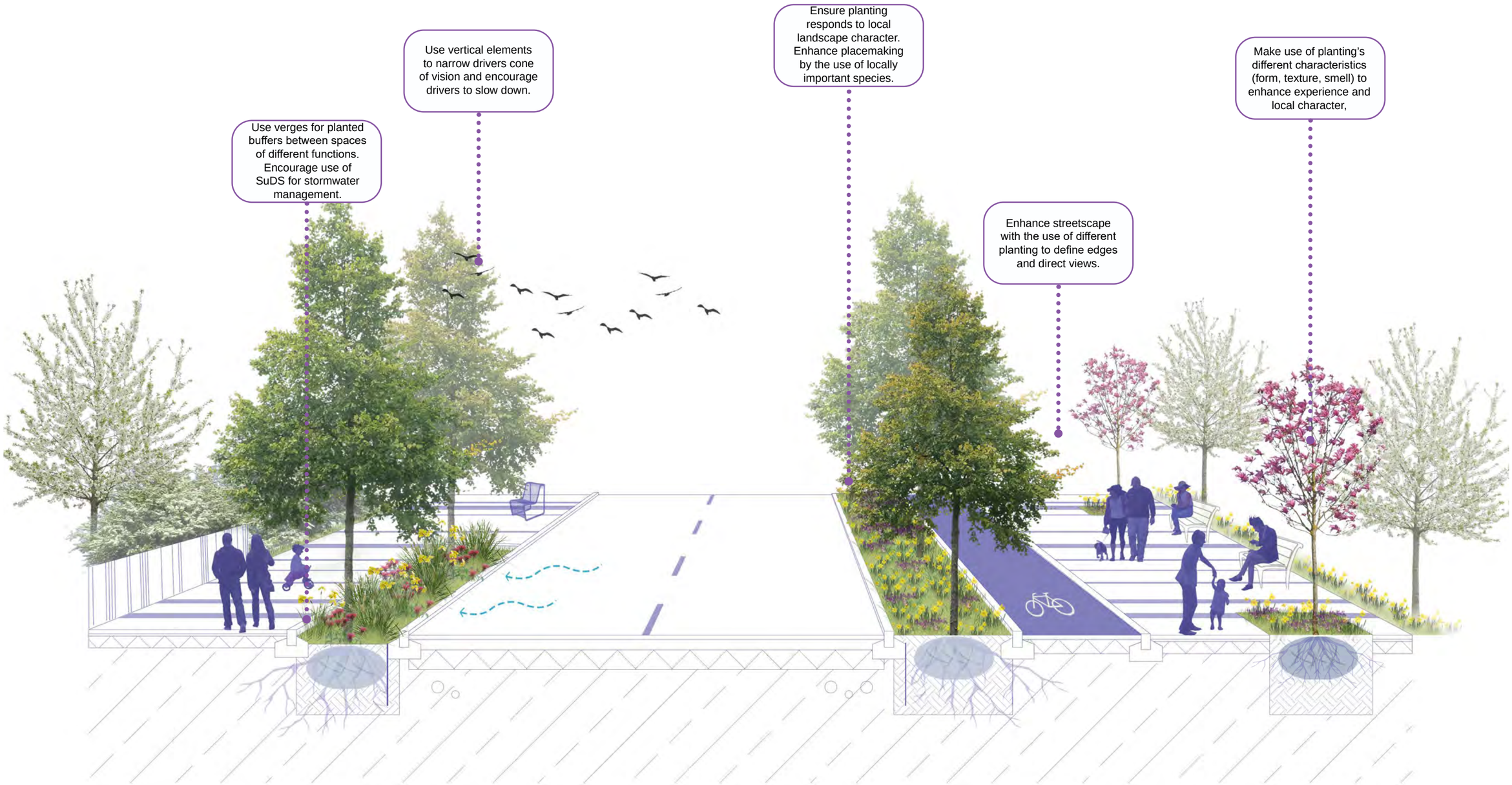


Figure 3.53: Summary of Soft Landscape Treatments for Placemaking and Shaping. Section represents Spring season.

Enriching Place and it's Characteristics

Table 3.4: Table summarising all design considerations for integration of soft landscape treatments for Enriching Place and it's Characteristics that have been explored within this section.

In relation to landscape, townscape and streetscape character, any planting proposals must seek to;	• Respond and enhance landscape and townscape character and the visual experience. • Introduce variety within the roadside treatments with gaps in planting offering views to the surrounding landscape. • Respond to place and avoid a repetitive, one-size fits all approach to planting in and around settlements. • Enhance local features, historic boundary treatments, and sites of historic and cultural heritage value. • Specify suitable species that tie in with the local context and trees that are already in the local landscape. • Enhance the streetscape and define spaces by providing vegetated buffers and soft SuDs solutions between motorised and non-motorised road users and pedestrians.
Soft landscape treatments can be used to choreograph views, create a sense of space and contribute to road safety. Examples of how this can be achieved are as follows:	• Use of high hedgerows, shrubs, and trees to contain space, screen and direct views; • Use of vertical elements to encourage drivers to slow down in response to a narrowed cone of vision; • Use soft landscape treatments as traffic calming measures (e.g. by highlighting intersections and narrowing street width). • Use of planting to define edges and thresholds between spaces performing different functions (e.g., change in use); • Creation of focal points; • Make use of planting's different characteristics such as form (i.e. the overall shape and structure of a plant or tree), line, pattern, texture, habit (i.e. the nature of the way the plant or tree grows) to introduce interest and design compositions that can be both visually appealing and engaging, to foster unique experiences. Introducing changes among planting groups with common characteristics can, in fact, break the space into sub-sections and promote a wide range of experiential patterns for users; • Integrate soft landscape treatments along the street's centreline / axis to define the space and create a buffer zone between vehicles, pedestrians and cyclists as well as to perform SuDS and air cleansing functions.
The establishment of semi-natural landscapes in an urban setting is complex and should consider the following factors:	• The longevity of the flowering season – particularly over the summer months; • The integration of cues to suggest that a habitat is being managed (e.g., mowing a strip); • That a more positive attitude towards naturalistic vegetation can be learnt through familiarity and the promotion of its value; • The increased height of naturalistic vegetation in relation to mown grass is generally regarded more positively by the public when colour and flowers are included in the mix; • The availability and appointment of adequately skilled, long-term management teams, e.g., Community Employment Workers or Tidy Towns Groups.

Figure 3.54: Planted buffer in Midleton, Co. Cork.

Enriching Place and it's Characteristics

Soft landscape treatments can influence the full sensory experience by:	• Providing separation from sources of noise using planted bunds, green walls, and densely grown high hedges; • Creating habitats that encourage natural sounds and smells, promoting positive sensory experiences and reducing the negative ones; • Creating soft landscapes that encourage conversation and laughter, positively contributing to the population's mental health; • Planting edible species, where appropriate; • Planting fragrant species such as Lavender, Lilac, Jasmine, Honeysuckle, Fruit trees and Magnolias, where appropriate.
Effective vegetative screening;	• Can vary in width and distribution so as to complement the landscape character; • Can incorporate fences, walls and earth mounds (Woodland Trust, n.d.); • Uses dense and multi-layered vegetation, particularly shrubs to screen views. Deciduous plants provide in fact 40% less visual screening than evergreens after leaf fall, so evergreens or a wider deciduous buffer may be necessary for year-round screening. Please also consider topography and width of planting belt. • Consider vegetation and viewpoint height as part of the design.

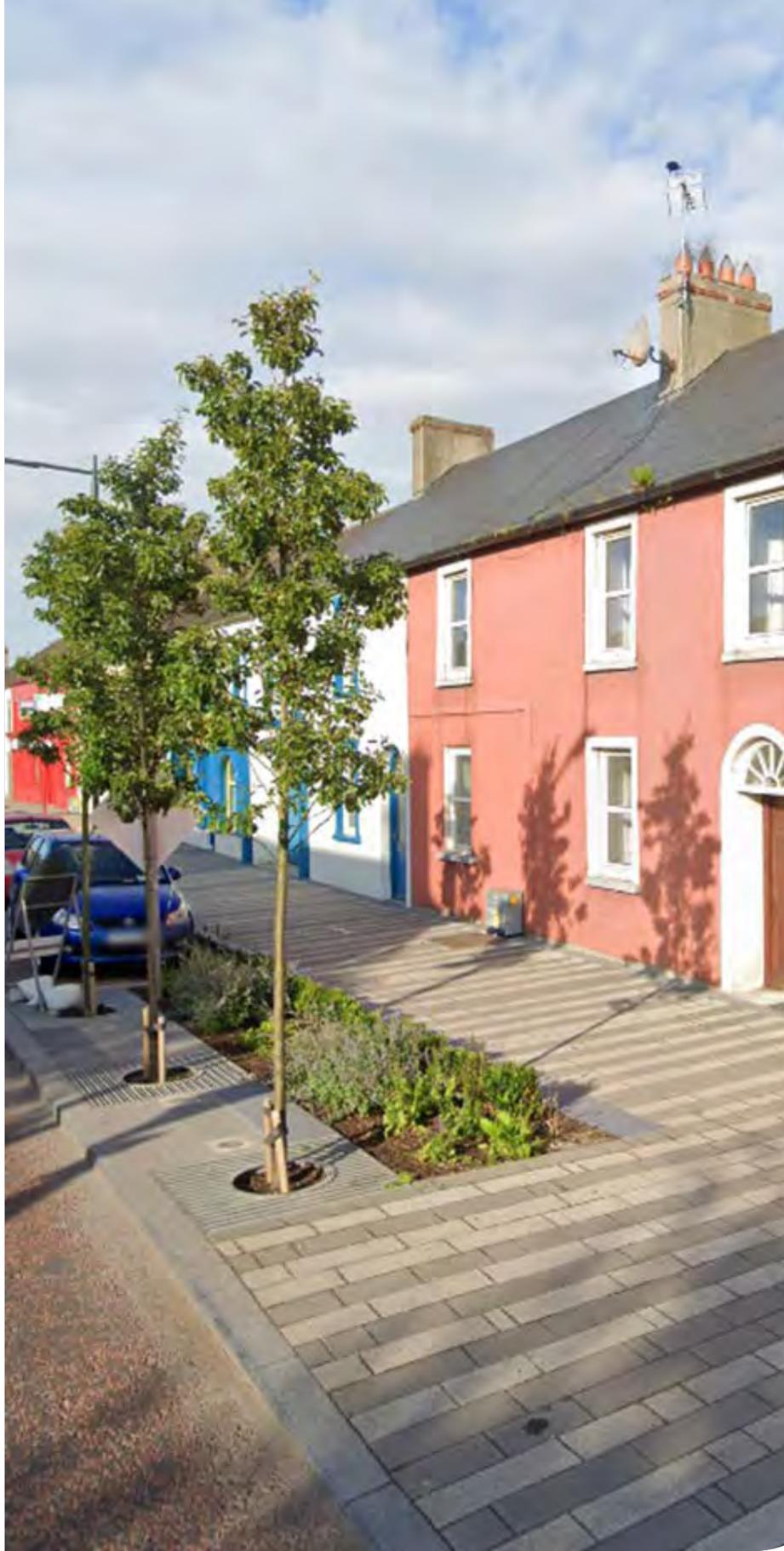


Figure 3.55: Soft Landscape Treatments along N25, Killeagh. Image courtesy of Cork County Council.

Communities, Health & Wellbeing

Soft Landscape for Communities, Health and Wellbeing

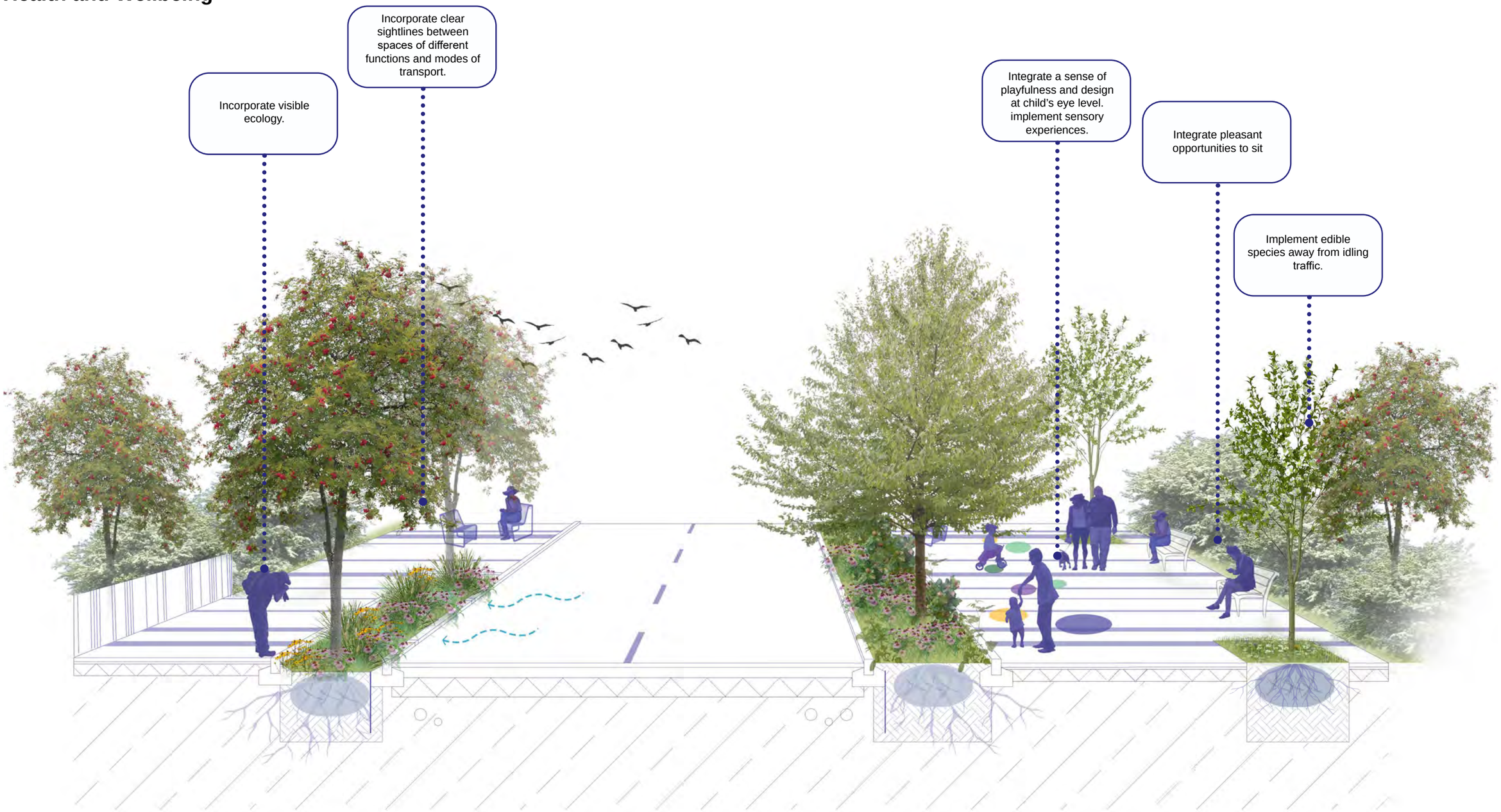
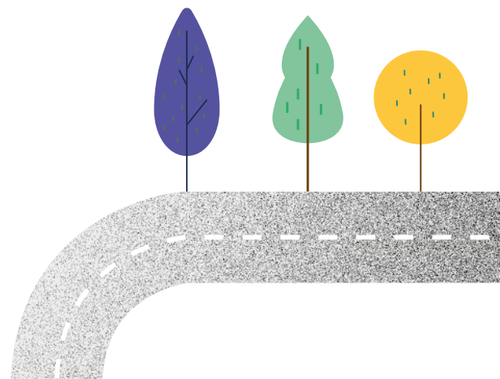


Figure 3.56: Summary of Soft Landscape Treatments for Communities, Health & Wellbeing. Section represents Summer season.

Communities, Health & Wellbeing

Table 3.5: Table summarising all design considerations for integration of soft landscape treatments for Communities, Health & Wellbeing that have been explored within this section.

IWhen designing inclusive soft landscape treatments, Landscape Professionals should consider:	• Integrate a sense of playfulness (this is specifically to encourage young and teenage girls to use public open space); • Incorporate clear sight lines and options for movement within planting areas; • Create pleasant spaces to sit (which planting could be a part of); • Use 'visible ecology', meaning the overt use of ecological and natural materials including: 1. Vegetable gardens, flowers, herb bushes, and; 2. Efforts to compost and recycle.
Soft landscape treatments that encourage playful experiences can include:	• Soft mounding and provision of slopes; • Planting that allows children to play within the vegetation's structure – for example, maze-like hedges or grasses, trees positioned to be used as goal posts, a series of circular planting beds, or well-spaced fruit trees that children can run around; • Trees that can be climbed and swung from; • The provision of insect habitats and plants that attract butterflies, birds etc.; • Planting and habitats that have been designed to include changes in colour, texture, pattern, movement, as well as promoting the experiencing of light and shade as appropriate, to complement the overall design strategy; • Planting that blooms, blossoms and produces edible fruit, that is non-toxic and non-spiky. (National Association of City Transportation Officials, 2020)
When designing and specifying edible soft landscape treatments, it is recommended to:	• Locate edible beds away from idling traffic; • Ensure that any edible beds are practically maintainable; • Work with local landowners and community groups to develop designs and plans for aftercare; • Consider creative ways of integrating edible trees, shrubs and plants and combine these in a way to reduce ongoing maintenance. Guidance for specifications can be found in Section 5 of the Guidance Document GE-ENV-03001. (Viljoen & Howe, 2005
The design of soft landscape treatments best creates environments for positive mental health when:	• It changes through the seasons; • It is legible at a human scale and appropriate to speed of movement (i.e., more detailed palettes and more change where people are moving through space at slower speeds); • It is physically permeable and includes choices of route; • It encourages social interaction; • It captures the imagination and encourages play; • It is designed with inclusivity in mind; • It intentionally triggers sensory responses; • It integrates water; • It encourages a connection with nature through the provision of a diverse range of habitats and palettes (as appropriate); • It encourages a connection with the landscape / place using vegetation can be used to frame or direct views or other sensory experiences.



Climate Resilience

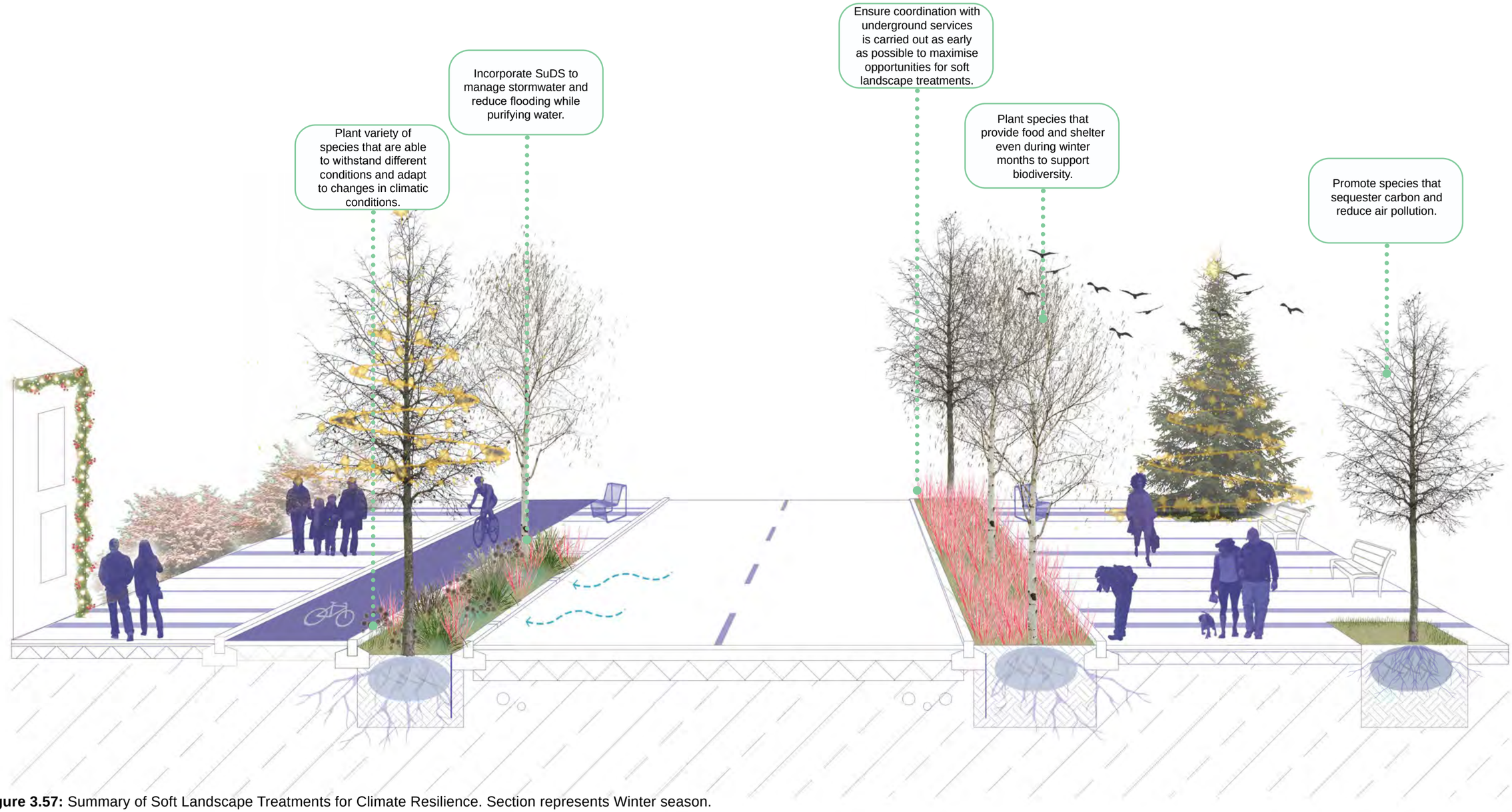


Figure 3.57: Summary of Soft Landscape Treatments for Climate Resilience. Section represents Winter season.

Climate Resilience

Table 3.6: Table summarising all design considerations for integration of soft landscape treatments for Climate Resilience that have been explored within this section.

Research suggests that streets and urban transport environments are better shaded when:	• Gradients of open areas and shade are developed: typically, edges between sun and shade are popular places for visitors in parks as these interfaces allow for; opportunities to adapt to diverse thermal conditions. • Consider the provision of a ratio of 40% sun, 20% half shade and 40% shade (Klemm, 2018).
The following best practices should be considered when selecting plants and trees responding to climate resilience:	• Create or mimic habitats and ecosystems by designing planting in layers that help sustain one-another (i.e., ground flora, field layer, specimens), rather than planting a series of single plants in soil. This will increase heat absorption and reduce water use: • The natural regeneration of the seed bank provides the most robust planting solution: this can manage to complement surrounding interventions; • Select plants and trees that will thrive with the predicted weather extremes, considering each environment on a case-by-case basis; • Consider organic and living mulches to retain water; • In areas that are not ecologically sensitive, consider specifying non-native trees and plants that have adapted to warmer temperatures and extreme weather conditions.
Key prompts for soft landscape incorporation within SuDS schemes are as follows:	• How can the creation of a SuDS scheme contribute to maximising biodiversity and placemaking opportunities; • Consideration over management strategies and maintenance commitments; • Limitations impacting the height of plants in relation to safety regulations; • Infrastructure cost (e.g., the cost of building a bio-retention tree-pit using engineered products versus a small-scale, multi-layered urban woodland); • Appropriate plant selection, including species that will tolerate both long periods of drought and significant rainfall; • Specification of a suitable permeable growing medium e.g., with voids, as appropriate.
To safeguard and contribute to improve soil quality Landscape Professionals need to:	• Understand the existing soil quality to determine whether it should be protected, restored or re-used; • Collaborate with ecologists to determine an appropriate rewilding or planting strategy to achieve desired actions; • Collaborate with design and construction teams to plan for the effective safe-guarding and re-use of soils across all project delivery stages.

Biodiversity

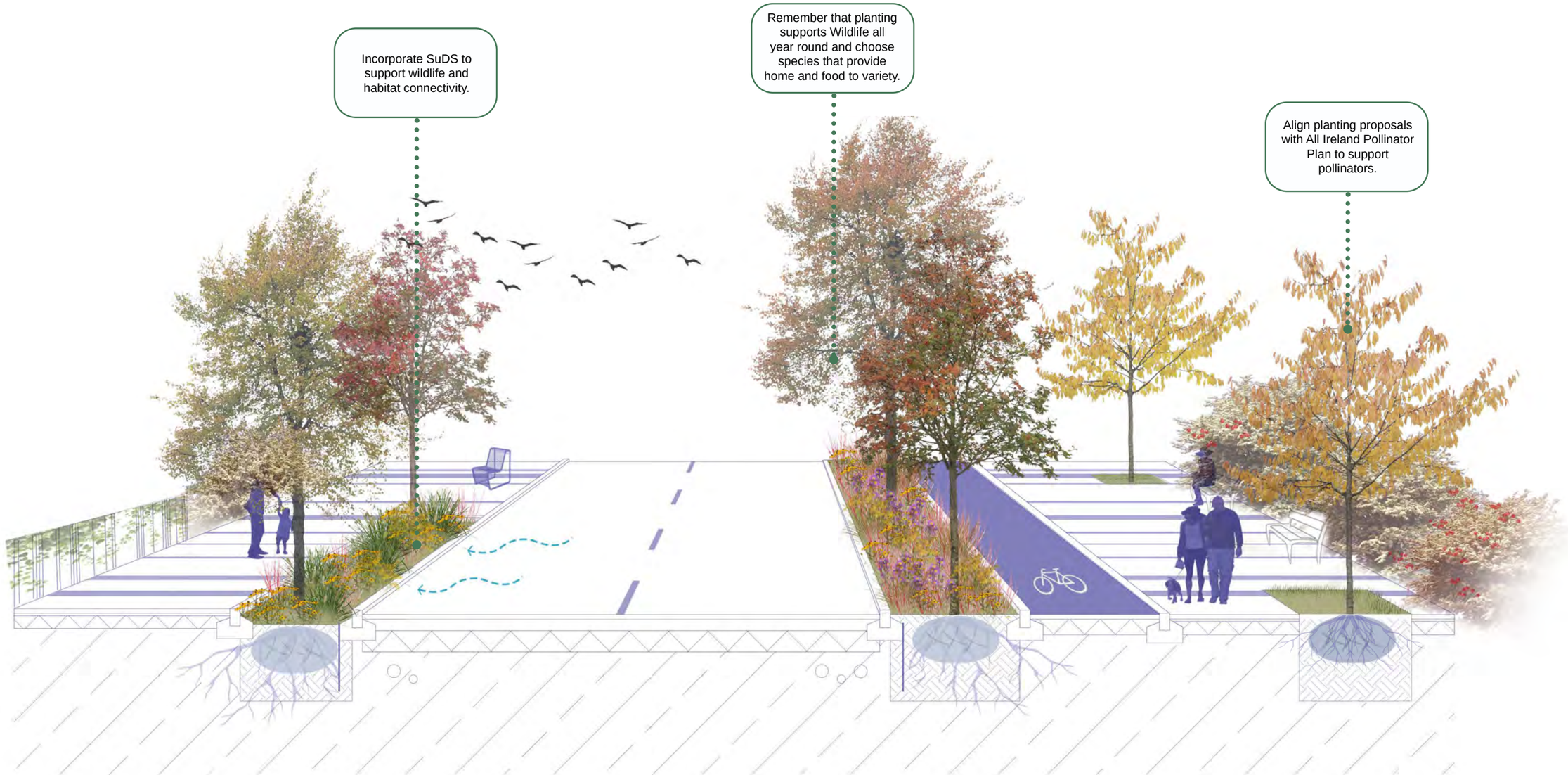


Figure 3.58: Summary of Soft Landscape Treatments for Biodiversity. Section represents Autumn season.

Biodiversity

Table 3.7: Table summarising all design considerations for integration of soft landscape treatments for Biodiversity that have been explored within this section.

Landscape Professionals working in multi-disciplinary teams have a critical role to play in the pursuit of better biodiversity, which can be achieved in the following ways:	• Preserving existing species and habitats that are of value; • Preserving biological cultural heritage; • Collecting the right data to inform design, management, and monitoring; • Defining Habitat Objectives for the Project (often achieved in consultation with the Local Biodiversity Officer); • Developing biodiversity positive strategies; • Developing design strategies for achieving biodiversity positive outcomes; • Planning and monitoring the delivery and management of habitats against Habitat Objectives. • Aligning with the local authority Biodiversity Action Plans if such in place. Project Ecologists have a critical role in all of these stages and should be part of multi-disciplinary teams.
Objectives for existing habitats can be broadly defined as:	• Conserve – Managing the habitat so it continues to function as its current habitat type; • Enhance – Undertake management or intervention to improve the habitat's condition and ecosystem service functioning; • Restore – Managing to assist recovery of habitat that has been degraded, damaged, destroyed or has naturally transitioned into another habitat type; • Transform - Process of establishing a primary habitat different to that occurring at present due to health and safety or operational constraints (NetworkRail, n.d.).
Approaches to achieving biodiversity positive outcomes should be agreed at the outset of a project. Design strategies must:	• Consider the whole site as a series of habitats – determining the value of each habitat as occurring on site, then replacing low value habitat with high value, therefore delivering greater levels of biodiversity. • Always design to maximise biodiversity – striving to design for biodiversity enhancement through long term preservation, management and protection of natural resources. (TII, 2019) Understanding the ecological baseline will facilitate the adoption of the most appropriate intervention, so as to maximise biodiversity, e.g., provided the best suited species is selected. • In seeking to minimise impacts of a development on biodiversity, consideration should be given to phased interference in a habitat. Compensatory planting may mitigate habitat damage or loss likely to occur through the proposed works.

Biodiversity

Landscape Professionals should consider the following aspects to encourage the slower passing of water through vegetative buffers, increasing its cleansing properties:	• The size of the buffer, e.g. A bigger buffer would typically deliver greater benefits; • Appropriate use of gradients, e.g. slopes steeper than 7 degrees do not act effectively as buffers as water would flow too fast; • Soil type and permeability, e.g., porous soils encourage quicker movement of water, while clayey soils heavily restrict water movement (Woodland Trust, 2012).
Ways to rethink the soft landscape design process to achieve more circular outcomes are to:	• Re-think traditional solutions • Re-use existing materials • Re-think plant selection & specification • Establish partnerships More detail is provided in Section 3.2.7
Simple ways to reduce carbon footprints and sequester more carbon using soft landscape treatments would include:	• Limit grass cutting and ornamental tree pruning (to maintain pleached trees for example), to reduce the amount of fuel used; • Convert grass lawns to semi-natural plant communities or shrub areas; • Plant more trees; • Make space for roots which are effective at storing carbon.

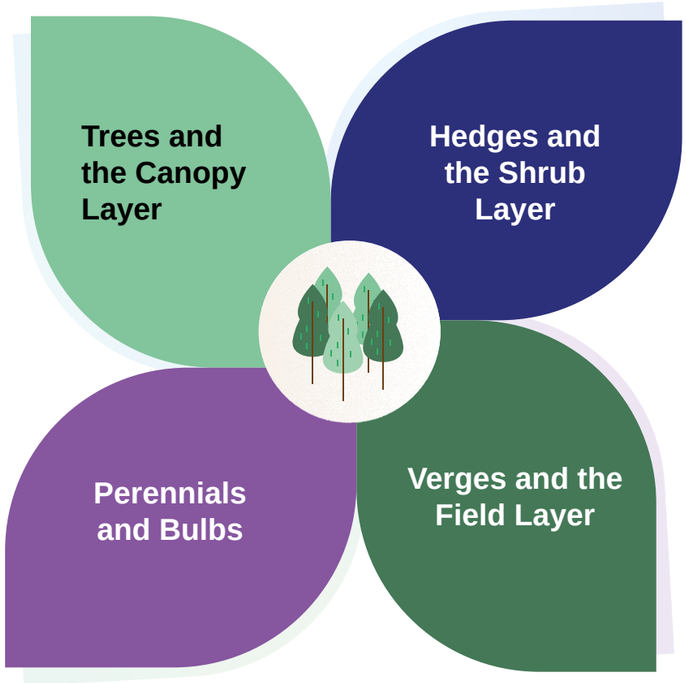
In addition to the guidance listed above, refer to Section 4 for general guidance notes that apply to the selection of plants for all landscape treatments.

4. Soft Landscape Treatments Design Guidance

Landscape treatments can be applied to Landscape elements. In the context of this Document, Landscape elements refer to features, structures or urban transport elements that provide a receiving environment with a range of landscape treatments.

This Document section presents and organises soft landscape treatments according to their height. Four main categories of soft landscape treatments have been identified, which are then further broken down into sub-categories - from here on referred to as ‘typologies’.

The four main categories of soft landscape treatments and their associated typologies referred to in this Document are:



Landscape treatments can be applied to Landscape elements. In the context of this Document, Landscape elements refer to features, structures or urban transport elements that provide a receiving environment with a range of landscape treatments.

Landscape elements require a combined approach across design teams, to ensure successful delivery. The two main categories of soft landscape elements and their associated typologies referred to in this Document are:

SuDS Features.

Typologies:

- Swales;
- Bioretention and rain gardens;
- Bioretention tree pits;
- Filter strips;
- Constructed wetlands;
- Infiltration basins.

Vegetation associated with Structures.

Typologies:

- Green walls;
- Median, island and roundabout planting;
- Raised planters.

The implementation of soft landscape cannot happen without the integrated and coordinated consideration of:

- What happens below ground – e.g., soil composition and tree pits specification to be coordinated with underground services;
- What happens above ground – how planting and trees can be integrated in relation to overhead services, lighting elements, signage, clearance zones and built form;
- What happens in and around planting – its relation to water systems, soils, catchments, ecosystems, streets, roads, services, and buildings;

- What is the relationship between water and planting– how planting copes with changes in rainfall, and how vegetation can cleanse water and reduce flooding events; and;
- The impacts all of the above may have on people and their experiences, as well as the sensitivities and characteristics of a place.

Species choice is vital to the success of any planting scheme. Where suitable ecological and site conditions exist, natural recolonisation should be considered as the most appropriate and cost-effective treatment adjacent to protected areas and sites of local ecological importance.

Species selection should be informed by local conditions. Planting and soft landscape treatments must be designed to support proposed:

- Uses, placemaking functions and sensory impacts e.g. screening, play, (see Section 3.1);
- Community & health’s benefits and functions;
- Climate resilience benefits and functions;
- Biodiversity benefits and functions.

Site Factors and Management Requirements

Site factors

- **Light and water availability on site;**
- **Soil pH;**
- **Soil conditions;**
- **Potential exposure to pollutants and salt;**
- **Need to discourage fauna from reaching hazardous areas;**
- **Slope steepness.**

Maintenance and management requirements

- **Mature plant sizes;**
- **Plant’s habit/form;**
- **Tolerance to pests and diseases;**
- **Tolerance to drought;**
- **Tolerance to pollution and the ability to trap particulate matter;**
- **Tolerance to road salts;**
- **Tolerance to light or shade;**
- **Life expectancy;**
- **Seasonal interest (i.e. presence of flower, fruit, foliage, stem colour);**
- **Maintenance (i.e. access and frequency of operations).**

4. Soft Landscape Treatments Design Guidance

The implementation of soft landscape cannot happen without the integrated and coordinated consideration of:

- What happens below ground – e.g., soil composition and tree pits specification to be coordinated with underground services;
- What happens above ground – how planting and trees can be integrated in relation to overhead services, lighting elements, signage, clearance zones and built form;
- What happens in and around planting – its relation to water systems, soils, catchments, ecosystems, streets, roads, services, and buildings;
- What is the relationship between water and planting how planting copes with changes in rainfall, and how vegetation can cleanse water and reduce flooding events; and;
- The impacts all of the above may have on people and their experiences, as well as the sensitivities and characteristics of a place.

Species choice is vital to the success of any planting scheme. Where suitable ecological and site conditions exist, natural recolonisation should be considered as the most appropriate and

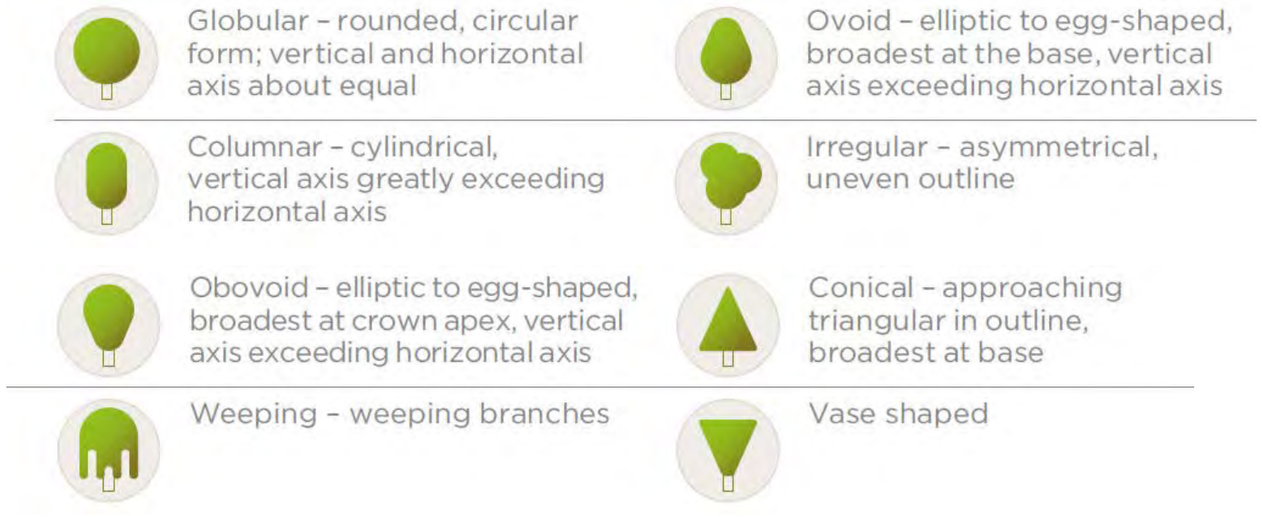


Figure 4.1: Different forms of trees as defined in TDAG' s Tree Species Selection for Green Infrastructure: A Guide for Specifiers.

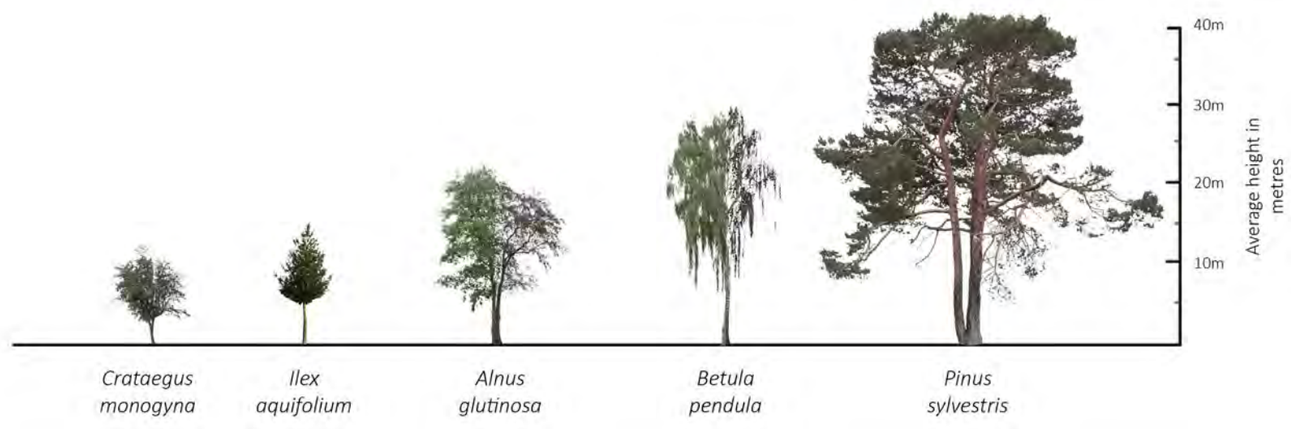


Figure 4.2: Sketch representing native Irish trees and their average mature height.

4.1.1 Trees and the Canopy Layer

As the effects of climate change becomes better understood, it is becoming increasingly clear that one of the best ways in which we can make our towns and cities more hospitable over the next few decades is to increase the number, and size, of trees in urban areas.

No Trees, No Future, Trees and Design Action Group, February 2010

Trees make an important contribution to placemaking and play a pivotal role in establishing biodiverse and climate resilient landscapes. Trees used adjacent to roads and within streets contribute to a sense of enclosure and introduce traffic calming measures within our towns and villages. Based on their proposed location, trees can be used to confer legibility to the landscape. Informal or multistem trees can reinforce a rural aesthetic, whereas trees arranged in clusters or small-scale woodland groups can contribute to the identification of a town Gateway.

If regularly spaced, trees can introduce more formal settings such as avenues, boulevards, or streets. More than any other vegetation element, trees possess an enormous potential to develop, enhance and promote a sense of place. Different tree types, forms, and habits as illustrated in Figure 4.1 can be used to fulfil a wide range of functions.

Over time, trees mature at different rates. The following diagram illustrates the average mature height of typical Irish tree species.

To ensure an adequate tree form is retained to both fulfil its function and to comply with safety requirements topping, pruning, canopy raising or clearing stems may be necessary.

Topping is the pruning of individual branches of a tree to retain pruned stubs. This practice can negatively impact on tree form, where the tree can appear disfigured and out of proportion as a result. While some trees may reasonably recover to topping, many trees do not. Where tree maintenance is required, a more aesthetically pleasing action is to raise the canopy height by removing small branches back to their point of origin. This approach preserves the natural form of the tree. Dublin City Tree Strategy 2016-2020 provides further information in this regard.

Where tree planting is likely to be damaged by vandalism, local community involvement may be the best approach to reducing anti-social activity. Replacing any broken or damaged trees as soon as possible is recommended to mitigate the impact on the wider area.

For the purposes of this Document, the broad soft landscape category of trees has been organised into the sub-categories below.

Definition of each category together with technical guidance to inform species selection, specification, organisation and planting, maintenance and management is provided in the Guidance Document GE-ENV-03001.

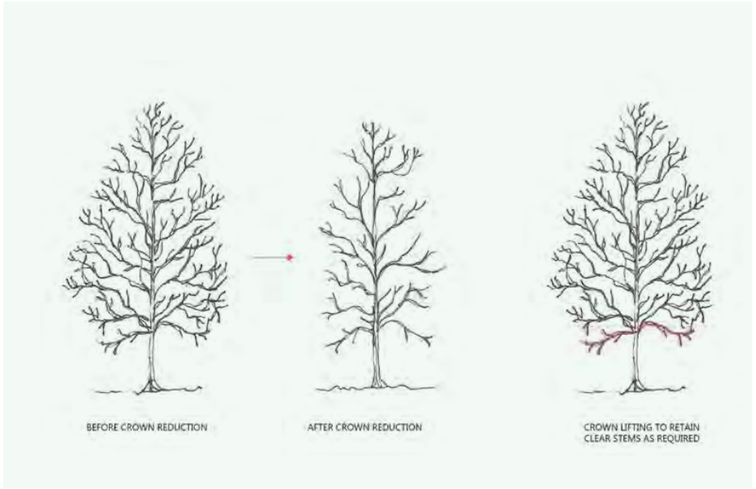
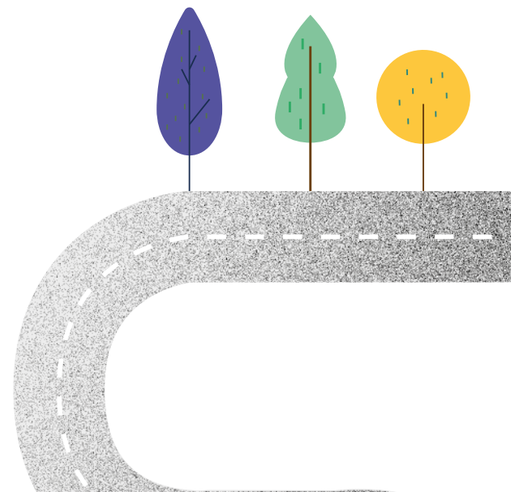


Figure 4.3: The effects of crown reduction and crown lifting



4.1.2 Specimen Trees

Specimen Trees

Figure 4.4: Specimen Pine trees installed at the renovated Michael Collins Monument at Beal na Blath to reinforce low speed environment.

Description

Specimen trees are individual trees chosen for a specific purpose. These are typically larger sized trees from 12-14cm in girth (3-3.5m in height) and more.

Function and Value

Specimen trees can act as a focal point in the transport corridor, highlighting a change in the road context including the start of lower speed limits, identifying a pedestrian crossing, or mitigating the impact of parking bays. Specimen trees may be chosen to provide shade, demark an entrance, or to reinforce a historical reference. Specimen trees may be planted in groups to provide maturity and character to new developments or in lines to separate different functional areas.

4.1.3. Woodlands

Woodlands

Figure 4.5: Woodland next to a transport corridor acting as a Green Infrastructure link

Description

For the purpose of this Document woodlands are considered as groups or clusters of trees where the canopies meet.

Function and Value

Woodlands may be used for various purposes within or in proximity to urban transport environments. Woodlands can screen or direct views, stabilise soil, infiltrate water, connect habitats, add vertical emphasis to a largely flat landscape, contributing to traffic calming, and provide local amenity. Over time, woodlands support a range of species and can sequester carbon dioxide.

4.1.4 Fruit and Nut Trees

Fruit and Nut Trees

Figure 4.6: Kilworth Apple Pressing.

Description

Although any flowering tree will produce fruit and may technically be called fruit tree, the term fruit tree is specifically used to refer to trees that produce fruit to be consumed by humans. Similarly, nut trees are identified as trees producing nuts edible for human consumption.

Function and Value

Technical guidance to inform hedges and shrub layer correct selection, organisation and specification is included in Guidance Document (GD) GE-ENV-03001. Guidance on planting, maintenance and management across all other categories is also included.

For the purposes of this document the term Hedges and Shrub Layer planting is used to describe the landscape layer sitting between the Woodland and the Grassland/Field. Hedges and Shrubs are generally found at the woodland edge. Shrubs are defined as woody plants with several stems that are smaller than trees, whereas hedges are closely planted shrubs that form a vegetated screen.

4.1.5 Hedges & the Shrub Layer

Native Hedges

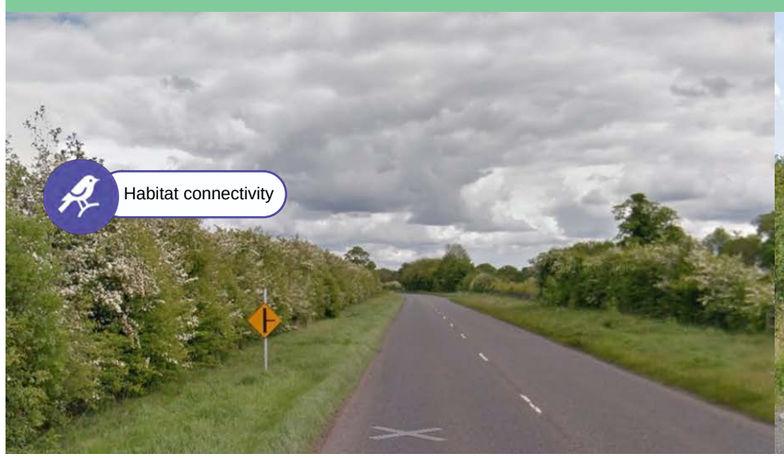


Figure 4.7: Native hedges planted on either side of the road. Image taken from Google Street View.

Native Hedges

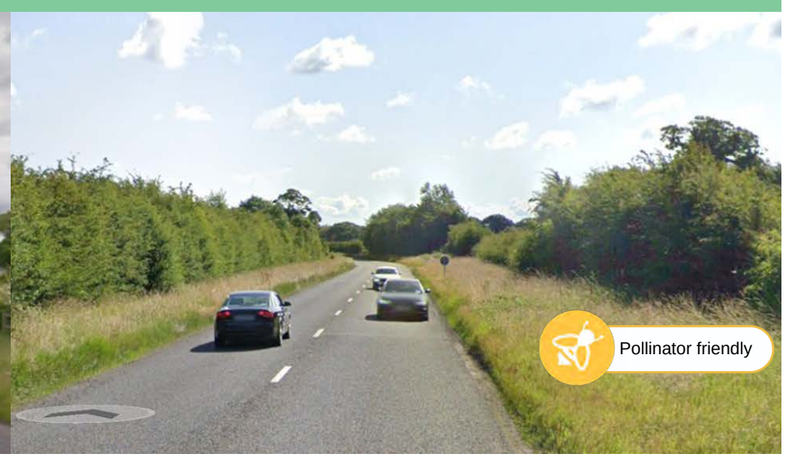


Figure 4.8: Native hedges planted on either side of the road. Image taken from Google Street View.

Ornamental Hedgerow

Figure 4.9: Ornamental hedgerow consisting of one species. Image taken from Google Street View.

Description

Hedges and field patterns are the most prominent features of the rural Irish Landscape. These linear elements are key contributors to the landscape character, identity and play an essential role in supporting biodiversity. Formal hedging influences from European gardens were evident in the demesne landscapes of the large Country Estates. These hedges included clipped forms of Yew (Taxus baccata), Beech (Fagus sylvatica), Box (Buxus sempervirens) and Sweet Box (Sarcococca spp). Hedgerows inclusion within the urban environment can reinforce a lower speed environment, as it is considered an enclosing element.

Function and Value

Technical guidance to inform hedges and shrub layer correct selection, organisation and specification is included in Guidance Document (GD) GE-ENV-03001. Guidance on planting, maintenance and management across all other categories is also included.

For the purposes of this document the term Hedges and Shrub Layer planting is used to describe the landscape layer sitting between the Woodland and the Grassland/Field. Hedges and Shrubs are generally found at the woodland edge. Shrubs are defined as woody plants with several stems that are smaller than trees, whereas hedges are closely planted shrubs that form a vegetated screen.

Native hedgerows

Depending on the context hedging may be native or non-native.

When planting hedges into the rural environment, selecting native hedging is typically the best option, as it closely reflects the local landscape character and better links with existing local vegetation. Principal hedgerow species should include Hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), Holly (Ilex aquifolium), and Hazel (Corylus avellana); complementary species such as Spindle (euonymus europaeus), Elder, (Sambucus nigra), Guelder Rose (Viburnum opulus), Dog Rose (Rose canina), Willow (Salix sp.), Wild Cherry (Prunus avium) or Honeysuckle (Lonicera periclymenum) should also be included at lower densities. All native hedgerow planting should follow All Ireland Pollinator Plan.

Ornamental hedgerows

Ornamental hedges may be more appropriate in urban or sub-urban contexts. Smooth or rough, airy or solid, dark or light, hedges vary in character depending on species selection, ultimately informed by design intent. Although the use of single species hedges such as Hornbeam (Carpinus betulus), Beech (Fagus sylvatica) or Yew (Taxus baccata) may achieve a strong design effect, on the other hand it would score significantly lower in terms of habitat or biodiversity creation.

4.1.5 Hedges & the Shrub Layer

Shrubs

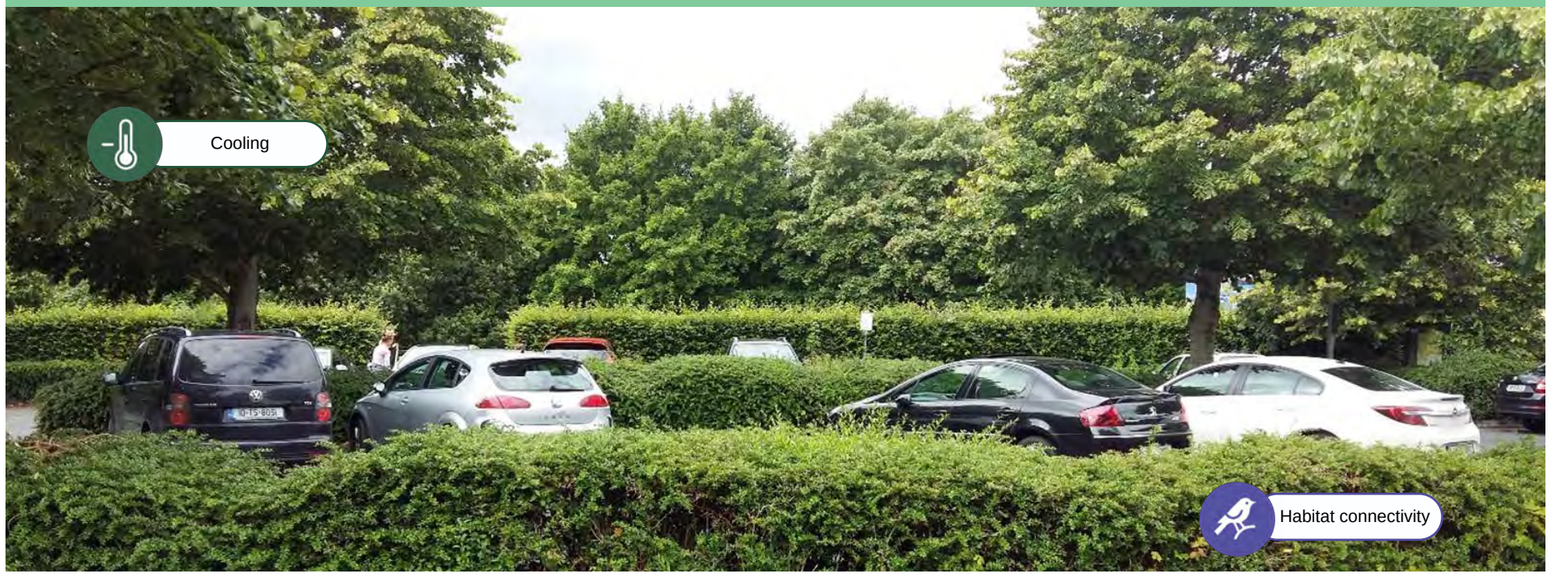


Figure 4.10: Hedges used as screen for car parking. Along with the trees, soft landscape will provide shade and minimise heat island *effect.*

Description

Shrubs may be selected for their form, colour, scent, winter structure etc.

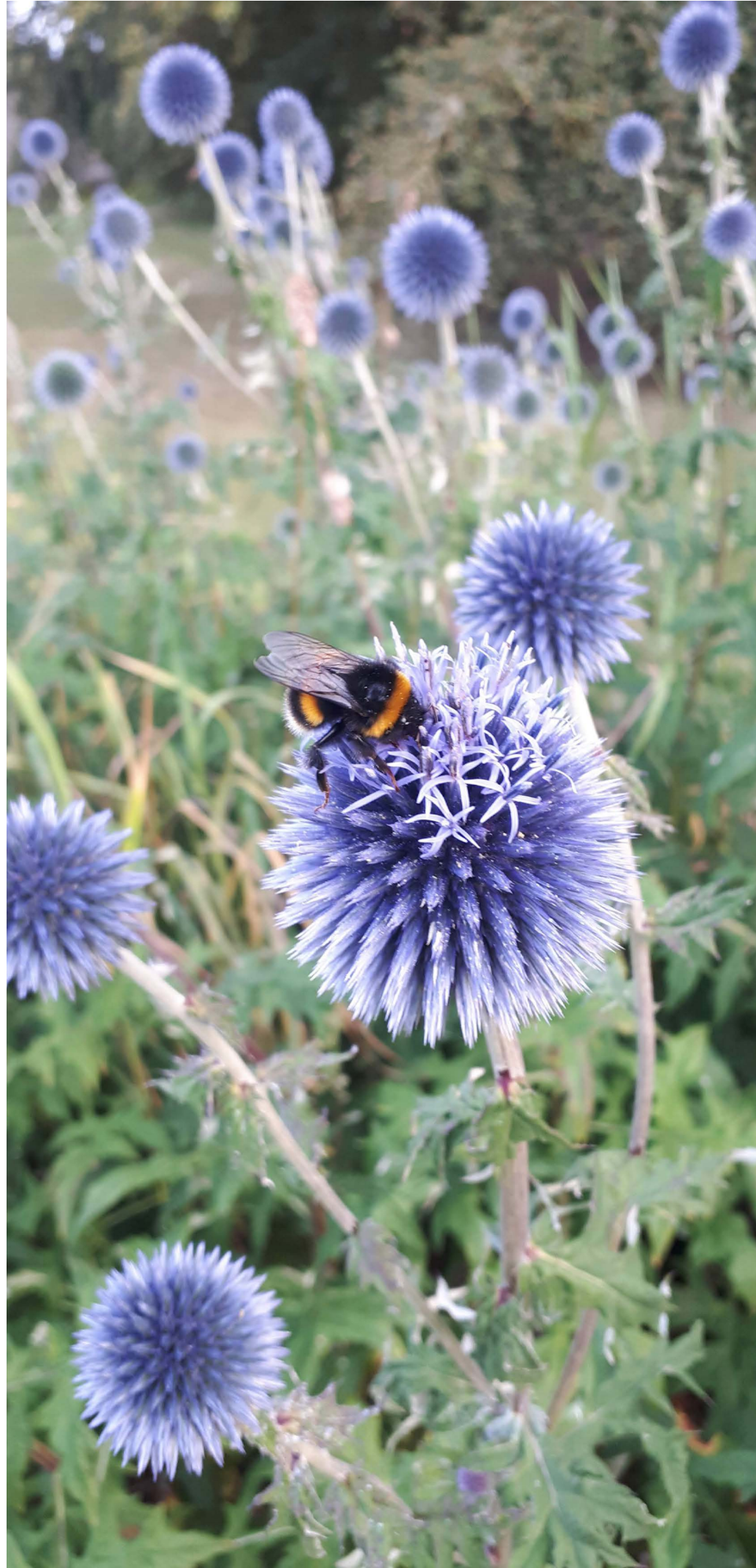
Shrub species selection requires therefore understanding of their characteristics and their performance. Where shrubs are to be included within perennial schemes selected species should be compact or suitable to hard pruning. Species worth considering are Hydrangea, Buddleja and Dogwood (Cornus ssp).

Function and Value

From a design perspective, hedges may be used as a screening element, to define a space within a wider planting scheme, or to demarcate areas subject to different uses. A sharp pruned form, typical within walled gardens' mixed borders, acts as a structural element within a larger planting scheme, whereas a looser shape is likely to indicate a rural hedge.

In rural Ireland, in addition to connect fragmented habitats, hedgerows can also be considered a habitat in their own right. When left to flower, hedgerows also provide nectar and pollen for insects.

Outside of urban areas, shrubs will commonly be used to provide habitat, facilitate biodiversity conservation and for visual screening. In contrast, within urban areas a higher emphasis is often placed on the visual characteristics of the species selected.



4.1.6 Perennials, Bulbs and Ornamental Grasses

Perennials, Bulbs and Ornamental Grasses

Figure 4.11: Perennials, Bulbs and Ornamental Grasses

Description

Perennials, bulbs and ornamental grasses are used to provide attractive colour and texture year after year. There are thousands of plants to select from this category: their size varies considerably, ranging from small species, close to the ground to others able to sway at an adult's eye level. The choice of species, layout of planting and combination of colours selected can reflect stylistic choices and societal drivers. In fact, their very use in the public realm is a relatively recent evolution in soft landscape design.

Function and Value

Technical guidance to inform the correct selection, organisation and specification of Perennials, Bulbs and Ornamental Grasses is provided in Guidance Document GE-ENV-03001. Guidance on planting, maintenance and management across all categories is also included.

Perennials

Figure 4.12: Perennial planting in Warsaw.

Description

Herbaceous Perennial plants are plants that live for more than two years. Although trees should technically be included, this category is generally used to describe small flowering species that persist for several years rather than decades.

Function and Value

Until recently, the use of annual/bedding plants (plants which are discarded at the end of the season) dominated our public spaces: contemporary concerns with regards to biodiversity and sustainability have brought perennial, bulb planting and ornamental grasses into our urban areas. Given their relatively recent implementation within urban environments' landscape treatments, their design and implementation are currently being developed and optimised.

Bulbs

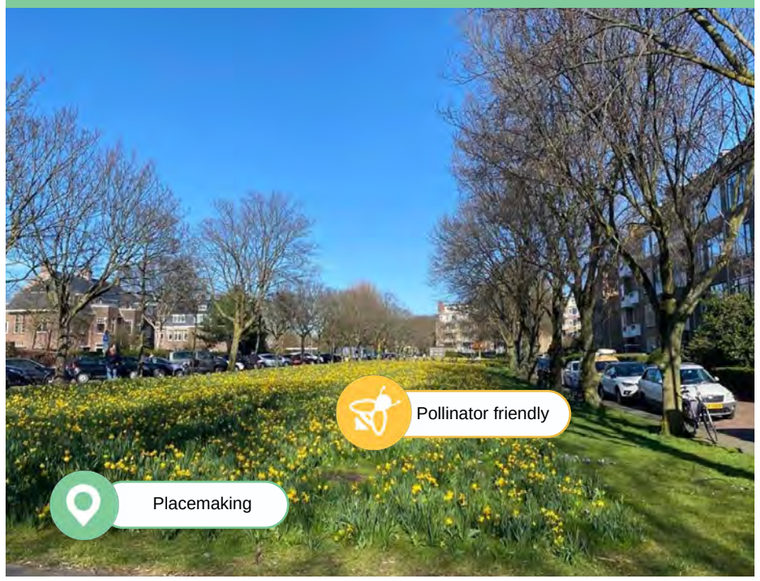


Figure 4.13: Daffodil carpet in March in The Hague, Netherlands.

Description

Flowering or ornamental bulbs are a type of herbaceous perennial plant that usually forms underground. The bulb is a buried element, able to store the required energy allowing leaf and stem development for the next season. Once the leaf and flower stem have developed, bulbs typically return to the dormant phase until the following year.

Function and Value

Bulbs clone themselves by producing smaller bulbs around the mother bulb. The advantage of using bulbs is that many varieties are spring flowering, therefore lengthening the flowering season.

4.1.6 Perennials, Bulbs and Ornamental Grasses

Figure 4.14: Grasses can provide visual interest through the winter months.

Figure 4.15: Meadow maintenance along roadside verge in Keenagh.

Ornamental Grasses Description

Ornamental grasses are typically perennial species: they can regrow in spring each year taking the energy stored in their roots from the previous season. Some species are evergreen, while some others are deciduous or winter dormant. There are many types of ornamental grasses which flower late in the summer and hold their structure into winter, extending the season of interest beyond the summer months.

Recent publications by the National Biodiversity Data Centre aim to highlight plant selections known to be good for pollinators. Pollen is generally produced by flowering plants as part of their reproduction process. The promotion of perennial plants (including bulbs and ornamental grasses) aims to increase and strengthen the pollinator's habitat. Planting design should combine technical considerations (including biodiversity criteria) with creative vision, therefore stimulating people's interest as well as providing for ecology.

Function and Value

A contemporary requirement of planting design is understanding how the use of stable plant communities can enliven public spaces by providing planting that inspires wonder and awe. Well-designed plant communities should mimic ecological niches. The combination of perennials, bulbs and ornamental grasses can both lengthen the season of interest for people while extending the flowering season for pollinators at the same time. When sunlight begins to warm the surface of the ground, spring bulbs such as Daffodils, Tulips and Camassia are the first to bloom in the season (late February). As these go dormant, emerging perennials dominate from spring until late summer. Later in the summer the grasses would dominate the scene, with the visual emphasis switching to their texture, foliage and seed heads.

It is also important to note that stable plant communities require less maintenance.

Verges & the Field Layer Description

Prior to the development of fossil fuel agriculture and its widescale adoption in the mid-20th century, lower intensity and traditionally managed meadows dominated much of our countryside. These meadows were managed by grazing or scything. Both methods allowed a greater number of perennial species to flower and allowed a visually appealing landscape to thrive. The flowering species also provided nectar, forage and habitat for a wide variety of pollinating insects and seed feeding birds. With the increase in agricultural productivity, meadows became replaced with single species grassed fields and short cut grassed lawns became the norm in our public spaces. Recent concerns about ecology have seen a huge demand for meadows to be introduced into our public spaces.

The term field layer is used to define grasslands and floralistic mixes that cover the ground plane. This layer includes verges and grassed areas and are a common landscape type throughout the road network and within urban settlements.

Function and Value

For the purposes of this Document, the broad soft landscape category of Verges and the Field Layer has been organised into the following sub-categories:

- Lawns. Lawns are areas of short cut grass. They generally require a minimum topsoil depth of 150mm over a subsoil base;
- Semi-natural grasslands. Grassland habitats that support a wealth of biodiversity. Historically these included hay meadows and were sustained by low intensity farming methods, managed by either grazing or scything. Short cut meadows are also falling within this category;
- Ornamental Meadows. Usually highly colourful floralistic mixes created with imported commercial seeds. Ornamental meadows typically include colourful mixes that would otherwise not grow together in nature. They should be considered a horticultural feature rather than a natural meadow's recreation.

Technical guidance to inform correct selection, organisation and specification for Verges and the Field Layer is provided in Guidance Document GE-ENV-03001. Guidance on sowing, maintenance and management across all categories is also included.

Figure 4.16: Ornamental Meadow with annual mix as a horticultural tool

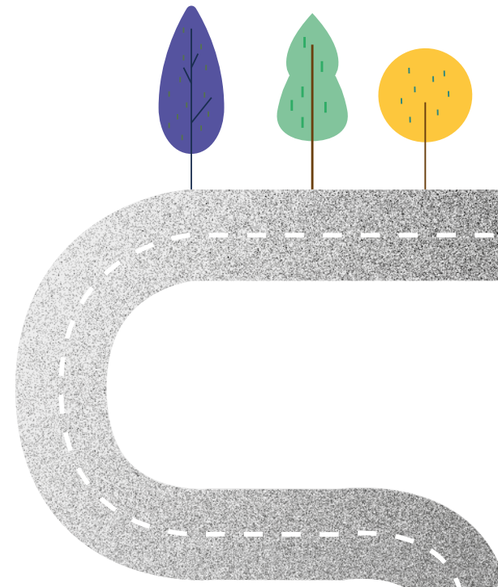
Function and Value

The linear, widespread nature of verges and the field layer means they are common in urban transport environments, supporting a wide range of functions depending on their specific subcategory:

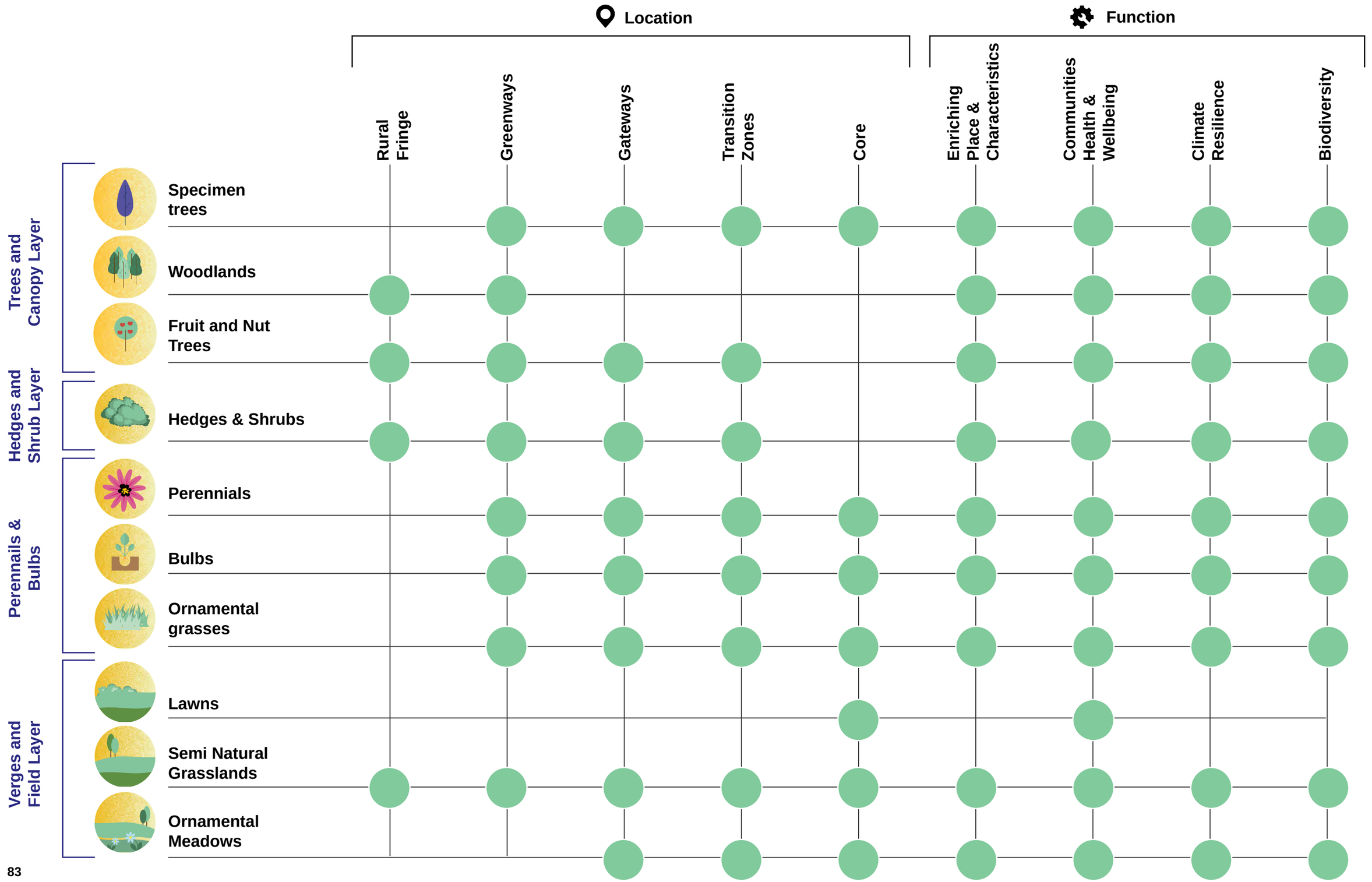
- Lawns: they can be used for sitting, playing etc. Lawns can support recreational activity in parks or public spaces and may be well-suited to areas subject to regular footfall in and around settlements. Their habitat function is minimal.
- Semi-natural grasslands: they support habitat creation and biodiversity; this is in turn promoting pest control for adjacent crops. Historically grassland meadows were sources of hay which was fed to animals. Due to their deep roots, semi-natural grasslands can help limit and prevent soil erosion.
- Ornamental Meadows: although they can support insects, ornamental meadows should be considered more of an amenity or horticultural feature rather than semi-natural grasslands. At the same time, their amenity value can provide dramatic visual appeal.

Type of mix	Advantages	Disadvantages	Suitable for	Duration
Annual seed mix	Very colourful and highly attractive	The seed must be purchased and resown every year. Provides less nectar for pollinators than perennial seed mixes.	Large raised beds, Town centre planting, areas where high impact is desired. Not suitable for large areas under management, or for use in the countryside.	One year
Perennial seed mix	Very attractive, and a good source of pollen, nectar and habitat for pollinators.	May take a few years to fully establish.	Large managed areas, e.g., linear strips adjacent to Greenways, etc.	Long term
Annual and perennial seed mix	Good initial display of colour and good source of pollen, nectar and habitat	May look less impactful in year two when the annuals have largely stopped flowering and before the perennials are established.	Large managed areas, e.g., linear strips adjacent to Greenways, etc.	Long term

Table 4 .1 Field Layer Terminology (National Biodiversity Data Centre, 2019).



4.1.8 Summary of Landscape Treatments, their Potential Location, Function and Value



4.2.1 Sustainable Drainage Elements

Sustainable Drainage Systems (SuDS) are integrated elements that seek to recreate natural hydrological or drainage processes within our urban environments. These elements contribute to slowing the rate at which our infrastructure and urban landscapes discharge rainwater back to the water catchment and incorporate vegetated interventions that mimic natural drainage processes. These elements may be combined in series to temporarily store water during storm events, reduce peak flows, pollutants, and the volume of rainfall runoff into the natural water system. Their specific design will depend on the characteristics of the receiving environment.

Sustainable Drainage Systems (SuDS) capture rainwater close to the source and unlike conventional systems retain this rainwater as an ecological and landscape asset. The combination of technical performance and ecology function enable the enhancement of our urban landscapes through the reintroduction of wetland vegetation.

These soft technical solutions, aim at the reduction of the quantity of sealed surfaces and may be used in place of traditional hard engineering solutions. Technical performance should be combined with consideration of the ecological habitat, as well as other human interest to deliver landscape benefits for all.

For the purposes of this Document SuDS elements with a vegetated component are considered in greater details; these include:

- Swales;
- Bioretention and rain gardens;
- Bioretention Tree pits;
- Filter strips;
- Wetlands and Infiltration Basins.

The elements listed above are not rigid as frequent overlap between components may occur. However, the presence (or absence) of permanent standing water has a significant bearing on the design of the relevant vegetation, and therefore plays a key role in the species selection.

Designers and specifiers shall be aware of the potential for risks to the public linked to introducing temporary and, more in particular, standing water bodies into infrastructure schemes. Public access may need to be restricted and a risk assessment shall be carried out at design stage.

Swales

Swales are linear, vegetated channels that may be used to infiltrate, convey and store stormwater. Swales often run parallel to infrastructures such as roads, footpaths, and cycleways. Swales can simply be grassed but often include plants or trees, which add to the swale's biodiversity, connectivity and aesthetic value. The linear nature of swales mean that they can often help define a boundary, edge or threshold between different types of spaces within urban transport environments.

Swales contain gentle slopes that convey surface water and allow for infiltration. Swales may be wet or dry depending on soil conditions and intended function. Impervious membranes including synthetic liners or puddled clay may be used to limit groundwater discharge, therefore creating a wet swale; sand and drainage stone may be added to improve drainage and create a dry swale.

The incorporation of sacrificial limestone chippings and the use of engineered soils can trap oil and petrol contaminants before the storm water is directed off site. Swales may be fitted with a French filter drain to take excess water into a main drain during periods of heavy rainfall. Swales constructed with an engineered soil are referred to as Bioretention Swales.

Bioretention systems and Rain Gardens

Bioretention is a stormwater practice that treats and filters runoff water using engineered soils and vegetation. Bioretention systems are shallow vegetated depressions typically designed to treat the first flush from a stormwater event. Within bioretention systems engineered soils are specified as filter media. The filtered runoff is typically collected using an underdrain. Bioretention systems can include trees within their composition. Maintenance is required to remove periodic build-up of silt derived from urban runoff.

Figure 4.17: Grey to Green, Sheffield.

Rain gardens are like bioretention systems although simpler in design: often, existing garden soil is used. The combination of a diverse planting scheme with rain gardens solutions can perform a hydrological function whilst contributing to biodiversity and enhancing the aesthetic value of urban transport corridors.

Bioretention Tree Pits

Bioretention Tree Pits (also known as SuDS tree pits) are constructed to collect rainwater from adjacent surfaces and attenuate this runoff through engineered soils. Bioretention tree pits can be accommodated both within paved streets and within open vegetated areas. Where possible, open tree pits are preferred to the use of load bearing soils usually required beneath pavements.

Bioretention tree pits tree pits shall include an underdrain, to prevent accumulation of standing water in the root zone for over 24 hours. Where possible, bioretention tree pits should be connected in a continuous linked trench, to facilitate healthy root development. If designed in this manner, trees can share the soil rooting volume.

Engineered soils allowing free draining to an underdrain should be specified. As the runoff entering the SuDS tree planting will carry silt and pollution, silt removal should be incorporated into the system to facilitate maintenance.

Filter strips

Filter strips are gently sloping vegetated (often grassed) strips of land slowing rainfall runoff and allowing for the trapping of suspended sediment. Planting should not be an impediment to this flow. Filter strips are often the first interface to a SuDS system and are usually connected to other elements downstream within the drainage system. Filter strips may also be lined to intercept polluted runoff or may be designed in combination with a filter drain when they are likely to intercept oil or heavy pollution.

Wetlands and Infiltration Basins

Wetlands utilise the combined natural processes of vegetation, soil and microorganisms to attenuate and treat wastewater. Wetlands include aquatic vegetation which helps with the settlement of sediments in the water column.

Wetland vegetation also facilitates the removal of nutrients and pollutants in the water column and encourages aerobic decomposition. The retention or inclusion of standing bodies of water in the landscape also brings significant ecological and habitat benefits. In addition, the presence of such an ecological feature can serve as a community feature bringing with it place-making and educational values.

Infiltration basins are shallow vegetated depressions that allow for the storage of stormwater in case of heavy rainfall events. These elements are landscaped in a manner consistent with recreational use and often form part of parks and open spaces. Infiltration basins are typically dry except during periods of heavy rainfall. Infiltration basins provide containment and allow infiltration of stormwater through the soil, contributing to groundwater recharge.

4.2.2 Vegetation Associated with Structures

This category includes soft landscape treatments and elements associated with structures including:

- Green walls;
- Median, Island and Roundabout planting;
- Raised Planters.

Technical guidance to inform the Specification, Planting, Maintenance and Management is provided for each treatment in Guidance Document GE-ENV-03001.

Green walls

The incorporation of vegetation into vertical structures can create an attractive façade, benefit biodiversity and contribute positively to climate resilient design solutions. For the purposes of this report Irrigated Green Walls (more accurately described as pocket based green walls) are not considered further.

Green walls with self-climbing vegetation may be considered where blank façades present an opportunity for introducing additional planting. This intervention may require structural supports, to be developed and reviewed by structural engineers. The type of structural support is dependent on the planting specified: co ordination between Structural Engineers and Landscape Professionals is key to achieve a successful outcome.

Green walls also offer visual screening opportunities in urban settings, together with bringing environmental benefits such as habitat creation, air filtering, and noise mitigation.

Figure 4.18: Infiltration basin used as open space in Fitzgerald Park, Cork.

Median, Island and Roundabout planting

Median

The median is the area between opposing lanes of traffic. Medians offer significant potential for all categories of soft landscape treatments and can contribute to a strong sense of place by making junctions more obvious to approaching traffic. In addition, median planting can positively allow for pollinating plants and contribute to SuDS.

Traffic Island

A traffic island is a small area in the middle of a road which provides a safe space for pedestrians to stand, while marking a division between two streams of traffic. Traffic islands may offer potential for planting. Traffic islands can provide reference points for road users waiting to enter a junction. Too much visibility as well as too little visibility at a junction can contribute to problems and need careful assess

Roundabouts

Roundabouts are the safest form of stop at grade junctions for motorised vehicles. From a soft landscape perspective, roundabouts include a large central island which can offer potential for planting not posing a conflict to the sightline requirements. Thoughtful and distinctive roundabout planting and design can make a strong contribution to placemaking while also benefiting biodiversity and contributing positively to SuDS.

Planting shall be carefully selected to meet clear zone and sightline requirements.

For further guidance on design of the traffic islands, median strips and roundabouts refer to DN-GEO-03060.

For the purpose of this Document, raised planters are considered planters that are not in contact with the existing native soil. This approach offers many benefits in urban environments where underground car parking, buried services, or contaminated soils may exist. However, raised planters also carries disadvantages such as the potential for soils to dry out, and planter conflicting with visual sightlines.

Figure 4.19: Planted median strips between traffic lanes in Summerhill, Dublin.

Figure 4.20: Planted traffic island, Warsaw.

Figure 4.21: Beresford Place, Dublin. Image from Dublin City Council Parks Instagram Page.

Construction of in-ground planters is generally preferable and more sustainable long-term. However, raised planters can be appropriate in the following scenarios:

- To create a buffer between the road and footpath;
- To help direct pedestrians towards specific locations (e.g., crossings), instead of using more visually intrusive elements such as guardrails;
- In areas where underground services/basements or poor soil conditions do not allow planting directly into the ground;
- Where they can help in addressing issues linked to change in ground level or the provision of ramps;
- To help integrate vents or other service infrastructure into the streetscape.
- Function and Value
- From a functional perspective, planting adjacent to structural elements can deliver many benefits, including:
- Avoid, reduce or minimise development in sensitive or prominent locations;
- Provide reference points for road users providing a sense of place;
- Provide amenity for pedestrians within the public realm;
- Introduce biodiversity and habitat into the public realm;
- Visually minimise insensitive design.

Trees can act as a landmark and may be seen by drivers approaching an area ahead of signage and road markings, therefore contributing to traffic calming. When selecting trees, safety considerations need to be taken into account, for instance canopy's eventual spread and height, any forward visibility issues, and the clear zone required in relation to the road speed. Depending on the project and its location, trees on streets will need a certain clear stem height to facilitate inter-visibility. Final plant selection shall be agreed with TII.

Finally, if planting is being chosen to create impact, consider using a limited palette of plants and colours. Although it is preferable to design planting mixes that provide all year long interest. It may be necessary to consider if there is a particular time of the year when planting should be at its most vibrant given the local context, for example during an annual festival season. If a roundabout is to act as a gateway, the inclusion of vibrant planting may be appropriate.

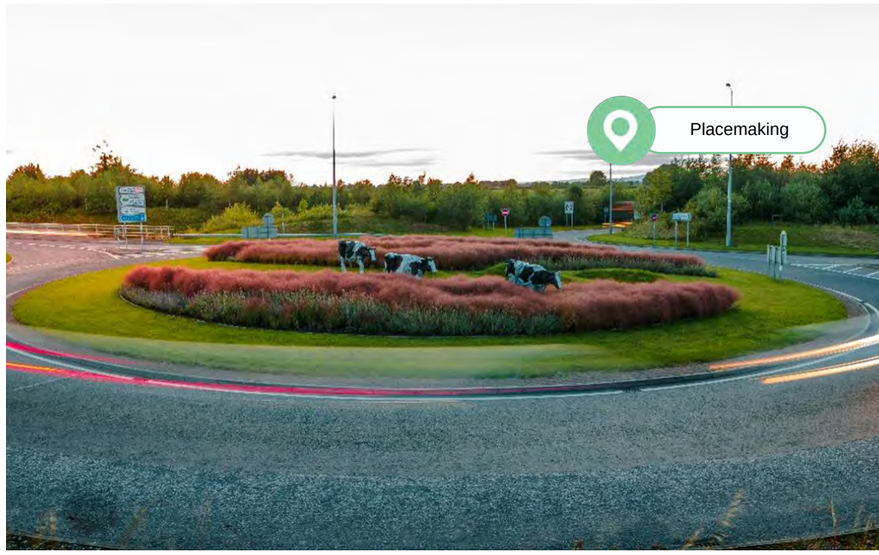


Figure 4.22: Roundabout at Fermoy M8 entrance to town.

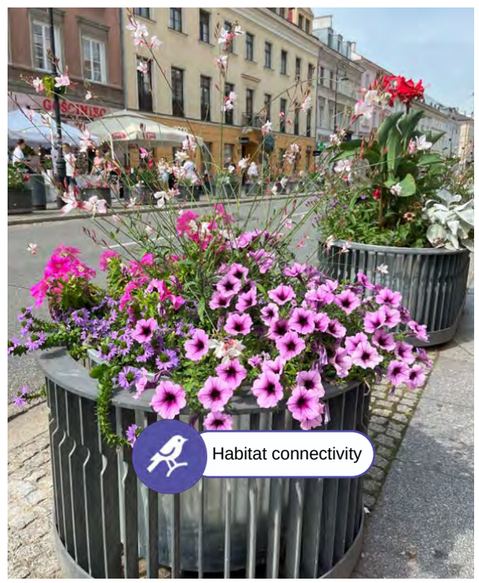
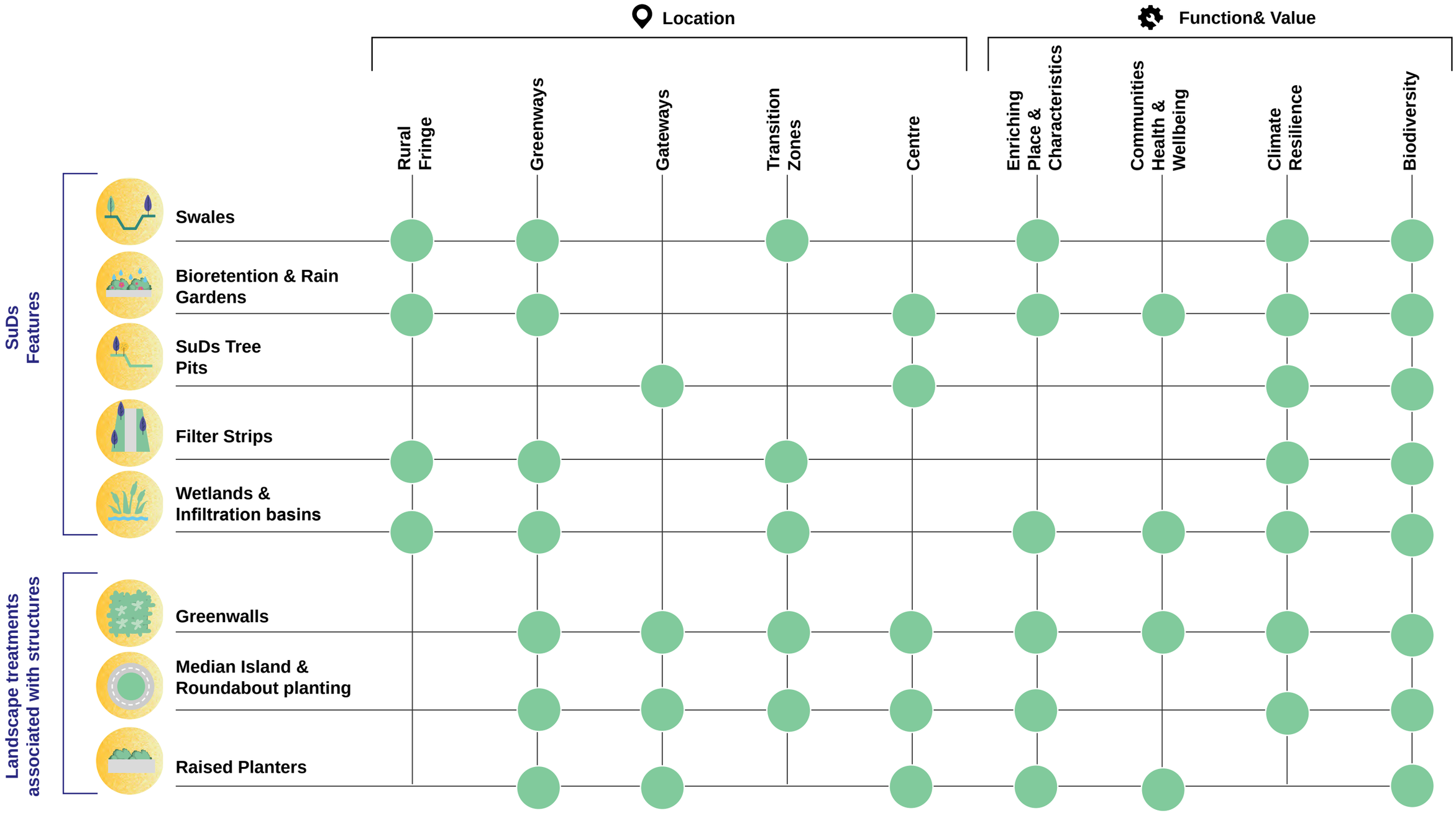


Figure 4.23: Flowering plants in a raised planter separating footway traffic from pedestrians.

4.2.3 Summary of Landscape Elements, their Potential Location, Function and Value



5. Soft Landscape Planning and Design Actions

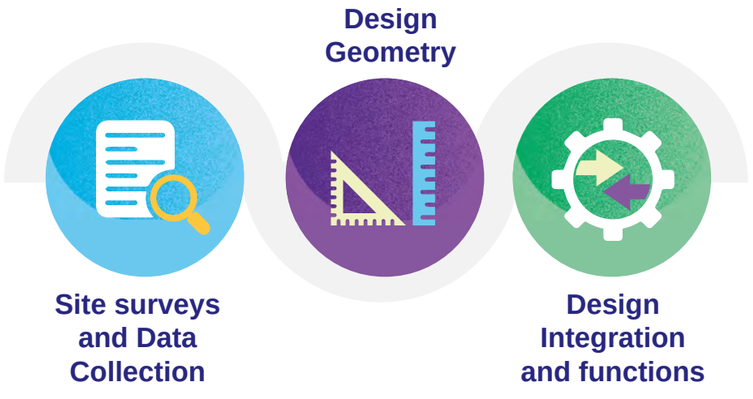
Section 5 describes key processes and drawings required throughout the soft landscape design process; it also expands on references made in Table 2.1 in Guidance Document GE-ENV-03001, providing an overview of TII Project Phases and the Landscape Professional's Inputs and Outputs. It is organised as follows:

- Actions informing the Planning and Design Phases;
- Key Delivery Documentation for Construction and Implementation.

The first part provides technical guidance related to soft landscape design's Planning and Design Phases. The content set-out is relevant to TII's Planning & Design Project Phases:

0. Scope and Pre-Appraisal;
1. Concept & Feasibility;
2. Option Selection;
3. Design and Environmental Evaluation;
4. Statutory Processes.

This section includes standards and recommendations relating to:



5.1 Site Surveys and Data Collection

Design decisions need to be informed by accurate data, mapping, and surveys. The following surveys are critical in the soft landscape design process:

A topographical survey of the site produced in AutoCAD will be required for all specialists to use as a base plan for detailed site surveys.

Existing services survey

At the project outset or as early as reasonably practical, existing services documentation, as well as any proposed services to be implemented, shall be requested from all relevant parties as appropriate. Example of parties typically involved include TII, Local Authorities, Irish Water, ESB Networks, petrol station owner, site owner etc.

A record of these survey should be kept throughout the project and updated if appropriate.

A site survey would often include a Ground Penetrating Radar (GPR) survey, aiming to record all buried services within and interfacing the site. Nevertheless, buried services may still be difficult to pinpoint: in such instances, slit trenching / trial holes are recommended to confirm existing services location. Based on the programme, these activities can be integrated within the Ground Investigation project phase. When carrying out ground investigation activities on a road or its proximity, adequate traffic management measures are to be put in place.

Drawings of existing services shall:

- Be shared with the multidisciplinary design team;
- Be kept up to date throughout all TII Project Phases as appropriate;
- Be used as a reference when preparing maintenance, management, and end of life plans.

Soil surveys

From the project outset, it is important to understand the health and quality of soil, in order to establish remedial actions and planting strategies. A soil survey should therefore be undertaken to determine soil compaction, nutrition, and porosity levels. The level of detail of soil surveys can carry depending on the site and project requirements.

Soil surveys can provide information on expected crop yields, an indication on which species are more likely to thrive and indicate the most appropriate water management strategies.

A baseline soil survey would typically include data on:

- Soil types;
- Soil depth, fertility, drainage and carbon content;
- Soil limitations;
- SuDS consideration, land drainage;
- Soil microbe population;
- Contamination restrictions;
- Improvement methods;
- Habitat suitability;
- Topsoil excess.

(: Tim O Hare Associates)

Soil surveys should comply with BS EN ISO 14688-1:2018 Geotechnical investigation and testing - identification and classification of soil. Identification and description (ISO 14688-1:2017) - current at the time of writing.

Arboricultural surveys: their components and how to use them
Arboricultural surveys are required when trees and their root systems are affected by works on site. They shall be carried out by a professional Arboriculturist prior to any design work taking place, in accordance with BS 5837:2012, Trees in relation to design, demolition and construction.

Healthy, mature trees can deliver a significantly wider range of ecosystem and placemaking benefits than newly planted ones: multidisciplinary design teams should therefore aim to preserve as many as possible.

Arboricultural tree surveys are key tools to get an understanding of both underground and overground parameters, as well as the existing trees' characteristics.

These surveys provide details on the tree species, size, location, condition, life expectancy and its potential future size. Trees are then categorised according to their condition, to identify those of the greatest value, which should be retained and protected, and trees in poor condition that could potentially be removed.
Surveys will also identify any statutory protections and define each tree or tree group's Root Protection Area (RPA). The survey shall be carried out from ground level and shall include all individual trees with minimum stem diameter at breast height equal to 75 mm measured at approx. 1.5m above ground level.
The Arboricultural Impact Assessment will show the impacts of the proposed construction work on the existing trees and it usually consists of drawings and reports.

Arboricultural tree surveys include:
Tree Tagging and Provisional Hand Marked Topographic Survey:
The Consultant shall carry out on-site tagging of all trees to be included in the arboricultural survey, whether or not they are plotted on the provisional site extents drawings or topographic drawing.

Arboricultural survey tabular report:
Data pertaining to all trees, avenues, roundabouts, groups of trees, woodlands and hedges in the arboricultural survey will be detailed in tabular format using terms of reference in accordance with BS 5837:2012.

Arboricultural survey narrative report:
The Consultant shall provide a narrative summary of the general condition of the existing tree population.
Tree condition category CAD model and drawings, and PDF format copy. The Consultant shall summarise all information described in section "4.5 Tree categorisation method" of BS 5837:2012 - Trees in relation to design, demolition and construction – Recommendations, in drawing format, referred to as "tree condition category model". Using the topographic tree survey drawing as a basis for mapping all trees, avenues, groups of trees, hedges and woodlands, the Consultant shall produce a CAD model file, colour coded so as to indicate to which of the four categories (i.e., A, B, C or U) each surveyed element would belong to. PDF format copies should also be provided.

Tree root protection area CAD model:
In addition to the tree condition category drawing model, the Consultant shall provide a CAD model of the Root Protection Area, indicating the minimum area around all trees, groups of trees, avenues and woodlands deemed to contain sufficient roots and rooting volume to maintain viability.

Arboricultural survey photographic record:
The Consultant shall carry out a photographic survey of all trees, avenues, groups of trees and woodlands included in the Arboricultural tree survey.

Arboricultural impact assessment, as required:
In addition, the Consultant may be required to carry out an Arboricultural Impact Assessment, in accordance with BS 5837:2012, section 5.4 as required by Local Authority.

Planning process support, as required:
The Consultant shall, if required, fulfil the role of the Arboricultural Specialist as the scheme's EIA process takes place. The Consultant shall produce the Arboricultural Survey Tabular Report and the Arboricultural tree survey narrative report to support the Environmental Impact Statement, with particular regards to the Landscape and Visual Assessment and the Flora and Fauna Assessment.

Construction stage support, as required:
If required, Arboriculturalsists shall assist with overseeing the digging of trail pits and assessing related outcomes, supervising other critical works in relation to trees, and preparing the Arboricultural Method Statements.

Figure 5.1: Pollarded Lime Trees lining road corridor.

Root Protection Areas (RPAs)
According to BS 5837:2012, RPA is a calculated area of ground that lies immediately under a tree and just beyond the extent of its crown. Its identification aims to prevent damage to the tree's rooting system. In planning, the concept of RPA is used to avoid loss or damage to trees being retained within a development (Woodland Trust, 2021).
To enable trees to be successfully retained, it is critical to safeguard their rooting systems. On receipt of the tree survey, a cross-checking exercise should be undertaken to compare the trees' RPA against site characteristics including existing and proposed services, buildings, levels changes, all of which have the potential to detrimentally impact on tree health.

Methodologies for surveying trees in Urban Transport Environments

TII have identified four methods for surveying;
- Individual trees;
- Avenues;
- Woodland belts and groups, and;
- Roundabouts.

These methods are outlined below.
Arboricultural Survey Method – Survey of Individual Trees:
The Consultant shall carry out a survey of all trees whose root or canopy system falls within the 'extents of the Arboricultural survey' indicated on the accompanying drawings, except for trees located within screen/woodland, avenue or roundabout groups. The survey shall be carried out from ground level and shall include all individual trees with minimum stem diameter at breast height equal to 75 mm measured at approx. 1.5m above ground level.

Arboricultural Survey Method – Survey of Avenue Trees:
The Consultant shall carry out a survey of all tree groups whose root or canopy system falls within the avenue groups indicated on the accompanying drawings. The survey shall be carried out from ground level and shall be applied to all avenue groups as indicated on the accompanying drawings. Although avenues are typically assessed as a visual group with a common categorization, average height (maximum or minimum), stem ranges, and therefore subject to shared management proposals, should significant variations in attributes be noted during the survey, the assessment of individual trees within the avenue group might be required.

Arboricultural Survey Method – Woodland Belts and Groups: The Consultant shall carry out a survey of all trees and tree groups whose root or canopy system falls within the screen or woodland groups indicated on the accompanying drawings. The survey shall be carried out from ground level and shall include tree groups where the predominant species and approximate percentages, in the case of mixed woodland groups, shall be listed. For tree groups, the lateral spread and average (or maximum and minimum) height and stem rages should be recorded: this approximation is allowed as it is not practical or necessary for every stem diameter and branch spread for every tree within a group to be recorded. Management requirements for the group should be noted under general observations within the schedule as appropriate.

Arboricultural Survey Method – Survey of Roundabouts:
The Consultant shall carry out a survey of all trees groups whose root or canopy system falls within the roundabouts as indicated on the drawings in accompanying drawings. The survey shall be carried out from ground level and shall be applied to all roundabout groups as indicated on the accompanying drawings. While generally roundabouts should be assessed as a visual group with a common categorization and management proposals, if significant variations in attributes or species composition are noted during the survey, there may still be a need to assess individuals within these groups.

Protected Trees
In addition to the carrying out of the Arboricultural survey, Arboriculturalists (as well as Landscape Professionals) are responsible for identifying any trees protected by Planning designations, e.g. Tree Preservation Orders (TPOs).
Section 205 of the Planning and Development Act, 2000 sets legal framework within which the Local Planning Authorities are empowered to make TPOs. The order prevents the cutting down, topping, lopping or wilful destruction of trees without the specific consent of the Planning Authority. Such TPOs do not apply to the cutting of trees which are dead or dying or have become dangerous, or to the cutting of trees in compliance with statutory obligations to prevent or abate nuisance. More information on TPOs is available from Crann's website.

Figure 5.2: Mature planting in an urban setting in Leuuwarden, Netherlands.

Trees and Vegetation to be Retained
Where existing trees and vegetation are identified as to be retained, these must be clearly identified on all relevant drawings. The design team should refer to the Arboriculturist for advice on appropriate protection measures. It is important that the Arboriculturist acts as an advisor throughout the entire design and construction process as they can aid in the identification of any potential conflict, and assist the team in working out suitable solutions which are effective and collaborative. If areas of concern or conflict are identified, the Arboriculturalist shall undertake an Arboricultural Impact Assessment to suggest the best possible solution.

Where conflicts between soft landscape treatments and services arise, the design team shall negotiate to achieve the best all round solution that delivers and maximises the function and value of urban transport environments.
Where large tree species or their zones of influence are located close to development or construction sites, all relevant documentation including tree survey, planning application, tender and construction documents, and others as appropriate, shall include provision for adequate protection of these trees. Refer to the Dublin City Tree Strategy 2016-2020, Appendix 5, for recommendations on the design and construction process for trench works in proximity to trees.

Ecological Surveys
At the start of a project, it is necessary to identify any protected habitats or species that may have legal protection. Qualified ecologists shall be employed to survey existing habitats: the related findings will be used to inform site strategies, design actions and will act as the baseline condition to monitor any future impact against.

Data are increasingly important in the design process and where possible, they should be recorded in a format that can be used in a rich data environment, such as Geographical Information Systems (GIS) or Building Information Systems (BIM). This approach can help designers understand in more depth the current condition and distinctiveness of the existing habitats on site and in its proximity.

All ecological data should be recorded in accordance with the National Biodiversity Data Centre - biodiversity recording standards and shared with the relevant stakeholders as appropriate.

5.2 Integrating Soft Landscape Design into Urban Transport Environments

Integrating Trees and Services
Where possible, tree planting should be co-ordinated to avoid clashes with below ground services (as well as other elements above ground). Trial holes should be dug to confirm the location, size, and direction of these services.

Having said that, it is not always possible to completely avoid conflicts with services, especially within complex urban environments.

There may be instances where it is possible to deviate existing services that would otherwise clash with a tree pit proposed location. Should this not be viable, an option for retaining the existing services would be wrapping them in a geotextile layer, and backfilled with gravel to protect services from overrun.
See Standard Construction Details CC-SCD-03001 to CC-SCD-03017 accompanying this document.

Where appropriate, root barriers can also be used to protect services. Other significant information related to root growth that should be considered when specifying root barriers:

- Typically, most of the root growth would be restricted to the top 600mm of soil depth;
- The use of root barriers may prevent the development of lateral tree roots and impact the structural integrity of the tree;
- Tree roots may need to be contained within individual or continuously planted strips to control root growth.

Underground, overground, and overhead services such as lighting, drainage pipes, feeder pillars, and ducting etc. are common constraints for soft landscape designs. These all need to be assessed early in the project, allowing adequate time to define appropriate solutions should conflicts occur.

Figure 5.3: Planted verge on the gateway to town.

Here are some common conflicts and recommended solutions: Table 6.1: Common conflicts and recommended solutions associated with integration of soft landscape with services.

The design team shall comply with the requirements for services provision specified by TII, the Local Authority, Irish Water, Gas Networks Ireland, ESB Networks and any other relevant service providers. However, coordination between Landscape Professionals and relevant bodies / utility providers must be sought to find agreed solutions to complex interfaces, with the final aim to protect strategic services whilst promoting good urban tree coverage.

An example of this approach can be found in Cardiff, where services have been incorporated into the tree pit extent. Please refer to pictures shown on right -

Protection of Tree roots from excavation
As detailed earlier in this section, tree roots' damage or severance caused by excavation works being carried out in their proximity should be avoided, as this can have a detrimental impact on the structural stability of the tree as well as on the capacity of the tree to absorb water and nutrients from the adjacent soil. Refer to British Standard 5837:2012 'Trees in Relation to Design, Demolition and Construction – Recommendations' for further guidance.

Where a risk of damaging a tree root system exist, and in particular in proximity to the rootball, non-invasive excavation tools and equipment such as air spade or air powered excavators should be considered. All such tools and equipment should be operated by trained operators only.

All soft landscape treatments specified shall be designed allowing for the safe maintenance of any existing or planned overhead or underground service.

Potential conflict	Proposed trees are perceived to be located too close to proposed lighting pole
Solution	Lighting engineer and Landscape professional to liaise so as to agree on shifting lighting element locations and/or trees on a case-by-case scenario
Potential conflict	Multiple services restrict the proposed tree pit extent
Solution	Group together services to maximise a space for trees
Potential conflict	Tree root located in close proximity to building foundations
Solution	Explore the use of root protection barriers and root director products. Careful consideration should be given to tree species selection (refer to section 4.1.1 of this document)
Potential conflict	Underground services not picked up by existing services survey now located where the tree has been proposed
Solution	Pending on type of clash, consider wrapping the services in a layer of geotextile, then backfill with gravel to protect services

Table 5.1: Clarendon Common conflicts and recommended solutions associated with integration of soft landscape.

Figure 5.4: Clarendon Street by Colm Kenny Landscape Architecture

Useful guidance when working with existing services can be found in the following documents:

- Chapter 8 of the Temporary Traffic Measures and Signs for Roadworks by the Department of Transport, Tourism and Sport, when designing any works that requires traffic management;
- The Health and Safety Authority Code of Practice for Avoiding Danger from Underground Services;
- Code of Practice for Avoiding Danger from Overhead Electricity Lines, ESB Networks.

Good integration of soft landscape treatments and services can be achieved by:

- Collecting detailed site services data using survey techniques presented in this section;
- Locating services out of the 600mm root depth where most tree roots grow;
- Installing root protection barriers along building foundations and around services as required;
- Providing suitable growing conditions for trees, e.g. by using tree trenches or crate systems that can link street tree pits with nearby soil volumes (e.g., parks and gardens).

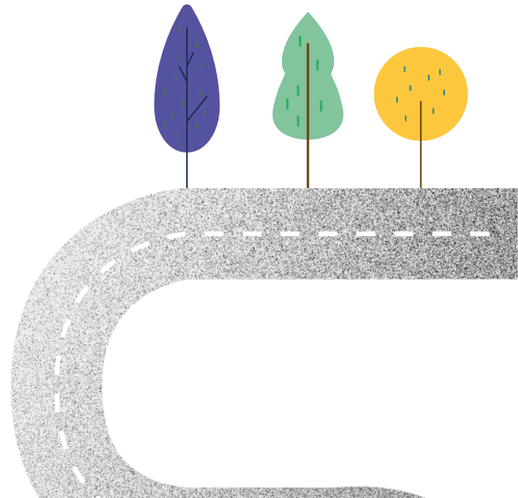
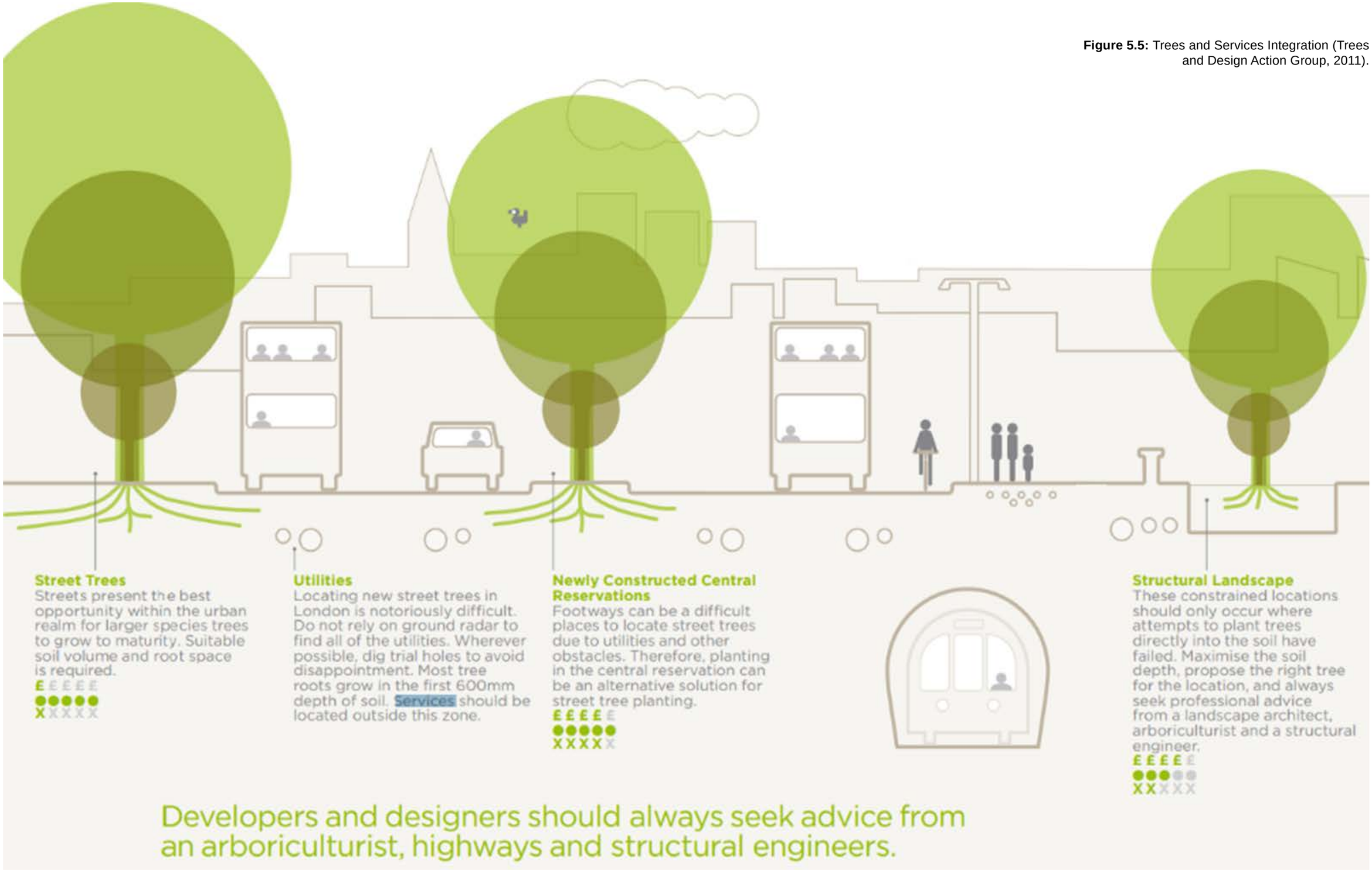


Figure 5.5: Trees and Services Integration (Trees and Design Action Group, 2011).



The following documents should be referred to when planning soft landscape treatments that include existing or proposed trees:

- British Standard BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations;
- The Forest of Fingal, a Tree Strategy for Fingal, May 2010;
- Trees in Hard Landscape; A Guide for Delivery, The Trees and Design Action Group, UK;
- Trees, Planning and Development: A Guide for Delivery, The Trees and Design Action Group, UK;
- Trees in the Townscape: A Guide for Decision Makers, The Trees and Design Action Group, UK;
- Living with Trees, South Dublin County Council, Tree Management Policy 2021-2026;
- Dublin City Tree Strategy, 2016-2020.

Soft Landscape and Safety Requirements

Proposed vegetation should be specified to comply with safety requirements throughout its lifecycle. An example of this would be considering a tree, mature tree size (or as much of it that is expected to be achieved within an urban environment), rather than tree size at the time of nursery tagging or planting.

In addition, the following should be noted:

- Ensure new soft landscape treatments do not obstruct sight lines and/or narrow footpaths or cycle lanes (TDAG 2014);
- Refer to The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges DN-REQ-03034 when considering the positioning of soft landscape treatments adjacent to roads;
- Soft landscape treatments should not clash with required sight distances. For visibility requirement refer to the appropriate standard depending on site location. For National Roads and transition zone refer to TII publication, for town and urban areas refer to DMURS;
- Areas that are included in visibility envelopes shall be planted with grass or species having a low mature height and low maintenance requirements. The specified plant species shall not grow higher than specified by DMURS or TII Standards depending on the project location.

Figure 5.6: N81, Baltinglass

A.1 Requirements of a Brief for Procurement of Landscape Professionals

Sample Brief

An Integrated Design Team For Landscape Services

For Phase 0 to Phase 7. [Select phases to which services apply].

Introduction

Transport Infrastructure Ireland (TII) seeks to commission the services of a suitably qualified and experienced Landscape Professional specialising in public realm design, for the Project as described above. The successful Landscape Professional will work as part of a larger design team.

The specific services in respect of the project will be delivered in stages as set out below:

- Phase 0 - Scope and Pre-Appraisal
- Phase 1 - Concept and Feasibility
- Phase 2 - Options Selection
- Phase 3 - Design and Environmental Evaluation
- Phase 4 - Statutory Processes
- Phase 5 - Enabling and Procurement
- Phase 6 - Construction and implementation
- Phase 7 - Close out and Review

The purpose of this document is to provide tenderers with information regarding the scope of service to be provided. The appointed consultant will be required to provide services in stages from Phase 0 to stage 7 as described in this document and the attached Tender and Schedule, and other Request for Tender (RFT) documents.

Tenderers should refer to the Project Brief Document and associated Tender Documentation and Information Pack for a full detailed description of all service requirements.

Requirements

Landscape Professionals involved in TII projects concerning the planning, design and delivery of soft landscape treatments in and around transport corridors are required to meet all of the following criteria:

- National Framework of Qualifications (NFQ) Level 8 (or equivalent level) in Landscape Architecture (or equivalent discipline); and / or, a master's degree (NFQ Level 9 (or equivalent) in Landscape Architecture (or equivalent discipline);
- Full corporate membership of the Irish Landscape Institute (MILI), or equivalent professional body that represents landscape professionals, and is a member of the International Federation of Landscape Architects; or be eligible for same.
- At least ten years of relevant post-graduate experience as a Landscape Architect.

It is important to note that the minimum number of years' relevant post-graduate experience may change (upwards or downwards) depending on the size, nature, and complexity of the project in question. Furthermore, further criteria must be laid down to specify the post-graduate experience that is considered relevant to the project's context.

It is essential that careful consideration is given to including adequately experienced professionals with the relevant expertise; effective collaboration shall also be enabled to ensure successful implementation of Soft Landscape Treatments.
The Project Manager must therefore document the identified criteria ensuring Landscape Professionals are qualified, competent, and expert.

The professionals to be involved at the early stages of a project should be as instructed by the Project Manage r and based on desktop analysis of the potential project area.

Town / Village Background

To be inserted based on local context and history.

Planning Context

Ireland's Towns and Villages are the centre of the social and civic life of much wider communities. Town centres with a vibrant commercial offering, diverse services and an attractive public realm sustain economic growth, attract more people to the region, and promote a sense of well-being and identity. It is vital for town centres to be successful and viable to provide for their populations as well as to encourage visitors.

Many of our towns are under pressure from several factors. Notably high levels of traffic, poor pedestrian connectivity, relatively high vacancy rates, and limited night-time activity. Despite this the Town Centre continues to provide a good range of retailing, with many local or family-owned premises. The traditional town centre creates an attractive built environment complementing the natural setting. However, investment in the public realm of our towns and villages to achieve traffic calming while delivering an expanded public realm is central to maintaining and enhancing the vitality of these into the future.

National Roads and Greenways run through many towns and villages around the country with very different characteristics. Good design begins with an understanding of the place. So it follows that different design solutions should be applied in different places to take account of this variety and local context. This context should influence traffic calming measures and also present opportunities within the public realm. By analysing the context and its various components, these opportunities become clearer.

In order to address these issues holistically it is necessary to start with the design of the street as more than a conduit for traffic. The publication of the Design Manual for Urban Roads and Streets (DMURS) in 2013 sought to rebalance the competing needs of all road users with the identification of place

- Develop and investigate in further detail the issues, opportunities and feasibility of the project.
- Input to examination of potential solutions to determine a preferred option for the project.
- Provide inputs to the project design, following the selection of a preferred option, based on both technical and environmental inputs (including the production of an LVIA where required), to a stage where sufficient levels of detail exist to establish landtake requirements (if any) and to progress the Project through the statutory processes.
- Compile Planning level documentation and participate in oral hearing(s) as required by the statutory processes to ensure that the proposed project is developed in accordance with planning and environmental legislation.
- Compile tender documentation, including soft landscape design plans and schedules to allow for the appointment of a Contractor to execute the Main Contract and undertake enabling works to facilitate the works.
- Complete all outstanding contractual and residual issues relating to the project.

The Landscape Professional will provide the following:

- The provision of improved pedestrian, cycle and vehicular access as required along with age friendly public realm improvements in the works area which will provide:
- A high-quality sense of place which reflects the town/village setting and identity which connects all elements of the wider urban realm - linking pedestrian, residential, economic, civic, community and recreation networks;
- Protection and enhancement of the existing built and natural heritage of the area;
- Protection and enhancement of the existing and future community and residential population in the area;
- Conditions for opportunities for private investment in the area thereby underpinning commercial and recreational activity within study area which in turn provides the basis for all other desired outcomes to flourish;
- Installations that are age friendly, socially inclusive and accessible for all users.
- Urban tree planting strategy to ensure trees that best contribute to the Project's objectives based on the principles of DMURS to improve place making and assist in traffic calming measure within the proposed public realm design. Suitable street trees will be required to be specified at locations within the proposed design of the streetscape and the park context using resilient and appropriate tree choices. The choice of street tree planting will be carefully considered taking into account landscape and townscape character.

The tree planting strategy should make reference to guidance as per the Trees in Hard Landscapes: A Guide for Delivery companion document to Trees in the Townscape: A Guide for Decision Makers http://www.tdag.org.uk/trees-in-hard-landscapes.html

- Advice, in collaboration with the wider design and project team and design solutions to avoid conflict of tree planting and underground services and surrounding infrastructure. [utility services mapping to be provided]. Innovative and available technical solutions will be required to enable the successful establishment of the trees given the congested below ground conditions. Input will be required on the sizing and design of the below ground rooting environment and treatment of the surface tree opening for each tree pit location.
- Advice on sustainable drainage and biodiversity enhancement measures following 'All-Ireland Pollinator Plan' (AIPP) guidelines.
- Arboricultural input as required to provide the design team with a tree protection and constraints plan where exiting retained trees may be impacted by the scheme works.
- Design of nodes within the public realm which may include seating, paving etc.

Key Landscape Tasks & Deliverables

Refer to Section 4.2 of this Document

Programme

It is intended to deliver the project under Part 8 of the Planning and Development Regulations by the LPA, with the tender to be submitted by (insert date). Therefore, one of the conditions of engagement for this consultancy service is an ability to meet a tight programme and to demonstrate a clear understanding of the project brief. Evidence of a history of successfully delivering similar schemes is required.

The timelines for the following project phases are anticipated following appointment:

Phase	Timeframe
· Phase 0	To be completed
· Phase 1	To be completed
· Phase 2	To be completed
· Phase 3	To be completed
· Phase 4	To be completed
· Phase 5	To be completed
· Phase 6	To be completed
· Phase 7	To be completed

References

Note on relevant documents that should be included.

General

- DMURS (Design Manual of Urban Streets and Roads)
- Pollinator-friendly management of Transport Corridors - All Ireland Pollinator Plan, National Biodiversity Data Centre (2019).
- The Sustainable Drainage Systems Manual (SuDS Manual C753), Construction Industry Research and Information Association (CIRIA)
- A Guide to Landscape Treatments for National Road Schemes in Ireland (NRA, 2006).
- Guidelines on the Implementation of Landscape Treatment on National Road Schemes in Ireland (NRA, 2012).
- Trees in the Townscape: A Guide for Decision Makers.
- All relevant local Tree Strategies.

TII Documents

- TII Sustainability Statement and Sustainability Implementation Plan (TII, n.d.).
- TII (Guidance) GE-ENV-03001 Guide for the Implementation of Soft Landscape in Towns and Villages on National Roads.
- TII Publication (Standards) DN-GEO-03084 The Treatment of Transition Zones to Towns and Villages on National Roads.
- TII Biodiversity Plan (2023)
- TII Landscape Plan (2023)

Figure 5.7: Biodiversity friendly Gateway

Figure 5.8: Grassed verge in an urban setting.

A.2 Sample Management and Maintenance Guide

Contents

1. Maintenance (also called establishment phase)

Contractor's Obligations

The Contractor shall comply with the maintenance schedule as shown on Table A.

The Contractor shall provide the Employer's Representative with a list of the dates of visits to carry out maintenance Works for the specified maintenance period after substantial completion.

The Contractor shall give the Employer's Representative 14 days' notice of any proposed change in the date of a visit and any such change shall be confirmed to the Employer's Representative in writing.

Following each visit the Contractor shall report to the Employer's Representative any additional operations considered necessary to ensure the satisfactory establishment of plants.

Plants which have become loosened, lifted up or out of the ground shall be set upright and re-firmed by treading.

Watering

All plants shall be watered adequately to ensure healthy growth. The contractor shall include for 3 visits to water the establishing perennial plants during dry periods during the first growing season only. Any additional visits deemed necessary to water the establishing vegetation shall be agreed as an additional priced item by the ER in advance.

The contractor shall include for 3 visits to water the establishing trees during dry periods during the first growing season only. Any additional visits deemed necessary to water the establishing vegetation shall be agreed as an additional priced item by the ER in advance.

When watering, the Contractor shall apply sufficient water to return the soil to field capacity. In the event of restrictions on the use of water, the Contractor shall make his own arrangements for obtaining and using water from other sources.

Weeding, Litter and invasive Species

Plants shall be kept free of pests and diseases.
Control measures shall be carried out by agreement of the Employer's Representative

A circle 300mm radius from the base of each tree and a strip 300mm either side of each hedge shall be kept free of grass and weed growth and kept tidy (as agreed/appropriate due to receiving environment). For establishment phase only.

Planted areas shall be kept free of grass and weed growth and kept tidy. In areas containing low shrubs, ground cover plants, herbaceous material and bulbs, this control shall be by mechanical means. In other planting areas where chemical weed control shall be permissible, the tops of weeds shall be removed after die-back is complete.

Weeding shall be carried out either by hand or by using a contact or translocated herbicide as agreed/appropriate due to receiving environment. For establishment phase only. The tops of weeds shall be removed after die-back is complete.

Planting areas outside the weed free circle 300mm radius from the base of each tree shall be controlled by mechanical means. Those weeds including their root systems covered under the 1956 Weeds Act shall be eradicated in a method approved in writing by the Employer's Representative. Vegetation in these areas shall be cut down in June and September.

The Contractor shall control and remove from all grass areas, except road verges, any pernicious or noxious listed in the Noxious Weeds Act 1936 by physical or chemical means as necessary. Such weeds shall be removed before they come into flower.

Slow-release fertilizer (where required) shall be evenly incorporated into the surface of the soil over the rooting area of each tree, hedge and plant other than grassed areas. Slow-release fertilizer shall be evenly incorporated into the mulch over the rooting area of each tree.

All litter shall be removed from Site.

Plant Supports, Trimming and Pruning
Plant Supports such as canes, tree ties and tree stakes shall be checked and when necessary adjusted.

The Contractor shall prevent chafing and damage to the bark of trees, caused by rubbing against stakes.

All trimming and pruning to be carried out in accordance with specifications.

The ground surface shall be made good and left tidy to the satisfaction of the Employer's Representative.

Landscape Treatments – Specific Instructions

Trees, Woodland and Fruit Trees
Tree stakes, ties and other supports and also guards, shelters and the like, shall be removed by the end of the second planting season, after obtaining the agreement of the Employer's Representative. The hole in the ground shall be back filled with topsoil.
Trees pruning/maintenance where necessary shall be pruned to a height as per landscape drawings. This work is to be guided by a qualified arboriculturist. Maintenance shall ensure that the clear stem height as described above is retained.

Hedges and Shrubs
Other than in hedges, straggling items, over-vigorous shoots, suckers and dead, misshapen or broken branches shall be removed from trees and shrubs by pruning back with a clean smooth cut to the main stem, or a sound and living outward growing lateral.

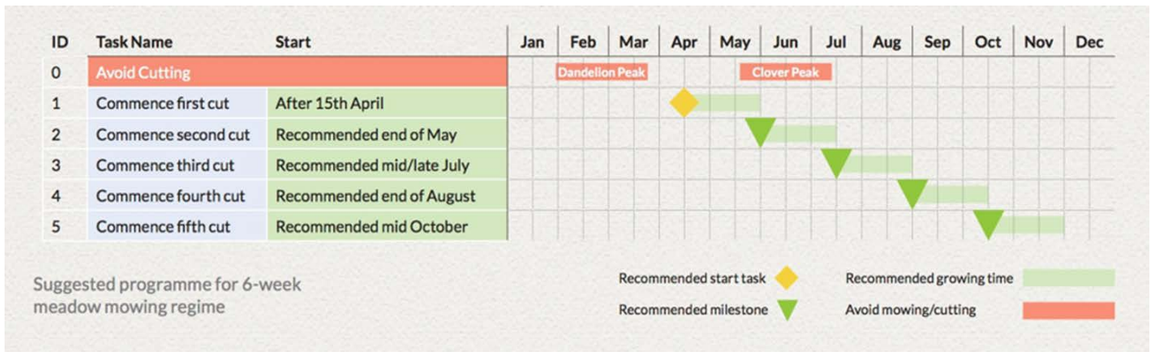


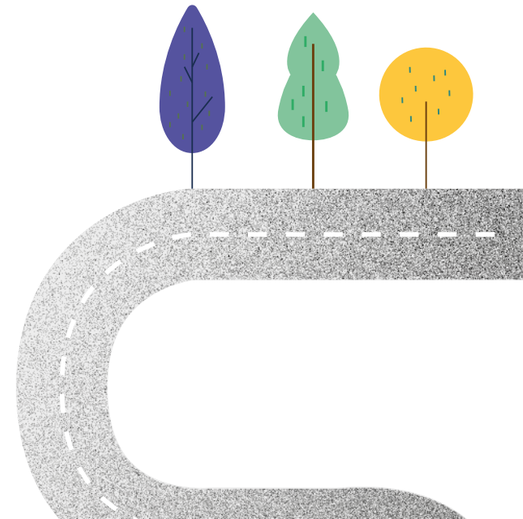
Table B extracted from Pollinator Friendly Management for Transport Corridors available from Pollinators.ie

Existing grassed areas to be managed as Semi Natural Grassland.

All other grass areas shall be maintained to a height not exceeding 450mm. This shall be achieved with an annual cut in September each year. Where existing sward appears excessively rich in nutrient this may require another maintenance cut in April each year. All arisings shall be removed off site.

Swathes of grass cuttings shall be collected up and removed from Site by the Contractor.

Any ruts or ridges shall be levelled off, topped up as necessary with topsoil and re-cultivated and reseeded.



Key Maintenance Actions Over Time

Operation (during the maintenance/establishment period)	Date by Month (Starts April)											
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Fed	Mar
1. List of visits	X											
2. Plant replacement inspection					X							
3. Site visit with landscape professional				X								
4. Plant replacement							X	X	X			
5. Watering (year 1 only)		X		X		X						
6. Reforming	X	X	X	X	X	X	X	X	X	X	X	X
7. Removal of Litter	X	X	X	X	X	X	X	X	X	X	X	X
Post and disease control	X	X	X	X	X	X	X	X	X	X	X	X
9. Plant support	X	X	X	X	X	X	X	X	X	X	X	X
10. General pruning	X	X	X	X	X	X	X	X	X	X	X	X
11. Fencing and rabbit guards	X	X	X	X	X	X	X	X	X	X	X	X
Trees woodlands & fruit trees - key operations												
Weed Control	X	X	X	X	X	X	X	X				X
Slow-release fertilizer									X	X		
Tree Inspection												
Pruning works to trees indicated on landscape drawing	X	X	X	X	X	X	X	X	X	X	X	X
Hedges transplants and shrubs - key operations												
12. Weed control	X	X	X	X	X	X	X	X				X
13. Cut down vegetation between circles			X			X						
14. Slow-release fertilizer								X	X			
15. Pruning to hedges										X		
Perennials and ornamental grasses - key operations												
1. Weed control	X	X	X	X	X	X	X	X				X
2. Show release fertilizer (if required)												X
3. Annual pruning of perennials										X		
4. Additional pruning of any perennials requested by client (due to untidy appearance etc.)									X			
SuDS Elements (swales, infiltration strips, constructed wetlands etc.) key operations												
1. Weed control	X	X	X	X	X	X	X	X				X
2. Removal of vegetation and debris to ensure no blockage within (SuDs) networks		X				X				X		
3. Annual pruning of perennials												
Operations to bulbs												
1. Bulbs		X	X									
Operations in grass areas												
1. Grass - Mowing	X	X		X	X		X					
2 Grass - Control and removal of pernicious woods	X	X	X	X	X	X	X	X				

Site Inspection and Replacement

1. Landscape Professional to visit the site accompanied by the contractor during each Summer/growing season (June-September) – and to undertake a written Audit Report of the site. The Audit Report is to be sent to the client who instructs the contractor to address the items raised in the Audit Report.
2. The contractor shall be obliged to provide photographic proof that items have been rectified to satisfaction of Landscape Professional. All items/ replacements shall be completed as soon as the season allows.
3. Replacement planting shall be as original planting, except that no further topsoil needs to be brought to pits.
4. Areas of grass which have not established successfully shall be made good as appropriate.

Figure 5.9: Perennials used as a buffer planting in Carlow.

A.3 Sample Schedule of Quantities

Trees and the canopy layer

Street trees

Botanical Name	Common Name	Height (m)	DBH caliper cm	Clear Stem (m)	Specification	Transplant (times)	Breaks/ branches	Root cond.	Quantity
Tilia cordata	Small leaved lime	4-6m	20-25cm	2.5m	Mature	3 x	N/A	Rootballed	18
Acer campestre	Field maple	4.24-5m	16-18cm	2m	Advanced heavy standard	3 x	N/A	Rootballed	22
Amelanchier lamarckii	Juneberry	3-3.5m	N/A	1m	Multistem	2 x	5 breaks min	Rootballed	12

General Woodland Planting Mix

Botanical Name	Common Name	Height (m)	Specification	Transplant (times)	Root cond.	Spacing	Quantity	Percentage
Wuercus petraea	Sessile oak	60-90cm	Transplant	1+1	BR	1 plant per 1.5m^2	150	15%
Betula pubescens	Downy birch	90-120cm	Transplant	1+1	BR	1 plant per 1.5m^2	200	20%
Corylus avellana	Hazel	60-90cm	Transplant	1+1	BR	1 plant per 1.5m^2	200	20%
Crataegus monogyna	Hawthorn	90-120cm	Transplant	1+1	BR	1 plant per 1.5m^2	200	20%
Sorbus acuparia	Towan	60-90cm	Transplant	1+1	BR	1 plant per 1.5m^2	100	10%
Botula pendula	Silver Birrch	60-90cm	Transplant	1+1	BR	1 plant per 1.5m^2	50	5%
Ilex aguifolium	Holly	60-90cm	Transplant		2L Container	1 plant per 1.5m^2	50	5%
Rhamnus cathartica	Buckthorn	60-90cm	Transplant	1+1	BR	1 plant per 1.5m^2	50	5%

Figure 5.10: Nursery Stock.

Native Hedgerow Mix

Botanical Name	Common Name	Height (m)	Specification	Transplant (times)	Root cond.	Spacing	Quantity	Percentage
Crataegus mcnogyna	Hawthorn	90-120cm	Transplant	1+1	BR	5 per linear m		60%
Prunus spinsos	Blackthorn	60-90cm	Transplant	1+0	BR	5 per linear m		10%
Rose caniana	Dog Rose	60-90cm	Transplant	1+1	BR	5 per linear m		10%
Salix aurita	Eared Willow	60-120cm	Transplant	1+1	BR	5 per linear m		5%
Viburnum opulus	Guelder rose	40-60cm	Transplant	1+1	BR	5 per linear m		5%
Lonlcera periclymenum	Honeysuckle	20-30cm	Transplant	N/A	2L Container	5 per linear m		5%
Corylus avellana	Hazel	60-90cm	Transplant	1+1	BR	5 per linear m		5%

Ornamental Hedgerow

Botanical Name	Common Name	Height (m)	Specification	Transplant (times)	Root cond.	Spacing	Quantity	Percentage
Taxus Baccata	Yew	40-60cm	Transplant	1+1	BR	5 per linear m		100%

Figure 5.11: Rural setting characterised by hedgerows.

Herbaceous Perennails and Bulbs

Herbaceous Mix

Botanical Name	Common Name	Specification	Spacing	Quantity	Percentage
Euphorbia characals	Spurge	2L Container	7 per m^2	105	15%
Alchemelia mollis	Landys Mantle	P9 Container	7 per m^2	180	20%
Nepeta racemosa walkers low	Catmint	P9 Container	7 per m^2	180	15%
Carex pendula	Pendulous Sedge	2L Container	7 per m^2	75	10%
Matteuccia struthiopteris	Ostrich Fern	2L Container	7 per m^2	70	15%
Anexmonex hybrid ‘Honorine Jobert’	Japanese Anernone	2L Container	7 per m^2	105	5%
Hydrangea paniculata ‘Limelight’	Limelight Hydrangea	3L Container Bushy	7 per m^2	10	5%

Bulbs Mix

Botanical Name	Common Name	Specification	Spacing	Quantity	Percentage
Crocus vernus	Spring crocus	4-5cm	10 per m^2	500	50%
Murscari	Grape hyacinth	14-19cm	10 per m^2	500	50%

Verges and the Field Layer

Bulbs Mix

Botanical Name	Common Name	Quantity - 40g per m^2	Percentage
Dwarf perennial rye grass lorina	Dwarf perennial rye grass lorina		20%
Dward perennial rye grass merci	Dward perennial rye grass merci		15%
Strong creeping red fescue pernille	Strong creeping red fescue pernille		20%
Slender creeping red fescue red rescue	Slender creeping red fescue red rescue		20%
Browntop bent highland	Browntop bent highland		10%
White clover hula	White clover hula		5%

Species rich grass mix

Botanical Name	Common Name	Quantity - 20g per m^2	Percentage
Festuca rubra “Commutata”	Chewing fescus		15%
Festuca ovina dunruscula	Hard fescue		20%
Destuca rubra	Strong creeping red fescue		20%
Poa pratenss	Smooth stalked meadow grass		20%

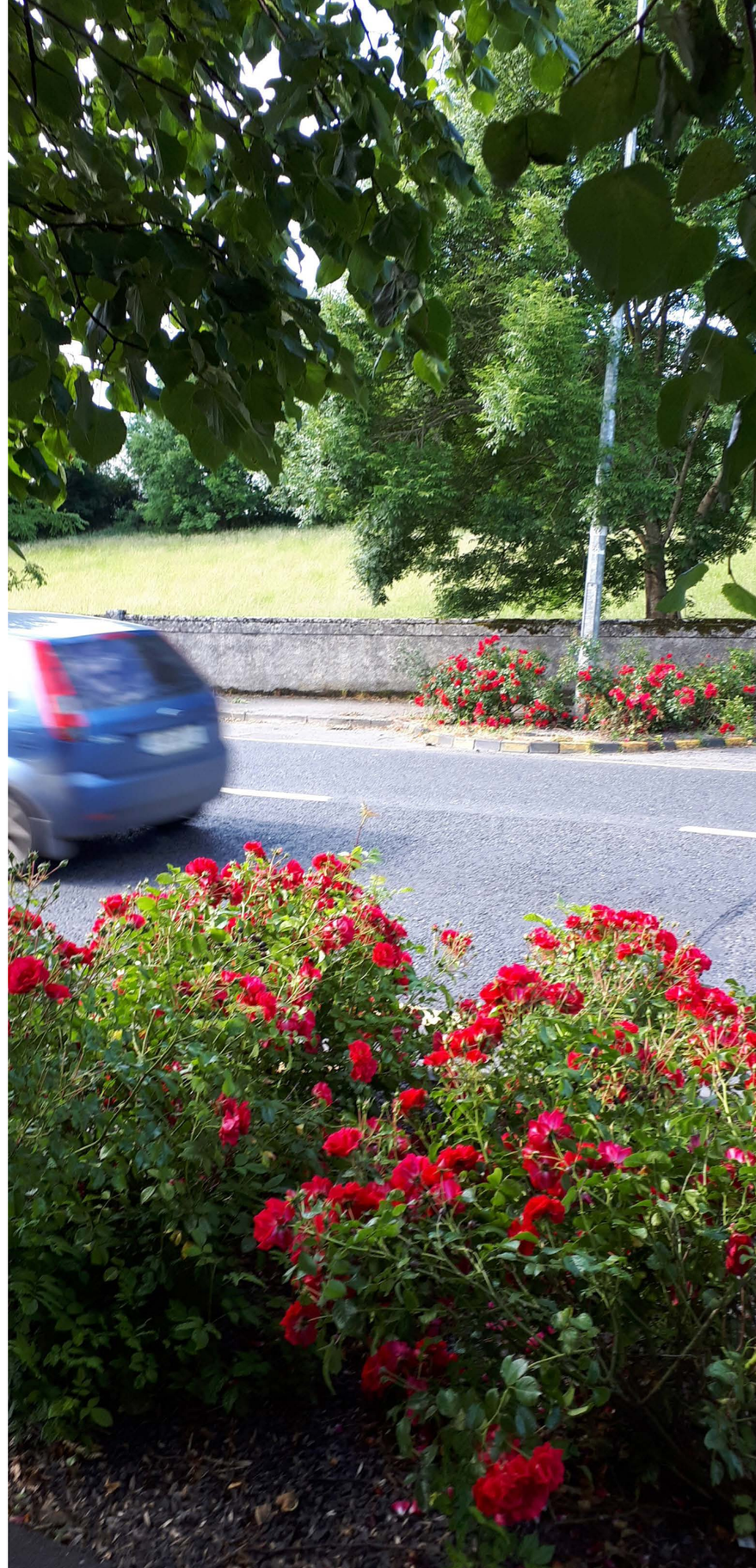


Figure 5.12: Use of colour along transport corridor.

Botanical Name	Common Name	Quantity-20g per m^2	Percentage
Agrostis capillaris	Browntop Bentgrass		5%

Soil and Additional Elements

Topsoil

Origin Supplier	Certification	Quantity
	BS3882 or equivalent	m^3

Tree Pit 1

Pit with Structural Soil

Item	Description	Specifications	Quantity
1	Excavation and disposal		m^3
2	Infill A		m^3
	Infill B		m^3
	Infill C		m^3
3	Surface A		m^2
	Surface B		$m^{3=2}$
4	Accessory A		Item
	Accessory B		Item
	Accessory C		Item

Note: All item to be priced separately, trees to be priced separately
Note: Items described above are sample items

Figure 5.13: Trees protected by metal guards in Midleton, Cork.

A.4 Sample Landscape Report

Contents

1. Introduction

[Insert a description of the scheme. Location and type of scheme. For example, if the landscape works are part of a safety schemes ref DMURS and TII Safety.)

[INSERT LOCATION MAP]

2. Existing Landscape Context

[include a description of the existing landscape context and features that have been used to inform the design e.g. local plant communities/ local landscapes adjacent to the scheme, existing streetscape planting, usage by community.]
For example – In the town core the existing street is dominated by hard surfaces with few street trees. It adjoins the XXX amenity area which contains xxxxx. It is a key pedestrian circulation route to xxxxxx. In the transition zone existing short mown grass areas will be considered as part of the scheme as currently they have little value for placemaking/ ecological connectivity etc.

3. Scheme Landscape Objectives – Design Vision

[Insert the scheme objectives and how the use of soft landscape can help achieve these objectives. How the scheme offers opportunities for landscape interventions in keeping with the overall scheme objectives and TII's sustainability / biodiversity focus Has the scheme resulted in the reallocation of road space and how this has allowed for in the integrated design soft landscape areas. Has the soft landscape been included as part of NBS design objectives e.g. Suds. Area street trees being used to add vertical elements to aid traffic calming? Demonstrate collaborative working in developing the design both within the project team and with stakeholders. Demonstrate innovative and creative thinking with regard to the soft landscape treatment]
For example - The primary objectives of the landscape scheme are identified below;

-
-
-

For example - A key element of the scheme is the reduction of carriageway widths . As a result of these design proposals, and in compliance with TII standards, there is a resultant redistribution of space along the N99.

4. Planting Strategy and Concepts

[describe how the landscape design has evolved and the overall planting strategy. Explain how the design solutions arrived at was informed by the local context. Landscape Costs as a proportion of the project budge and whole life costs can also be considered. How landscape quality and functionality has been achieved]

4.1 Planting Strategy

[Insert details relating to particular plant typologies used and their functions]

For example -Tree planting strategy to define junctions with large canopy feature trees. Columnar tree planting to create a buffer between modes along xxx street in the transition zone. Hedgerows have been used at xxxx to function as xxxxx

4.2 Planting Concepts

[Include details of overarching concepts e.g. Ecological connectivity, edible landscapes, planting for climate resilience.

For example - Improved roadside landscapes provide habitat, shelter and food to aid local biodiversity and green infrastructure has a role to manage storm water by reducing the amount of hard surfacing along the route. Planted beds have been included at key location along the street. They have a number of functions – to direct pedestrians to safe crossings, to prevent illegal kerb parking and to reduce the extent of hard surfacing .

4.3 Ecological Linkages and Biodiversity

[provide how the design aligns with TII Biodiversity objectives such as per the TII SIP. How it aligns with the AIPP and any Local Authority landscape policy or tree strategy.]

4.4 Landscapes for Climate Resilience and Sustainability

[provide how the design aligns with TII Sustainability objectives as per the TII SIP]

4.5 Drainage

[Insert details of any existing drainage issues and how and where landscape has been used to address drainage proposal e.g. SUDs planting.)

4.6 Integration with Hard Landscape

[Summary of hard landscape details as they relate to the soft landscape design e.g. permeable paving, tree pit details]

5. Site Constraints and Departures

5.1 Site or Utility Constraints

[Insert details of any under or overground utilities that may impact on landscape and how the design team have addressed these e.g. underground cables incorporated into tree pits as per TII details, utility boxes positioned to avoid impacting existing trees etc.

5.2 Other Environmental Assessments

[Insert details of any relevant assessments for example ecological assessments, tree survey, bird survey, air quality as it impacts on the landscape proposal)

For example - The proposed scheme will have no direct impacts on any Special Protection Areas or Special Areas of Conservation identified in the Local Authority Development Plan. A Tree survey was carried out that showed X trees of Category A, B, C.

6. Landscape Management and Maintenance

6.1 Establishment Phase

[Insert summary details of scheme contractors' commitments with regard to planting establishment and Maintenance period. Length of maintenance period as per scheme contract).
For example - The proposed scheme will have a 3 year maintenance period as part of the contact. This will entail xxxxx

6.2 Landscape Management aims

[Insert details of the key short medium and long terms landscape management aims developed as part of the schemes design. Consider the whole life cycle of the landscape).
For example - The proposed scheme aims for long-term improved hedgerow connectivity. This will entail xxxxx. Grass Meadows are to be established on slopes. Grass to be managed in line with the AIPP to improved grass areas for pollinators.

6.3 Landscape Maintenance

[Insert details of landscape maintenance tasks for each landscape type , required to achieve short – medium – long term landscape management aims).
For example – Hedgerows to be cut xxx per year for the first xx years and there after cut xxx. Grass to slopes to be cut xx per year for the first xx years and then xxx. Perennial in rain garden to be cut back every march and arising removed. Planting areas to be reviewed every 5 years and edited / restored as required to fulfil their design function and management aims.

Appendix A – Design Drawings and Planting Specifications

Appendix B – Cost Estimate

Cost Estimate under development.

B.1 Pilot Project – N76 Grangemocklar, Co. Tipperary

Project
Grangemocklar

Description:
Upgrade of an existing stretch of National Road N76 through rural village aprox. length 2km.

Project elements
Transition zones, Gateways, Village Core

Landscape elements:
Rural Hedgerows, New Native Woodlands, Planting at Gateways, Trees in Soft, Trees in Hard (Structural Soil), Perennials in Village Core, Street Furniture

Work Phases:
3, 5, 6, 7

Status:
Currently at construction stage - 2023

Images above showing project nearing completion at Grangemocklar

Details
This project involved a significant investment into landscape elements as a part of the traffic calming process.

New rural hedgerows were planted and existing hedgerows were strengthened in the rural-urban transition zone to introduce some vertical elements into the drivers field of vision.

At the village gateway, tall trees, and a native woodland was introduced to increase this sense of enclosure. Additional perennial planting was included to emphasise this threshold.

Tree and hedgerow planting was introduced adjacent to the footpath throughout the village core.

New paving and durable thick limestone kerbs were also introduced within the village core.

Street trees with a vertical clearance or clear stem height of 2.5 meters were planted into the existing streetscape. These were planted into structural soil and open ground level planters. The necessity of achieving a clear stem height of 2.5 meters limited the palette of appropriate street trees.

A diverse palette of flowering perennials and ornamental grasses was introduced into ground level planters within the public realm.

New street furniture was also introduced within the village core encouraging gathering on the village streets at the bridge, bakery and pubs.

B.2 Pilot Project – N24 Carrick-on-Suir, Co. Tipperary

Project
Carrick on Suir

Description:
Upgrade of an existing stretch of National Road N24 through country town approx. length 3.5km.

Project elements
Transition zones, Gateways, Town Core

Landscape elements:
New Avenue Tree Planting, Planting at Gateways, Trees in Soft, Trees in Hard (Structural Soil), Perennials at Junctions and in Village Core, Introduction of Specific Planting at School Entrances, Street Furniture

Work Phases:
3, 5, 6, 7

Status:
Currently at construction stage - 2024

Images (1st row) showing preparation of structural soil tree pits at Grangemocklar, currently under construction at Carrick on Suir.

Image (2nd row) showing installation of street furniture at Carrick on Suir

Details
Currently characterised by its wide carriageway the N24 has limited traffic calming elements, especially at the rural/urban transition zone.

This proposal seeks to reduce this horizontal field of view by introducing pairs of London Plane trees to both side of the carriageway. Fast growing, these trees will bring vertical emphasis into the field of view and contribute towards traffic calming.

As this scheme becomes more urban this avenue planting gives way to specific nodes where pedestrians and cyclists are likely to congregate.

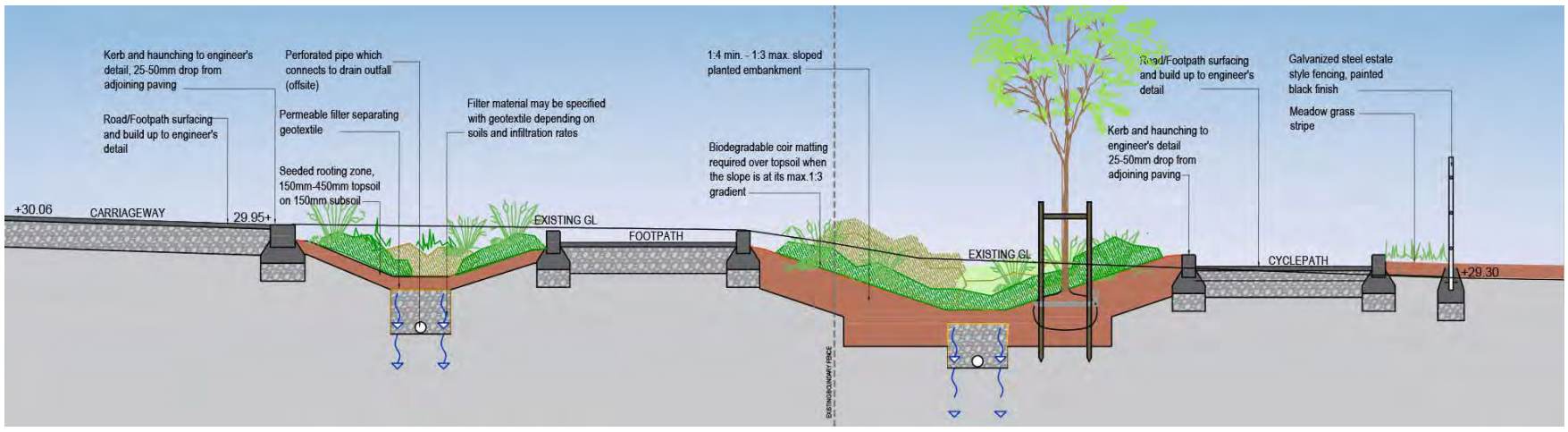
These nodes are located at schools, and junctions and here the design introduces seasonal variety with the planting palette. This is supplemented with street furniture including seating to facilitate gathering, waiting and bicycle parking.

Extensive research into low fertility soils allowed the introduction of bespoke soil mixes for the perennials proposed which aim to limit non target species (weed) growth. These soils are coupled with sterile mulches. These soils are to be introduced within street level planters.

New street planting is also proposed with structural soils which enable footpath/pavement loading and root development.

B.3 Pilot Project – N21 Fossa, Co. Kerry

Project
Fossa, Killarney



View looking from South to North,
Fossa village centre

Description:
Upgrade of an existing stretch of National Road N72 through rural village; length 1.5km.

Project elements
Transition zones, Gateways, Cycleway, School Entrance, SUDS features, Village Core

Landscape elements:
New Greenway parallel with N72 which links to Killarney National Park, Planting at Gateways, Trees in Soft, Trees in Hard, Perennials at Junctions and in Village Core, SuDS Feature Planting accepting road runoff, Introduction of Specific Planting at School Entrances, Street Furniture

Work Phases:
3, 5, 6, 7

Status:
Currently at Tender stage - Q1 2024

Image illustrating detail for infiltration/SUDs treatments at Fossa, currently at Tender stage

Details
A suite of landscape features are proposed for the streetscape works at the N72 in Fossa. The total scheme length is approx. 1.5km.

Extensive research into low fertility soils allowed the introduction of bespoke soil mixes for the perennials proposed which aim to limit non target species (weed) growth. These low fertility soils are to bring fast infiltration of surface water runoff from the adjacent carriageway. These soils are coupled with sterile mulches and are to be introduced within street level planters which will divide the Greenway from the N72.

New street planting and the introduction of placemaking elements including street furniture are also to be introduced at the entrance to Fossa National School. This will help bring definition to the centre of the village.

Term	Definition
Age Class	Groups of trees belonging to the same age (e.g., 0–5 years old, 5–10 years …). This is used as a tool to design and manage woodlands and forests to create diversity in its structure. (A-Z of tree terms, 2021).
Annual	A plant that completes its life cycle (germination, flowering, seeding, dying) in one growing season.
Arboriculturist	A specialist in the care, cultivation, and maintenance of trees.
Bare root	Grown from seedlings, hardwood cuttings and then transplanted - supplied bare root.
Biennial	A plant which grows from seed one year and flowers, fruits, and dies the next.
Biodiversity (Biological Diversity)	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. Thus, biological diversity may be considered at three levels: ecosystem diversity, species diversity, and genetic diversity within species.
Blue Green Infrastructure (BGI)	Is a ‘strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem service’ (EUR-Lex, 2013).
Broadcast sowing	Scattering seeds evenly over the ground rather than in furrows or drills.
Canopy Layer	Refers to the layer of leaves and branches formed by the large trees in the woodland. (Real New Forest Guide, 2022)
Clear Zone	The Clear Zone is the total width of traversable land on the nearside or offside of a road which is to be kept clear of unprotected hazards. This width is available for use by errant vehicles. The zone is measured from the nearest edge of the trafficked lane: i.e., the hard shoulder or hard strip forms part of the Clear Zone, refer to DN-GEO 03036 for the required Clear Zone widths.
Constructed wetland	Artificial sustainable wastewater treatment which is designed to look and function like a natural wetland. Constructed wetlands are used for treatment of wastewater and are carefully designed to integrate into surrounding landscape by using native plants, trees, and soil. (Irish Water, 2019)
Contact weed killer	A weed killer that kills by direct contact.
Cuttings	Side slopes arising where a road is constructed at a lower level than the landscape. Usually occurs where a road corridor encounters areas of local elevation.
Cycle Facilities	Cycleway: An offline public road reserved for the exclusive use of people cycling or people walking, wheeling, and cycling. Greenway: A cycleway that caters for people walking, wheeling, and cycling in a mainly recreational environment. Cycle Lane: An on-road part of the road pavement reserved for use by cycles.
Designer	The organisation responsible for undertaking and / or certifying the design.
Designer’s Risk Assessment	Key document within which a designer identifies hazards arising from the design, assesses how serious the potential risk is, and decides how to eliminate or reduce these risks (HSA, 2022).
Design Statement / landscape strategy	A key design document submitted as part of the Planning Application process that sets out fundamental landscape design analysis, principles, concepts, strategies, rationale, and proposals.
Drift Planting	A planting style that is designed to imitate natural growth habits by creating colonies of single plant varieties that appear to have occurred through self-seeding or other unaided means of propagation or planting. (Stoll, 2015).
Drill	A narrow, straight furrow in the soil in which seeds are sown or seedlings planted.

Glossary

Term	Definition
Ecological Infrastructure Analysis	The concept of ecological infrastructure analysis involves defining ecological networks of core habitat areas and connectivity zones for a region to decrease the overall fragmentation of core habitats.
Ecological Landscape Design	A landscape design approach which integrates the principles of landscape architecture and landscape ecology while addressing the principles of Sustainable Development including Local Agenda 21 criteria.
Ecologist	A scientist who specialises in the study of the relationships and interactions between organisms and their environment.
Ecosystem	A community of different plant and animal species interacting with one another and with their non-living environment.
Ecosystem services	The direct and indirect contributions ecosystems (known as natural capital) provide for human wellbeing and quality of life.
Embankments	Side slopes arising where a road is constructed at a higher level than the landscape.
Field Layer	The layer of vegetation that tends to cover the soil, sometimes called the herb layer.
Germination	The physical and chemical changes that take place as a seed starts to grow and develop into a plant.
Grafted	The process of combining one plant's qualities of flowering or fruiting with the roots of another to achieve a more beneficial outcome overall (usually in terms of vigor, size, or resilience). (RHS, 2022)
Grassland	Habitat dominated by grasses, or plants that are 'grassy' in appearance. There are three main grassland categories, and these include improved grassland (agricultural grassland and amenity grassland), semi-natural grassland (dry calcareous and neutral grassland, dry meadows and grassy verges, dry-humid acid grassland, wet grassland) and freshwater marsh (marsh) (Fossitt, 2000).
Green Infrastructure (GI)	A strategically planned network of natural and semi-natural areas, which include other environmental features designed and managed to deliver a wide range of ecosystem services. These include water purification, air quality, space for recreation and climate mitigation and adaptation.
Green wall	A vertical structure attached to the exterior or interior of a building intentionally covered by vegetation that grows in a layer of soil on its surface.
Growing Medium	A growing mixture or other material in which plants may be grown.
Habitat	The physical and living environment in which an organism or community of organisms survive.
Hardy	Plants with ability to withstand year-round climatic conditions including frost, without needing protection.
Hazard	A hazard is any physical obstruction which may, in the event of an errant vehicle leaving the carriageway, result in significant injury or death to the occupants of the vehicle.
Hedgerow	A row of bushes, trees and / or plants enclosing or separating fields or parcels of land.
Landscape	"An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe, 2000). (TII, 2020)
Landscape Architect	A Landscape Professional who specialises in, "the planning, design and management of the external environment" (Irish Landscape Institute, 2022).
Landscape Audit Report	A joint report conducted by a Landscape Professional a joint with the site contractor each growing season (June-September) to identify defective plants or maintenance items within the project area.
Landscape Character	May be defined as a "distinct, recognisable, and consistent pattern of elements, or characteristics, in the landscape that make one landscape different from another, rather than better or worse". (Natural England, 2012). (TII, 2020)

Glossary

Term	Definition
Landscape Professional	All landscape practitioners including landscape scientists, landscape planners, landscape architects, landscape managers and urban designer. (Landscape Institute, 2018)
Landscape Quality	A particular combination of the visual and non-visual attributes of the landscape.
Landscape Sensitivity	The extent to which the inherent character and visual amenity of a landscape are vulnerable to change due to a particular type of development activity.
Lawn	An area of open, regularly mown grass.
Local Needs Analysis	A rigorous process identifying issues that are important now and in the near future for the communities directly impacted by or neighbouring a project or programme.
Maintaining Organisation	The organisation which will be responsible for the maintenance of the road or thoroughfare after construction.
Meadow	Meadow is a grassland habitat which is rarely fertilised or grazed and mown only occasionally. (Fossitt, 2000).
Median / Island planting	The use of planting in areas dividing opposing traffic lanes or regulating the flow of traffic on roads.
Mulches	Loose coverings or sheets of material placed on the surface of soil.
Native species	Species which naturally exists at a given location or in a particular ecosystem.
Nurse species	Nurse plants are those that facilitate the growth and development of other plant species (target species) beneath their canopy because they offer benign micro-habitats that are more favourable for seed germination and/or seedling recruitment than their surrounding environment. (Ren, et al., 2008).
Organic matter	Composts or similar materials derived from plant material.
Passively safe	Obstructions that comprise easily deformable elements, or that have been tested and passed for the appropriate speed class in accordance with I.S. EN 12767, Passive Safety of Support Structures for Road Equipment – Requirements, Classification and Test Methods.
Pedestrian Facilities	All types of measures which improve conditions for people walking and wheeling, including: Footpath: A path, separated from the road by a kerb, for use by pedestrians which does not form part of the road pavement. Footway: A path for use by pedestrians, separated from the road by a verge, which does not form part of a road pavement.
Perennial	Any plant that re-grows year after year (deciduous or evergreen / hardy or non-hardy).
Project Manager	The person assigned responsibility for the planning, execution, and delivery of a Project.
Root Protection Area (RPA)	A root protection area is usually a calculated area of ground that lies immediately under a tree and just beyond the extent of its crown. (Woodland Trust, 2021)
Rural Area	An area outside of a built-up area which is generally controlled by speed limits greater than 60 km/h.
Schedule of [Environmental] Commitments	Sets out requirements emanating from contractually or legally prescribed consultations with third parties (e.g., National Parks and Wildlife Service (NPWS), Regional Fisheries Boards (RFB's) or Office of Public Works (OPW)) and provide a method of documenting compliance with these commitments and/or requirements. (National Roads Authority, 2007)
Settlement	A place where people come to live. (Cambridge University Press, 2022)
Shrub planting	A woody plant that has several stems and is usually less than 1.5 metres tall.
Shrub layer	A layer of vegetation that consists of low woody vegetation of shrub form.

Glossary

Term	Definition
Specimen trees	Individual trees selected for a specific purpose often acting as a focal point or defining spaces. Trees can be planted individually, in groups or rows.
Streetscape	Everything that makes up the street environment. (NGAN, 2015).
Study Area	The geographical area identified as being potentially suitable for, and influenced by, the development of a Project. (TII, 2019).
Townscape	Townscape is a subset of landscape and comprises ‘’landscape within the built-up urban area, including the buildings, the relationship between them, the different types of urban open spaces, including green spaces and the relationship between buildings and open spaces’’ (LI/IEMA, 2013) (LI, 2018) (TII, 2020). Throughout this document the term ‘landscape’ is also used to include ‘townscape’
Wider Verge Area	The landscape area outside of the immediate roadside verge
Woodlands	Land that is mostly covered with woody vegetation or dense growths of trees and shrubs.
Woody	Vegetation composed in part of wood or hard wood-like tissue.

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